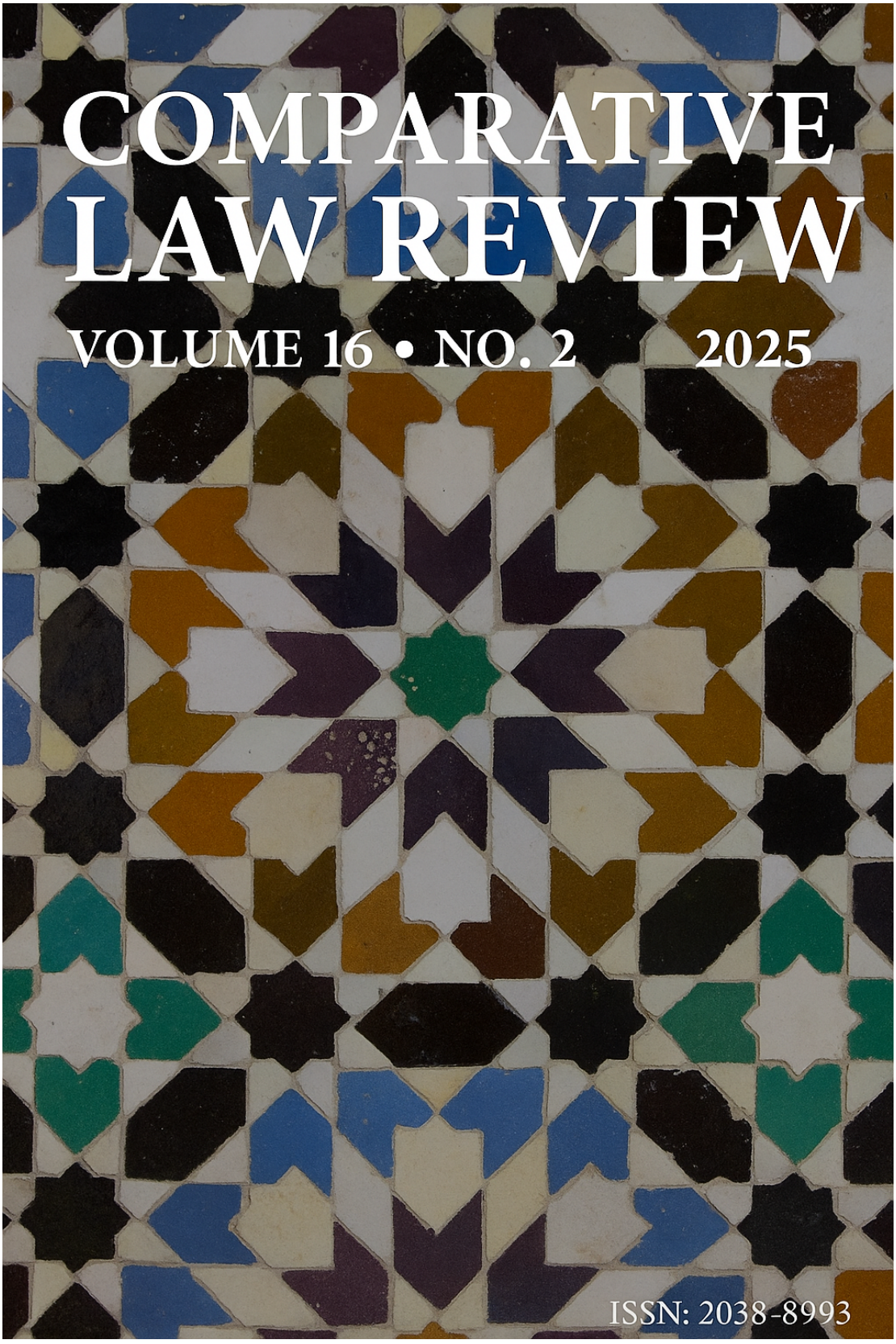

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A COMPARATIVE ANALYSIS OF REGULATORY SANDBOXES: MODELS, EVOLUTION AND STRATEGIC IMPLICATIONS IN EU, USA AND CHINA*

Andrea Stazi[Ψ] *– Riccardo Jovine*[γ]

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The article compares the design, evolution, and strategic uses of regulatory sandboxes across the European Union, the United States, and the People's Republic of China. Using a comparative lens to conduct an analysis of law and politics, the authors demonstrate that sandboxes are not neutral test beds but rather jurisdiction-specific governance instruments that strike a balance between innovation, legality, risk, and market structure. The European Union trajectory shifts from soft-law facilitators to hard-law experimentation, most visibly evident in the DLT Pilot Regime and the AI Act's mandatory sandboxes, which embed proportionality, rights, and supervisory convergence while exposing the "sandbox paradox" of potential competitive distortions. The United States landscape is presented as decentralized, with dynamic state programs coexisting with cautious federal soft law, yielding agility but weak interoperability and uneven consumer protection. The People's Republic of China model is analyzed as centrally steered, soft-law heavy, and incumbent-oriented, aligning pilots with industrial policy, financial stability and technological sovereignty, yet marked by opacity and limited open access. Sandboxes thus appear as transitional constitutional technologies: effective when disciplined by legality, accountability and competitive neutrality, and when used to inform, not replace, enduring regulatory reform.

Keywords: Regulatory Sandbox – Artificial Intelligence – Blockchain – Comparative Law

I. INTRODUCTION: RESEARCH OBJECTIVE AND SCOPE

Since the latter half of the twentieth century, legal scholarship has been increasingly confronted with the profound implications of technological advancement. Traditional jurisprudence, long occupied with the dialectic between natural law and legal positivism, was disrupted by emerging questions about how law can and should respond to scientific innovation. The conceptual foundations of law began to undergo a more structural transformation prompted by rapid developments in digital technologies and computational systems.[1]

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* The paper expresses the joint effort and common reasoning of the authors. However, paragraphs 1 and 5 are attributable to A. Stazi, paragraphs 2, 3 and 4 to R. Jovine.

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1 See: J. M. Balkin, *The Three Laws of Robotics in the Age of Big Data*, in *Ohio State Law Journal*, Vol. 78, No. 5, 2017, 1217–1241, in which the author examines how the legal system struggles to keep pace with rapid

Rather than being a gradual evolution, this transformation presented itself as a rupture, demanding a new legal grammar. In seminal contributions, scholars such as Lawrence Lessig and Joel Reidenberg urged the legal community to recognize that traditional normative categories, rights, obligations, and authority were being redefined by code, protocols, and algorithmic governance.[2] Legal regulation, they argued, no longer operated solely through statutes or case law, but increasingly through technical architectures that "regulate by design".[3]

In the early stages of this shift, a pioneering voice was that of Lee Loevinger, who clearly diagnosed the growing disconnection between legal complexity and democratic intelligibility. In a prescient essay, he warned that the law was evolving into an esoteric cult, unintelligible to the very citizens it was meant to guide: "It is one of the greatest anomalies of modern times that the law, which exists as a public guide to conduct, has become such a recondite mystery that it is incomprehensible to the public and scarcely intelligible to its own votaries. [...] Daily, the law becomes more complex, citizens become more confused, and society becomes less cohesive."[4]

This concern resonates deeply today, as regulatory complexity continues to expand alongside the growth of technological ecosystems. The contemporary legal order appears to be perpetually playing catch-up with technical innovation, reacting rather than anticipating. As Mireille Hildebrandt argues, law risks becoming too slow for the speed of code, where the pace of legal change is chronically outstripped by that of machine learning, data infrastructures, and automated decision-making systems. [5]

Yet, contrary to a purely deterministic view of technological disruption, many scholars advocate a renewed emphasis on human interpretation, discretion, and normative reasoning in the legal domain. Frank Pasquale, for instance, emphasizes the importance of preserving legal hermeneutics and due process in the face of "black-box" algorithms and

technological change, particularly in the fields of artificial intelligence and big data, framing these as "disruptive technologies" that outstrip traditional forms of governance.

[2] L. Lessig, *Code and Other Laws of Cyberspace*, Basic Books, 1999, argues that "code is law", meaning that technological architectures can regulate behavior as effectively as legal rules. His framework suggests that law is no longer the exclusive domain of textual normativity, but increasingly competes with—or becomes embedded within—technical systems; and J. R. Reidenberg, *Lex Informatica: The Formulation of Information Policy Rules through Technology*, in *Texas Law Review*, 1997, Vol. 76, No. 3, 553–593, develops the notion of *Lex Informatica*, emphasizing that the architecture of networks and the technical standards embedded in information systems function as a distinct and autonomous source of normative regulation, shaping rights and obligations beyond the reach of traditional state-based law.

[3] R. Brownsword, *Rights, Regulation and the Technological Revolution*, Oxford University Press, Oxford, 2008, highlights the tension between legal formalism and the need for adaptive regulatory mechanisms in response to technology. He supports the call for a regulatory model that can incorporate principles of flexibility and innovation, echoing the need for legal adaptation.

[4] See: L. Loevinger, *Jurimetrics: The Next Step Forward*, in *Minnesota Law Review*, 1949, Vol. 33, No. 5, 455–493, critiquing the excessive complexity and inaccessibility of modern law, likening it to a "priestly cult" removed from democratic understanding.

[5] M. Hildebrandt, *Smart Technologies and the End(s) of Law: Novel Entanglements of Law and Technology*, Edward Elgar, 2016, discusses how the temporal lag of law vis-à-vis technology challenges its regulatory effectiveness. She warns that legal systems may become obsolete unless they can anticipate and internalize technological change, supporting the idea that law today is often too slow for the speed of code.

opaque regulatory logics.[6] The call is not for rejecting technology, but for integrating it responsibly within a constitutional and ethical framework.

The emergence of "regulatory sandboxes", experimental legal frameworks for new and emerging technologies, can be seen as a practical manifestation of this broader intellectual transition.

These environments challenge traditional dichotomies such as rule vs. discretion, or legality vs. innovation, by allowing temporary regulatory relaxation under controlled conditions. They thus embody a shift from static to adaptive governance, a movement from normativity grounded in textual rules to normativity mediated through institutional and technological iteration.[7]

In this context, regulatory sandboxes emerge not merely as technical devices for easing compliance but as emblematic sites where law and technology negotiate their boundaries. They even offer a vantage point from which to observe how different jurisdictions reconcile the competing demands of innovation, legal certainty, consumer protection, and market integrity.[8] The following paragraphs trace this evolution across three distinct regulatory frameworks.

The European Union exemplifies a gradual transition from soft-law experimentation to codified, supranational frameworks, embedding innovation within constitutional principles and the principle of proportionality.

The United States, by contrast, reveals a fragmented and competitive laboratory of state-level initiatives, tempered by cautious and largely non-binding federal engagement.

The People's Republic of China presents yet another model, where sandbox experimentation is subsumed within a state-led strategy of financial stability, technological sovereignty, and developmental governance.

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[6] F. Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information*, Harvard University Press, Cambridge, 2015, defends the importance of legal interpretation and transparency in an age dominated by opaque algorithmic systems. He emphasizes the risks posed by unaccountable decision-making technologies, reinforcing the text's argument for the indispensable role of human judgment in law.

[7] See: A. Stazi, *Smart Contracts and Comparative Law: A Western Perspective*, Springer Nature, Switzerland, 2021, shows how smart contracts and "techno-regulation" embody a new form of normativity, where rules are no longer exclusively textual but technologically embedded. This highlights the inherent tension between rigid legal categories and adaptive, code-based regulation; A. Stazi, R. Jovine, *GMOs, Food Traceability and RegTech: Genetically Modified Food, Traceability Systems and Blockchain as a Regulatory Technology*, Springer, Switzerland, 2024, 131 ff., underline that regulatory technology and blockchain-based sandboxes enable a dynamic form of compliance, where regulation evolves through iterative experimentation under controlled conditions, thereby shifting governance from static normativity to adaptive institutional and technological processes; and K. Yeung, *Algorithmic Regulation: A Critical Interrogation*, in *Regulation & Governance*, 2017, Vol. 12, No. 6, that conceptualizes algorithmic regulation as a new paradigm of governance that utilizes continuous data collection, real-time monitoring, and automated decision-making to steer human behavior toward pre-specified goals. She emphasizes that such systems differ fundamentally from traditional rule-based legal frameworks by embedding regulatory logic directly into technical infrastructures and software processes, thereby raising serious concerns about legitimacy, accountability, and due process.

[8] T. Buocz, *Regulatory sandboxes in the AI Act: reconciling innovation and fundamental rights*, in *Law, Innovation and Technology*, 2023, Vol. 15, No. 2, 357-389, showing how EU sandboxes highlight the difficulties of balancing innovation with fundamental rights and legal certainty.

By comparing these trajectories, the analysis highlights not only the diversity of institutional responses but also the strategic implications of adopting different models of anticipatory regulation.

Thus, the interface between law and technology is not merely a matter of regulation, but also a matter of legal epistemology in the digital age, and into the broader struggle to align technological change with constitutional values, institutional capacity, and societal needs.

The evolution of legal systems in response to technological change through regulatory sandboxes is not only a question of how to regulate, but also a question of how law itself is constituted and comprehended in the digital age.

This analysis is focused on regulatory sandboxes in the financial and digital technology sectors, leaving space to research in other sectoral experimentation frameworks (e.g., in energy or environmental regulation).

In particular, the central objective of this research is to investigate how three major regulatory orders, the European Union, the United States, and the People's Republic of China, have conceptualized, institutionalized, and operationalized regulatory sandboxes as instruments of adaptive governance.

The aim is not only to describe institutional practices but to critically assess how each jurisdiction reconciles the dual imperatives of fostering technological innovation and safeguarding public interest objectives such as financial stability, consumer protection, and systemic integrity.

The selection of these three systems is driven by both substantive and methodological considerations. Substantively, the European Union, the United States, and the People's Republic of China represent the three principal poles of global regulatory influence. Their respective approaches to sandbox experimentation generate ripple effects well beyond their own borders, shaping transnational regulatory competition and cooperation.

Methodologically, their juxtaposition enables a functional comparative analysis: the European Union as a supranational legal order rooted in civil law traditions and constitutionalized proportionality; the United States as a common law jurisdiction with a federalist, polycentric regulatory architecture; and the People's Republic of China as a socialist system where sandbox experimentation is embedded within state-led strategies of technological sovereignty and economic planning.[9]

[9] See: A. Bradford, *Digital Empires: The Global Battle to Regulate Technology*, Oxford University Press, 2023. As Bradford argues, the global regulatory landscape is increasingly shaped by the rivalry among three "digital empires." The European Union advances a rights-driven and values-oriented regulatory paradigm, rooted in civil law traditions and constitutional proportionality, which seeks to discipline markets through the primacy of fundamental rights, consumer protection, and democratic accountability. The United States, by contrast, projects a market-driven model grounded in common law pragmatism and federalist fragmentation, privileging innovation, entrepreneurial freedom, and economic dynamism, while often responding only reactively to risks of consumer harm or market concentration. The People's Republic of China represents a state-driven model in which regulatory experimentation, including sandbox initiatives, is subsumed within broader strategies of technological sovereignty, economic planning, and social control, aligning the governance of digital technologies with national security and industrial policy goals. Bradford emphasizes that these models do not merely apply domestically; they project outward, generating powerful ripple effects of transnational regulatory competition and convergence. In her words, the contest among the three digital empires will "shape the ethos of digital society" for decades to come. Framing sandbox experimentation

The comparative scope is therefore deliberately designed to capture three distinct governance paradigms: the European Union, where sandbox experimentation is progressively moving from soft-law, national-level pilots towards harmonized frameworks; the United States, where fragmented yet dynamic state-level sandboxes coexist with a cautious and often reactive federal stance, reflecting the tension between innovation-driven competition and concerns for consumer protection; the People's Republic of China, where sandbox initiatives are closely intertwined with macro-level state objectives, particularly financial stability and the pursuit of technological self-reliance in strategic sectors such as AI and blockchain.[10]

This tripartite comparison enables us to examine how different legal traditions, institutional capacities, and political economies influence the design and operation of sandboxes. The study employs a functional and systemic comparative method, situating each regulatory model within its broader context. By doing so, it seeks to identify both convergences and divergences.

In addition to institutional design, a key variable shaping the emergence and function of regulatory sandboxes is the nature of national innovation systems. Jurisdictions differ significantly in innovation intensity, patent production, research and development investments, and technological capacity.

These structural differences influence whether and how sandboxes are deployed. For instance, the United States and China have leveraged sandboxes as strategic instruments to sustain high levels of digital innovation, while the European Union has approached them more cautiously, emphasizing proportionality, rights compliance, and public interest goals.

Moreover, this article does not assess the "success" of sandbox regimes in empirical terms regarding their long-term innovation outcomes. The focus here is comparative and conceptual, not evaluative.

Ultimately, the research aims to contribute to the scholarly debate on comparative innovation governance by offering a critical appraisal of sandbox frameworks as legal-institutional laboratories.

The findings will analyze not only the possible strengths and limitations of each model but also the potential for cross-jurisdictional learning, norm circulation, and the emergence of a shared *lex digitalis* capable of mediating between innovation and public interest in the digital age.

against this backdrop thus allows one to situate it within the broader dynamics of global regulatory rivalry, where each jurisdiction's approach both reflects its internal legal culture and radiates influence beyond its borders.

[10] See: A. Al-Maamari, *Between innovation and oversight: A cross-regional study of AI risk management frameworks in the EU, U.S., UK, and China*, in *arXiv*, 2025, that demonstrate that the EU has progressively moved toward harmonized frameworks grounded in proportionality, the U.S. maintains a fragmented, state-led architecture with limited federal engagement, and China embeds regulatory experimentation into state-directed strategies of financial stability and technological sovereignty.

II. Regulatory Sandbox in the European Union

The development of regulatory sandboxes within the European Union can be traced back to the broader movement of financial innovation regulation that gained momentum after the 2008 global financial crisis. As the fintech sector burgeoned, policymakers recognized the need to strike a delicate balance between fostering innovation and ensuring consumer protection and financial stability.

The orientation of European regulatory policy towards fostering financial innovation was particularly significant in the European Commission's launch of the "FinTech Action Plan" in March 2018.[11]

Framed within the broader strategic context of the Capital Markets Union, the Action Plan outlined nineteen specific initiatives aimed at fostering a more competitive and innovative financial sector across the European Union, while safeguarding financial stability, enhancing cybersecurity, and ensuring robust consumer protection.

The European Commission acknowledged that the rapid evolution of financial technologies necessitated a rethinking of the regulatory framework, which could accommodate innovation without compromising regulatory oversight.[12]

The European Union's initial approach toward regulatory sandboxes also reflects its moderate innovation performance. Compared to the United States and China, the European Union invests less in research and development and files fewer patents in frontier technologies such as artificial intelligence and blockchain.

As a result, sandboxes have often been framed as instruments to support small and medium-sized enterprise participation and compliance rather than to scale innovation globally. This aligns with the European Union's values-based model of innovation governance, where fundamental rights and harmonization goals take precedence over competitive acceleration.[13]

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[11] *Cf.* European Commission, FinTech Action plan: For a more competitive and innovative European financial sector, March 8, 2018, outlining the EU's strategic approach to FinTech, aiming to enable innovation and competition in financial services through consistent licensing, common standards, support for blockchain and cloud technologies, regulatory sandboxes, and improved cybersecurity. It emphasizes maintaining financial stability and consumer protection while fostering a digital single market.

[12] *Ibidem*. From the creation of standardized APIs to support open banking, to the promotion of regulatory sandboxes and the adoption of blockchain infrastructure, the plan reflects a commitment to future-proofing the EU's financial sector. It also recognizes the increasing importance of coordinated responses to emerging risks, particularly in the areas of cybersecurity and data governance. As the financial industry continues to evolve rapidly, the Action Plan underscores the EU's ambition to lead globally in digital finance by creating a harmonized environment where innovation can flourish responsibly.

[13] See: European Commission, *Science, Research and Innovation Performance of the EU 2024: A competitive Europe for a sustainable future*, 2024 and Digitaleurope, *The EU's critical tech gap*, 2024, these publications demonstrate that the European Union continues to invest less in research and development than both the United States and China, and that it produces comparatively fewer patents in frontier technologies such as artificial intelligence and blockchain. The European Commission's 2024 report identifies persistent structural weaknesses in private research investment and technology commercialization. The DIGITALEUROPE report further underlines the Union's technological dependency in critical and strategic sectors. Taken together, these analyses help explain why regulatory sandboxes in the European Union are primarily designed to facilitate compliance and participation of small and medium-sized enterprises rather than to

Among the most salient innovations promoted by the Action Plan is the institutionalization of regulatory sandboxes, structured environments in which firms can test novel financial products, services, and business models under the close and real-time supervision of competent authorities, yet without being subject to the full set of applicable regulatory requirements from the outset.[14]

These frameworks serve a dual function: they provide innovators with a degree of legal certainty and regulatory engagement, while simultaneously enabling supervisory authorities to better understand emerging technological risks and business models at an early stage.

Alongside regulatory sandboxes, the Commission emphasized the role of innovation hubs as other facilitators of technological innovation, establishing formalized channels of communication between innovators and regulators to navigate the complexity of an ever-changing regulatory landscape.[15]

The European Commission explicitly linked these mechanisms to the broader imperative of digital transformation, characterizing the financial sector as the principal user of digital technologies and a critical driver of economic and societal modernization.

In its Communications, the Commission emphasized the need for a proportionate and risk-sensitive approach to regulation, underscoring the flexibility afforded to national supervisory authorities in interpreting and applying EU norms, particularly within fintech experimentation spaces.[16]

The principle of proportionality, thus, emerges not only as a cornerstone of European regulatory thought, but also as a functional tool in calibrating oversight to the realities of technological disruption.

While the United Kingdom's Financial Conduct Authority pioneered the regulatory sandbox model in 2016,[17] its success catalyzed similar initiatives across multiple EU

promote rapid global scaling, in line with the Union's values-based model of innovation governance that prioritizes fundamental rights and harmonization over competitive acceleration.

[14] See European Banking Authority, *Discussion Paper: on the EBA's approach to financial technology (FinTech)*, 2017/02, p. 7. Regulatory "sandboxes" provide financial institutions and non-financial firms with a controlled space in which they can test innovative FinTech solutions with the support of an authority for a limited period of time, allowing them to validate and test their business model in a safe environment.

[15] *Ibidem*, p. 7. "Innovation hub" means an institutional arrangement where regulated or unregulated entities (i.e. unauthorised firms) engage with the competent authority to discuss FinTech-related issues (share information and views, etc.) and seek clarification on the conformity of business models with the regulatory framework or on regulatory/licensing requirements (i.e. individual guidance to a firm on the interpretation of applicable rules).

[16] *Cf.* European Commission, Communication on a Digital Finance Strategy for the EU, COM(2020) 591 final, 24 September 2020; and European Commission, FinTech Action Plan: For a more competitive and innovative European financial sector, COM(2018) 109 final, 8 March 2018.

[17] *Cf.* Financial Conduct Authority (FCA), *Regulatory Sandbox*, 2015, 1-22, available at: https://www.fca.org.uk/publication/research/regulatory-sandbox.pdf, providing the foundational framework for the UK's regulatory sandbox initiative. It outlines the rationale, implementation strategies, and potential benefits of establishing a "safe space" where businesses can test innovative financial products, services, and business models without immediately incurring the full weight of regulatory requirements. The document highlights how regulatory sandboxes can promote fintech innovation by reducing time-to-market and costs for startups, facilitating access to funding, and enabling financial regulators to work closely with innovators to embed consumer protection mechanisms early in product development. It also discusses various implementation strategies, including tailored authorization processes, no-action letters, and individual regulatory guidance, all aimed at fostering responsible experimentation within financial markets.

Member States, with at least thirteen jurisdictions instituting frameworks inspired by or aligned with this model. This diffusion reflected both regulatory emulation and a shared recognition of the utility of controlled experimentation in mitigating the risks of financial innovation.[18]

The Commission, through its exhortative yet strategic use of soft law instruments such as Communications, further invited national authorities and European Supervisory Authorities to adopt best practices, enhance cooperation, and develop a common understanding of innovation-related risks and regulatory responses.

This culminated in the drafting of the European Supervisory Authorities' Joint Report on FinTech Regulatory sandboxes and innovation hubs, intended to consolidate the state of play and identify optimal supervisory practices, thereby advancing the harmonization of fintech regulation within the Union.[19]

The report identified key best practices for the design and operation of sandboxes, including clear eligibility criteria, defined testing parameters, transparency in selection and exit processes, and mechanisms for data collection and feedback. Importantly, it also underscored the diversity of national approaches and the need for enhanced coordination to prevent regulatory fragmentation or arbitrage.

The European Supervisory Authorities concluded that while innovation facilitators were valuable tools, their effectiveness depended on the institutional capacity of regulators and the legal clarity provided to firms.

During this period, the European Banking Authority also launched its own FinTech Roadmap, which included monitoring innovation facilitators and supporting supervisory convergence. The roadmap emphasized the importance of cooperation among authorities

Furthermore, the report explores industry-led initiatives such as virtual sandboxes and sandbox umbrella companies, which could further enhance the fintech ecosystem by offering collaborative testing environments and structured oversight mechanisms. The Financial Conduct Authority's recommendations also consider potential legislative changes that could provide greater regulatory flexibility to sandbox participants. The report underscores the Financial Conduct Authority's commitment to balancing financial innovation with consumer protection, ensuring that regulatory frameworks evolve alongside technological advancements.

[18] The EU's approach has always been somewhat decentralized: instead of a single supranational sandbox, Member States like the United Kingdom (prior to Brexit), Lithuania, the Netherlands, and Denmark pioneered national-level sandboxes with their own regulatory frameworks and supervisory styles, under the broader encouragement of EU initiatives. In the fintech domain, the EU has used regulatory sandboxes to facilitate the deployment of innovative payment services, crowdfunding platforms, and digital banking solutions. Lithuania, for instance, became a European leader by establishing its sandbox under the Bank of Lithuania's supervision, rapidly attracting fintech companies due to its supportive regulatory environment. Meanwhile, the Netherlands' "InnovationHub" and Denmark's "FT Lab" demonstrated alternative models of sandbox-like cooperation spaces between innovators and regulators without full market deployment, showing the diversity of the European regulatory experimentation strategy.

[19] European Supervisory Authorities (European Banking Authority, European Insurance and Occupational Pensions Authority, European Securities and Markets Authority), *Joint Report: Regulatory Sandboxes and Innovation Hubs*, JC 2018 74, 2018, 1-46, providing a comprehensive analysis of innovation hubs and regulatory sandboxes established across EU Member States. It synthesizes best practices and operational models, based on national supervisory authority experiences, to promote regulatory convergence, legal clarity, and innovation scalability. The report also outlines future policy directions for harmonizing innovation facilitation across the EU.

and encouraged the use of knowledge-sharing platforms to harmonize practices across the EU.[20]

The typical lifecycle of a regulatory sandbox within the EU follows a structured sequence of procedural stages, albeit with national variations.

First, firms must submit a formal application detailing their proposed innovation, including its technological characteristics, intended market deployment, potential legal uncertainties, and expected benefits.

Competent authorities assess applications based on pre-established eligibility criteria, which commonly include the novelty of the solution, its benefit to consumers or financial markets, the presence of genuine regulatory ambiguity, and the applicant's readiness to test in a controlled environment.

Once admitted, the firm and the authority jointly define a bespoke testing plan, including parameters for supervision, duration, data reporting obligations, and risk mitigation strategies.

The testing phase is closely monitored by the supervisory authority, which may issue interim guidance or adapt the plan in response to emerging risks.

Upon conclusion, participants exit the sandbox, typically through one of three outcomes: (a) successful completion, with a path to licensing or market authorization; (b) redirection, if regulatory barriers remain; or (c) termination, if risks or deficiencies are identified.

Some jurisdictions require a formal exit report prepared by the competent authority, summarizing the results, compliance trajectory, and regulatory implications.[21]

Notwithstanding the advantages associated with sandbox participation, critical concerns remain regarding their potential to distort competitive dynamics.

A central critique is encapsulated in the notion of the "sandbox paradox": to be effective and attractive, sandboxes must confer a tangible advantage to participating firms, such as lighter regulatory requirements, faster authorization, or direct supervisory access.

However, these advantages, if not calibrated transparently and proportionately, risk creating an uneven playing field by favoring early adopters over market incumbents or non-selected applicants.

This may undermine competition and create de facto regulatory privilege, particularly if the sandbox selection criteria are not clearly disclosed or if institutional capacity for oversight is limited.[22]

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[20] European Banking Authority (EBA), *The EBA's FinTech Roadmap: Conclusions from the Consultation on the EBA's Approach to Financial Technology (FinTech)*, 2018, 1-33, articulating the EBA's strategic framework for addressing financial innovation in the EU, detailing policy priorities such as regulatory sandboxes, authorisation regimes, cybersecurity, and AML/CFT compliance. It synthesizes consultation feedback from industry stakeholders and establishes the groundwork for supervisory convergence, technological neutrality, and a coherent EU-wide response to the FinTech transformation of financial markets.

[21] The lifecycle model is increasingly referenced in EU-level guidance and is partially codified in the AI Act, which standardizes key procedural features such as documentation, transparency, data protection, and supervisory discretion.

[22] See: B. R. Knight, T. E. Mitchell, *The Sandbox Paradox: Balancing the Need to Facilitate Innovation with the Risk of Regulatory Privilege*, in *South Carolina Law Review South Carolina Law Review*, Vol. 72, No. 2, 2020, 446-475, stressing the structural risk that sandbox benefits, if not properly constrained, may translate into regulatory privilege for selected innovators.

Further risks include the possibility of fictitious competition, where sandbox participants appear to compete under experimental conditions that do not reflect real market pressures. Moreover, barriers to entry may paradoxically be reinforced, as firms within the sandbox can redirect saved resources toward marketing and research and development, while competitors outside bear full compliance costs.

Regulatory discretion in access, lack of procedural transparency, and information asymmetries may therefore generate competitive distortions, especially in sectors characterized by fast-moving innovation and high sunk costs.[23]

These concerns prompted a growing body of literature to call for clear, published access criteria, independent oversight of selection processes, and ex-post impact assessments on market structure and consumer welfare.[24]

While regulatory sandboxes can facilitate pro-competitive innovation, their design must avoid entrenching advantages that are not linked to merit, functionality, or long-term market efficiency.[25]

The onset of the COVID-19 pandemic accelerated the digitization of financial services, reinforcing the need for regulatory frameworks that could accommodate rapid technological change.

In 2020, the European Commission introduced the Digital Finance Package, a comprehensive set of legislative proposals aimed at fostering digital innovation while preserving market integrity and financial stability. Key components of this package included: the Digital Operational Resilience Act (DORA)[26], the Regulation on Markets in

[23] H. J. Allen, *Sandbox Boundaries*, in *Vanderbilt Journal of Entertainment & Technology Law*, Vol. 22, No. 2, 2020, 300-321, emphasizes the potential deregulatory drift and transnational regulatory arbitrage associated with sandbox diffusion.

[24] *Cf.* CGAP - World Bank, Regulatory Sandbox Global Survey (2019), available at: https://www.findevgateway.org/sites/default/files/publications/2020/surevy_results_ppt_cgap_wbg_final_20190722_final.pdf, highlighting that nearly a quarter of sandbox applications are rejected due to insufficient innovation, underlining the need for rigorous eligibility protocols.

[25] See: C. Poncibò, L. Zoboli, *The Methodology of Regulatory Sandboxes in the EU: A Preliminary Assessment from A Competition Law Perspective*, in *Stanford-Vienna European Union Law Working Papers*, No. 61, 2022, 15 ff., calling for greater transparency and consistency in sandbox access rules to avoid de facto market distortions.

[26] Regulation (EU) 2022/2554 of the European Parliament and of the Council of 14 December 2022 on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009, (EU) No 648/2012, (EU) No 600/2014, (EU) No 909/2014 and (EU) 2016/1011, focusing on strengthening the digital resilience of financial institutions and service providers in the EU. This way, companies can test their operational resilience strategies in regulatory sandboxes - especially cybersecurity measures - under controlled conditions. This allows firms to comply with DORA's requirements for ICT risk management, incident reporting, and third-party risk management while identifying vulnerabilities in a safe environment.

Crypto-Assets (MiCA)[27], the Retail Payments Strategy[28], and a renewed Digital Finance Strategy[29].

Although these instruments did not directly legislate on sandboxes, they established the broader digital regulatory framework within which sandboxes would operate. Particularly, the Digital Finance Strategy reiterated the importance of innovation facilitators and encouraged continued use of sandboxes to support testing of blockchain-based and AI-enabled services.

A pivotal development in the maturation of the regulatory sandbox ecosystem was the adoption of Regulation (EU) 2022/858, which established a pilot regime for market infrastructures based on distributed ledger technology, also known as the DLT Pilot Regime.[30]

This Regulation marked the first time the EU established a legally codified pan-European sandbox-like environment specifically for blockchain-based financial innovations. It represented a shift from experimental supervisory tools rooted in soft law to a harmonized legal framework that offers explicit regulatory pathways for technological testing.

Under this regime, eligible firms are permitted to operate market infrastructures using DLT for the issuance, trading, and settlement of tokenized financial instruments. Crucially, the Regulation grants targeted exemptions from certain requirements under core EU legislation, including MiFID II[31] and CSDR[32]. These exemptions are strictly delineated and subject to time limits, risk mitigation safeguards, and ongoing regulatory monitoring.[33]

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[27] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937, providing a harmonized legal framework for crypto-assets across the EU. This way, sandboxes allow firms to test crypto innovations such as blockchain solutions, stablecoins, and tokenized assets, while ensuring compliance with MiCA's requirements.

[28] European Commission, Communication on a Retail Payments Strategy for the EU, COM(2020) 592 final, 24 September 2020. The Communication outlined the European Commission's strategy to enhance the EU's retail payments ecosystem. It emphasized the development of instant payment solutions, the promotion of pan-European payment systems, and the integration of innovative technologies such as distributed ledger technology (DLT). The strategy also addressed the emergence of crypto-assets and the potential issuance of a Central Bank Digital Currency (CBDC), aiming to ensure that digital payment solutions are secure, efficient, and accessible to all EU citizens.

[29] European Commission, Communication on a Digital Finance Strategy for the EU, COM(2020) 591 final, 24 September 2020. The Communication outlined the European Commission's strategy to foster a digital financial ecosystem within the EU. It emphasized the removal of fragmentation in the digital single market, adaptation of EU financial services regulations to the digital age, promotion of data-driven innovation, and enhancement of operational resilience. The strategy ensures that digital finance benefits consumers and businesses while maintaining financial stability and consumer protection.

[30] Regulation (EU) 2022/858 of the European Parliament and of the Council of 30 May 2022 on a pilot regime for market infrastructures based on distributed ledger technology, and amending Regulations (EU) No 600/2014 and (EU) No 909/2014 and Directive 2014/65/EU.

[31] Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU.

[32] Regulation (EU) No 909/2014 of the European Parliament and of the Council of 23 July 2014 on improving securities settlement in the European Union and on central securities depositories and amending Directives 98/26/EC and 2014/65/EU and Regulation (EU) No 236/2012

[33] These exemptions include relief from certain MiFID II requirements, such as those related to pre- and post-trade transparency, transaction reporting, and record-keeping, which are adapted to account for the characteristics of DLT. Under CSDR, exemptions cover obligations related to settlement discipline and some of the authorization requirements for central securities depositories. In the case of integrated DLT trading and settlement systems, a combination of both sets of exemptions may apply. These flexibilities are

The DLT Pilot Regime effectively acts as a sandbox for blockchain applications in capital markets, enabling a safe environment for testing new infrastructures and processes while ensuring investor protection and financial stability.
Its implementation also stimulated a broader dialogue within the EU institutions regarding the scalability and replicability of similar frameworks across other technological domains. Thus, the DLT Pilot Regime is not only a milestone in blockchain regulation but a template for sector-specific sandboxes.
This progression from soft-law experimentation to codified regulatory regimes signals a broader shift in EU governance, whereby innovation facilitation mechanisms evolve into enforceable legal instruments. It reflects the Union's effort to reconcile regulatory flexibility with legal certainty, ensuring that anticipatory regulation is progressively embedded within the formal sources of EU law.
In response to persistent regulatory divergence across Member States and increasing market demand for uniform innovation frameworks, the European Supervisory Authorities updated their Joint Report on innovation facilitators in 2023.
This document introduced refined best practices aimed at achieving supervisory convergence across national sandbox regimes and enhancing cross-border coordination. Emphasis was placed on clear access criteria, transparency in decision-making, and data-sharing mechanisms among supervisory authorities.[34]
According to the report, by October 2023, 41 innovation hubs were operating across all 30 European Economic Area countries, and 14 regulatory sandboxes were established in 12 of them.
These sandboxes, though fewer in number than innovation hubs, represent a more advanced regulatory tool, offering a structured framework for testing innovative financial products and services in real market conditions under the supervision of national competent authorities. The European landscape of regulatory sandboxes demonstrates both convergence and divergence in design, scope, and institutional anchoring. Several patterns emerge when national frameworks are grouped by their defining characteristics.

granted on a case-by-case basis and are strictly conditional on compliance with the thresholds and safeguards set out in the Regulation.

[34] European Supervisory Authorities (EBA, EIOPA, ESMA), *Update on the functioning of innovation facilitators – innovation hubs and regulatory sandboxes*, Joint Committee Report ESA 2023 27, 11 December 2023, providing an updated, data-driven overview of innovation hubs and regulatory sandboxes across the European Economic Area. It offers critical insights into their evolution, operational challenges, and the shifting landscape of regulatory experimentation. New elements include emerging formats such as virtual sandboxes and cross-sector initiatives like the European Blockchain Sandbox and AI regulatory testing. The document consolidates national feedback and formulates targeted recommendations to improve supervisory alignment, institutional cooperation, and the practical implementation of innovation facilitators.

Latvia[35] (2017), Denmark[36] (2018), and Lithuania[37] (2018) stand out as among the earliest to operationalize testing environments. Their frameworks provided broadly accessible platforms for experimentation across banking, insurance, and securities, with Lithuania in particular becoming a regional hub for both foreign and domestic innovators. Latvia's approach, by contrast, has been more modest, focusing on regulatory guidance rather than experimentation. Denmark's FT Lab occupies a middle ground, offering a mature, cross-sectoral environment but without the same international prominence as Lithuania.

Austria[38] (2020), Hungary[39] (MNB Innovation Hub), and Italy[40] (2021) established broad-based frameworks intended to support innovation across multiple financial subsectors. Austria's sandbox operates under the Financial Market Authority and is linked to EU-level licensing regimes, though full regulatory recognition often requires external verification.[41] Hungary combines sandboxing with a wider innovation agenda, including temporary relief measures. Italy's distinctive threefold model, coordinated by the Ministry of Economy and Finance, reflects one of the most institutionalized approaches in Europe, with each supervisory authority hosting its own sandbox but under a common umbrella.

Estonia[42] (2023) and Slovakia[43] (2022) represent more recent efforts. Although Estonia had not admitted participants by the reporting cut-off date, its creation with European Bank for Reconstruction and Development support illustrates a forward-looking policy strategy. Slovakia, while newer, is explicitly positioning its sandbox to align innovative financial services with domestic regulatory expectations.

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[35] See: Latvijas Banka, *Regulatory Sandbox*, available at: https://www.bank.lv/en/operational-areas/supervision/support-for-fintech-and-innovations/regulatory-sandbox, and Financial and Capital Market Commission, *Annual Public Report 2021*, available at: https://datnes.latvijasbanka.lv/gada/FKTK/GP-2021-FKTK.pdf.

[36] Available at: https://www.dfsa.dk/financial-themes/fintech/ft-lab.

[37] Available at: https://www.lb.lt/en/regulatory-sandbox.

[38] Regulation (EU) 2020/1503 of the European Parliament and of the Council of 7 October 2020 on European crowdfunding service providers for business, and amending Regulation (EU) 2017/1129 and Directive (EU) 2019/1937.

[39] Available at: https://www.mnb.hu/en/innovation-hub/regulatory-sandbox

[40] *Cf.* Decree April 30, 2021, No. 100 - Regulation implementing Article 36, paragraphs 2-bis and following, of Decree-Law April 30, 2019, No. 34, converted, with amendments, by Law June 28, 2019, No. 58, concerning the regulation of the Committee and FinTech experimentation.

[41] Federal Ministry of Finance (Austria), *Financial Market Authority Act* (FMABG), as amended by BGBl. I Nr. 112/2024, Article 23a, establishing a formal regulatory sandbox regime under the Austrian Financial Market Authority. It allows firms developing ICT-based financial innovations to test their business models under supervisory oversight, without immediately fulfilling all standard licensing or regulatory requirements. Entry into the sandbox is subject to detailed eligibility criteria, including a plausible need for regulatory evaluation, absence of exclusive ECB/ESAs competence, a demonstrable economic interest in promoting innovation, and readiness for market testing. Notably, the sandbox process involves an advisory board and may include the granting of restricted authorizations. It also provides a framework for defining testing conditions, monitoring outcomes, and ensuring consumer protection and financial stability throughout the experimentation phase.

[42] Available at: https://www.fi.ee/en/news/finantsinspektsioon-offering-chance-testing-innovations

[43] Available at: https://nbs.sk/en/financial-market-supervision1/fintech/regulatory-sandbox/.

Norway [44] (2019) and Malta [45] (2020) emphasize risk-sensitive innovation. Norway's sandbox explicitly integrates data protection, anti-money laundering, and AI oversight into its design. Malta similarly frames its sandbox as a time-bound environment that balances innovation with market integrity and consumer protection.

Greece[46] (2021) illustrates a more sectorial anchored sandbox, where the Bank of Greece focuses primarily on banking and insurance and on fostering early regulatory engagement with fintechs. Spain's "Espacio Controlado de Pruebas" (2020) combines sectoral involvement with broad supervisory cooperation, making it one of the more structured and multi-agency frameworks.[47]

Viewed collectively, European sandboxes are moving beyond isolated national experiments toward a set of complementary practices. Best practices include multi-agency coordination, integration of responsible innovation principles, and openness to international participants.

While variation persists, especially between early movers and recent entrants, these frameworks together foster an increasingly coherent European environment that balances innovation with regulatory safeguards.[48]

A pivotal transformation in the governance of technological innovation within the European Union has been marked by the adoption of Regulation (EU) 2024/1689 of 13 June 2024, known as the Artificial Intelligence Act (AI Act).

For the first time, the Union's legal framework formally mandates the establishment of AI regulatory sandboxes as binding mechanisms of supervised experimentation. These sandboxes are regulated in detail under Articles 57 to 63 of the AI Act, providing a comprehensive structure for innovation facilitation under public oversight.[49]

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[44] Available at: https://www.finanstilsynet.no/en/topics/fintech-and-regulatory-sandbox/finanstilsynets-regulatory-sandbox/.

[45] See: Malta Financial Services Authority, *The MFSA FinTech Regulatory Sandbox*, 2023, the document states that the MFSA FinTech Regulatory Sandbox, established in July 2020 and updated in 2023 under "Sandbox 2.0", provides a controlled environment for testing innovative, technology-enabled financial solutions in Malta. It is open to regulated and unregulated FinTech service providers, as well as technology providers, including RegTech solutions. The sandbox facilitates testing through a structured lifecycle comprising Proposal, Application, Testing, and Exit stages, with strict eligibility criteria and regulatory oversight aimed at ensuring consumer protection and financial stability.

[46] The legal foundation for the Sandbox is set out in Executive Committee Act 189/1/14.05.2021, which outlines its operational structure, eligibility criteria, and procedural guidelines. Key Objectives of the BoG Regulatory Sandbox: support financial innovation while upholding the stability of the financial system; improve legal clarity for emerging technologies and business models; foster knowledge sharing and enhance regulatory understanding of new market developments.

[47] The financial sandbox allows for the testing of technological innovations applicable to the financial system in a controlled environment overseen by supervisory authorities. *Cf.* Law 7/2020, of November 13, on the digital transformation of the financial system.

[48] European Supervisory Authorities (EBA, EIOPA, ESMA), *Joint Report: Regulatory Sandboxes and Innovation Hubs*, cit., 1-57

[49] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828.

According to Article 57, each Member State must ensure the operationalization of at least one AI regulatory sandbox at the national level by August 2, 2026, with the possibility of creating additional regional or cross-border sandboxes.
These sandboxes are conceived as controlled environments for the development, training, testing, and validation of innovative AI systems, including real-world testing under supervision.
Their purpose is not only to foster innovation but also to ensure alignment with Union law, particularly regarding fundamental rights, health and safety, and data protection.
The sandbox regime is grounded in a public-interest logic: it provides legal certainty, encourages regulatory learning, supports SMEs and start-ups, and facilitates safe market access.
Competent authorities are required to provide guidance and supervision, including written documentation - exit reports - that can support subsequent conformity assessments.
No administrative fines can be imposed for infringements during sandbox participation, provided that participants act in good faith and comply with the sandbox plan and regulatory guidance.[50]
Article 58 mandates the Commission to adopt implementing acts defining the detailed functioning of the sandboxes, including eligibility criteria, participation conditions, transparency requirements, and legal effects of participation. Importantly, the regulation ensures free access for SMEs and encourages the inclusion of broader ecosystem actors such as research centers, notified bodies, and innovation hubs.
A special regime for the processing of personal data in the sandbox context is provided by article 59. Under strict safeguards and only when anonymized or synthetic data are insufficient, personal data may be lawfully reused for developing AI systems serving public interest functions (e.g., healthcare, environmental protection, transport safety).
Such processing must take place within protected environments, without affecting data subjects' rights or producing decisions impacting them.[51]
Beyond sandbox-specific rules, article 60 allows for testing of high-risk AI systems in real-world conditions outside sandboxes, subject to separate procedural safeguards (e.g., national authority authorization, informed consent, registration, and mitigation protocols).
While outside the sandbox regime, this provision reinforces the EU's commitment to a graduated approach to experimentation, distinguishing between controlled and less-controlled test phases.[52]

[50] Regulation (EU) 2024/1689, Article 57, paragraph 12: "Providers and prospective providers participating in the AI regulatory sandbox shall remain liable under applicable Union and national liability law for any damage inflicted on third parties as a result of the experimentation taking place in the sandbox. However, provided that the prospective providers observe the specific plan and the terms and conditions for their participation and follow in good faith the guidance given by the national competent authority, no administrative fines shall be imposed by the authorities for infringements of this Regulation. Where other competent authorities responsible for other Union and national law were actively involved in the supervision of the AI system in the sandbox and provided guidance for compliance, no administrative fines shall be imposed regarding that law."
[51] As highlighted in Recital 38, such environments are designed to "promote innovation and facilitate the development and testing of innovative AI systems under strict regulatory oversight".
[52] While AI regulatory sandboxes are intended to be open to all sectors, the AI Act specifically identifies certain application areas as high-risk, which are more likely to require supervised experimentation. According

The sandbox framework is complemented by provisions of articles 61-63, which ensure informed consent for real-world testing, dedicated support for SMEs and start-ups, including priority access and reduced compliance burdens, and simplified quality management for microenterprises under specific conditions.

Collectively, such provisions instantiate a multi-level regulatory infrastructure for AI experimentation in the EU, combining national implementation with Union-wide coordination. In this way the AI regulatory sandbox is no longer a policy aspiration or soft-law instrument. It is a legally entrenched instrument of anticipatory regulation. Such a model reflects the European Union's broader digital constitutionalism, promoting innovation under the rule of law, with mechanisms to ensure proportionality, accountability, and rights compliance throughout the AI lifecycle.[53]

Still, some scholars caution that the AI Act's sandbox regime may not fully deliver on its promise of a genuinely risk-based approach. As Ebers has noted, the regulation risks introducing rigidities and legal uncertainty if proportionality and contextual differentiation are not carefully implemented.[54]

A further and equally significant development in the European regulatory landscape, alongside the AI Act, is the Interoperable Europe Act Regulation (EU) 2024/903 and its Implementing Regulation (EU) 2025/1420 of 17 July 2025, which introduced a novel institutional framework for interoperability regulatory sandboxes.[55]

These instruments are designed to provide structured environments in which public administrations from at least three Member States, or in combination with European Union institutions, can jointly test innovative digital solutions under real-world conditions.[56]

By institutionalizing experimentation within a supervised yet flexible setting, the European Union aims to accelerate cross-border digital innovation while ensuring compliance with the legal and organizational requirements of the internal market.

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to Annex III of Regulation (EU) 2024/1689, these include domains such as biometric identification, critical infrastructure, education, employment, access to essential services, law enforcement, migration and border control, and the administration of justice. AI systems operating in these areas fall under the definition of high-risk pursuant to Article 6(2) and are thus prioritised for testing in regulatory sandboxes or under real-world testing protocols.

[53] In these terms, see: O. Pollicino, F. Paolucci, *Digital Constitutionalism*, in L. Floridi, M. Ziosi and M. Taddeo (eds.), *Companion to Digital Ethics*, Oxford University Press, 2025, emphasize precisely the transition from digital liberalism to digital constitutionalism, where EU law becomes a central tool to rebalance power relations between public and private actors in the context of AI.

[54] M. Ebers, *Truly Risk-Based Regulation of Artificial Intelligence: How to Implement the EU's AI Act*, in *European Journal of Risk Regulation*, Vol. 16 , No. 2, 2025, 684-703.

[55] *Cf.* Commission Implementing Regulation (EU) 2025/1420 of 17 July 2025 laying down rules for the application of Regulation (EU) 2024/903 of the European Parliament and of the Council, as regards the establishment and the operation of the interoperability regulatory sandboxes.

[56] *Cf.* Regulation (EU) 2025/1420, Article 2, stating that: "An interoperability regulatory sandbox shall be established through a specific agreement between at least three Union entities or public sector bodies. Legal entities forming a consortium may establish an interoperability regulatory sandbox, provided that the consortium involves at least three Union entities or public sector bodies and complies with the conditions set out in this Regulation."

The core rationale of interoperability sandboxes lies in their capacity to simultaneously address the legal, organizational, semantic, and technical barriers that often hinder seamless digital cooperation across Europe.

For administrations, particularly in smaller or less digitally mature Member States, the sandbox format offers a structured mechanism to identify regulatory bottlenecks, engage relevant stakeholders on equal footing, and develop solutions with tangible potential for deployment.

Unlike funding instruments or rigid pilot programs, interoperability sandboxes are deliberately designed as agile and adaptive tools: they can be initiated without fixed application windows, are not bound by prescriptive templates, and rely instead on a light governance framework centered on clearly defined legal questions and innovative interoperability objectives.

Transparency and knowledge-sharing represent a cornerstone of this mechanism. Each sandbox must produce interim and final reports, which are published on the Interoperable Europe Portal and discussed within the Interoperable Europe Board.

In this way, the regulatory learning generated by each experimental project can inform not only the participants but also the broader European community of practice, thereby creating a cumulative process of innovation diffusion and legal adaptation. The Portal itself is envisaged as a growing digital hub, progressively hosting sandbox results, a GovTech wiki, and collaborative platforms for future initiatives.

Complementary initiatives, such as the Public Sector Tech Watch, provide systematic monitoring and dissemination of lessons learned from these sandbox experiences, reinforcing the Union's commitment to a governance model that couples experimentation, transparency, and systemic integration.

As of today, the European Union's approach to regulatory sandboxes exhibits a twofold consolidation. On the one hand, the transition from fragmented national initiatives to more structured and harmonized frameworks, particularly in financial services. On the other hand, the institutionalization of innovation facilitators within binding legislative instruments, most notably the AI Act.

This trajectory confirms the EU's commitment to embedding innovation governance within a broader normative framework that prioritizes legality, proportionality, and compliance with rights.

Nonetheless, significant challenges remain. Despite the recent institutionalization of regulatory sandboxes under the AI Act and the Interoperable Europe Act, questions persist regarding their effective cross-border operationalization, the asymmetries in supervisory capacities among national authorities, and the absence of fully harmonized legal effects across Member States.[57]

[57] H. Burden, S. Stenberg, *EU Regulatory Sandboxes: An Opportunity for Coordinating AI Innovation*, *RISE Report*, 2025, Vol. 81 and T. Buocz, *Regulatory sandboxes in the AI Act: reconciling innovation and fundamental rights*, cit., 357-389, emphasize that, despite the EU-level recognition of regulatory sandboxes, their actual implementation remains primarily national and is not yet fully capable of supporting cross-border projects. Regarding the legal effects, see: H. Burden, *An Intermediate Governance Model for EU Regulatory Sandboxes*, *RISE Report*, 2025, pointing out that while sandboxes offer experimental flexibility, they produce limited and fragmented legal effects, which often result in a lack of harmonization across Member States.

The European Union model thus presents a distinctive paradigm of anticipatory regulation under constitutional constraints, increasingly characterized by a public interest rationale and multi-level coordination.[58]

From a comparative perspective, the European Union's model now presents a compelling counterpoint to the more market-driven and permissive sandbox architectures developed in the United States and the People's Republic of China, distinguished by its embeddedness in supranational legal constraints and its increasingly coordinated, public-interest orientation.

III. Regulatory Sandbox in the United States

The United States sandbox landscape must be understood in light of its vibrant innovation ecosystem. With leading patent activity, high research and development intensity, and dominant global tech firms, the United States possesses an innovation system that often drives policy experimentation.

Regulatory sandboxes have emerged not only to promote domestic entrepreneurship, but also to ensure strategic leadership in fintech and artificial intelligence development amid increasing competition from China and the EU. One key example is represented by the July 2025 "America's AI Action Plan", which identifies regulatory sandboxes as key tools to foster responsible innovation and maintain the United States technological leadership.[59]

Nevertheless, the evolution of regulatory sandboxes in the United States must also be understood within the broader architecture of American federalism and its historically entrenched sector-based regulatory model.

Unlike the European Union, which has increasingly consolidated its innovation facilitation mechanisms within supranational legal frameworks, the United States operates a fragmented system in which jurisdiction over financial services and technological innovation is diffused across multiple federal and state entities.

This structural decentralization generates a complex and often inconsistent regulatory landscape, where states compete to attract fintech experimentation while federal agencies remain circumspect in their engagement with sandbox mechanisms.[60]

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[58] D. Ahern, *The New Anticipatory Governance Culture for Innovation: Regulatory Foresight, Regulatory Experimentation and Regulatory Learning*, in *European Business Organization Law Review*, 2025, Vol. 26, 241-283, frames EU regulatory sandboxes as part of a broader anticipatory governance culture, emphasizing their proactive orientation.

[59] Executive Office of the President of the United States, America's AI Action Plan, July 2025, available at: https://www.whitehouse.gov/wp-content/uploads/2025/07/Americas-AI-Action-Plan.pdf.

[60] See: F. Arena, N. Dean, J. Wood, *Regulatory Sandboxes: Encouraging Compliance While Supporting Innovation*, in *ResearchGate*, 2025, available at: https://www.researchgate.net/publication/391657885_Regulatory_Sandboxes_Encouraging_Compliance_While_Supporting_Innovation, emphasize how the decentralized nature of United States financial regulation fosters regulatory experimentation at the state level, particularly in Arizona, Utah, and Wyoming, but also creates friction and inconsistency due to the lack of harmonization with federal initiatives. They note that federal agencies such as the Consumer Financial Protection Bureau and Commodity Futures Trading Commission have established innovation offices but have generally refrained from implementing full sandbox models, citing concerns about legal authority and market stability; and G. Frazier, N. Walter,

The American legal tradition, shaped by a constitutional division of powers, has not produced a unified regulatory authority analogous to the European Supervisory Authorities.

Instead, oversight responsibilities are distributed among agencies such as the Securities and Exchange Commission (SEC), the Commodity Futures Trading Commission (CFTC), the Consumer Financial Protection Bureau (CFPB), and the Office of the Comptroller of the Currency (OCC), each with functionally distinct competencies.

This institutional pluralism, while potentially fostering regulatory innovation through jurisdictional experimentation, also exacerbates coordination deficits and creates barriers to legal certainty for firms operating across multiple jurisdictions.[61]

This context helps explain why the United States has not adopted a federal regulatory sandbox akin to those implemented in other common law jurisdictions such as the United Kingdom or Singapore.[62] Instead, the first American sandbox was launched not at the federal level, but by a single state, Arizona.

Arizona's 2018 regulatory sandbox, codified through House Bill 2434 and administered by the Office of the Attorney General, represented the first formally established sandbox regime in the United States. The initiative was explicitly conceived as a deregulatory measure aimed at attracting FinTech and RegTech companies to the State by offering a supervised, time-limited environment for testing financial products without the full burden of initial licensing or registration requirements.[63]

Under the statutory framework,[64] eligible participants may test innovative financial services for up to 24 months, with the possibility of extension, and may serve up to 10,000 consumers, extendable to 17,500 upon additional approval).

Regulatory Sandboxes: How Federal Agencies Can Take Part in Cooperative Federalism and Catalyze Innovation and Economic Growth through Exercise of Their Exemptive Authority, in *The Dartmouth Law Journal*, Vol. XVIII, No. 2, 2021, 62 ff., further underscore the constitutional and policy implications of this fragmented model, framing state-level sandboxes as expressions of "cooperative federalism." They argue that, to unlock the full potential of such initiatives, federal agencies must actively use their statutory "exemptive authority" to align federal and state regulatory environments, especially in high-innovation sectors like FinTech and RegTech.

[61] See: D. A. Zetzsche et al., *Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation*, in *Fordham Journal of Corporate & Financial Law*, Vol. 23, No. 1, 2017, 31–103, offering a comparative framework that contextualizes the United States model within broader international trends, highlighting how the lack of centralized coordination in the United States contrasts with more coherent approaches adopted by jurisdictions like the UK and Singapore. Their analysis supports the view that fragmentation in the American regulatory system limits scalability and cross-jurisdictional learning.

[62] C. C. Chen, *Regulatory Sandboxes in the UK and Singapore: A Preliminary Survey*, in *SSRN*, 2020, available at: https://ssrn.com/abstract=3448901 or http://dx.doi.org/10.2139/ssrn.3448901, underscoring how Singapore's sandbox model is governed by a single regulatory authority, the Monetary Authority of Singapore, which adopts an experimentalist governance philosophy rooted in standardization, regulatory agility, and iterative adaptation. This centralized and proactive model, described as monocentric, contrasts with decentralized systems like the United States, where regulatory authority is fragmented across multiple state and federal actors, complicating the adoption of a unified sandbox framework.

[63] *Cf.* House Bill 2434 (2018), an act amending section 41-1491.10, Arizona Revised Statutes; amending title 41, Arizona Revised Statutes, by adding chapter 55; amending section 44-1531.01, Arizona Revised Statutes; relating to financial products and services. The Attorney General's Office, under the current leadership of AG Kris Mayes, continues to oversee the program within its broader consumer protection and innovation mandate, as reflected in the FY2024 Annual Report, which highlights the ongoing role in fostering secure market experimentation and safeguarding consumer rights across financial services and emerging technologies.

[64] *Cf.* A.R.S. §§ 41-5601 to 41-5612

The regime grants exemptions from specific state-level requirements, while preserving the applicability of general consumer protection laws such as the Arizona Consumer Fraud Act.[65]

Participants are subject to continuous supervision, record-keeping obligations, and mandatory exit procedures, including wind-down plans and transition to full regulatory compliance where applicable.[66]

The Arizona sandbox has served as both a policy laboratory and a regulatory statement. On one hand, it enabled controlled experimentation with emerging technologies such as blockchain, AI-enabled credit scoring, and alternative lending models. On the other hand, it manifested a form of competitive federalism, in a sort of race to regulate, whereby states actively craft legal infrastructures to attract entrepreneurial capital and position themselves as innovation hubs. The legislation's emphasis on cross-border cooperation with other domestic and foreign regulators reinforces this strategic ambition.[67]

Nevertheless, the Arizona model is not without its critics. Scholars have expressed concern over its deregulatory orientation and the potential erosion of consumer safeguards, particularly when firms operate under reduced oversight in a context of limited institutional capacity.

More broadly, the absence of federal alignment or harmonized criteria for inter-jurisdictional recognition undermines the scalability of the sandbox model and poses challenges for firms seeking multistate operations.[68]

Despite these limitations, empirical analyses indicate that Arizona's sandbox has in its way accelerated market entry and attracted early-stage venture capital investment for participating firms.[69] As such, the Arizona sandbox illustrates both the potential and the

[65] *Cf.* A.R.S. § 44-1521 et seq.

[66] G. Frazier, N. Walter, *Regulatory Sandboxes: How Federal Agencies Can Take Part in Cooperative Federalism and Catalyze Innovation and Economic Growth through Exercise of Their Exemptive Authority*, cit., 47 ff., detailing how the Arizona sandbox, administered by the state's Attorney General, was deliberately framed as a deregulatory instrument to encourage market entry by innovative financial service providers. They note that while the statutory framework offers exemptions from licensing and registration, it preserves the enforceability of core consumer protection statutes, particularly the Arizona Consumer Fraud Act. The authors also emphasize the program's built-in supervisory and exit mechanisms, designed to balance innovation facilitation with ongoing oversight and structured transition to full regulatory compliance.

[67] *Cf.* A.R.S. § 41-5611

[68] See: H. J. Allen, *Regulatory Sandboxes: One Decade On*, in *SSRN*, 2025, available at: https://ssrn.com/abstract=5365057 or http://dx.doi.org/10.2139/ssrn.5365057, cautioning that regulatory sandboxes often entail a rollback of consumer protection rules without sufficient evidence of offsetting public benefits, particularly in jurisdictions with limited regulatory capacity. She further stresses that the absence of consistent federal or inter-jurisdictional frameworks undermines the replicability and scalability of state-level sandbox initiatives, leaving firms to navigate a patchwork of requirements that complicates multi-state expansion.

[69] P. Watkins, E. Daniels, S. Slayton, *First in the Nation: Arizona's Regulatory Sandbox*, in *Stanford Law & Policy Review*, 2018, stress how the Arizona sandbox was strategically designed to lower entry barriers for innovative financial service providers by offering time-limited, supervised testing with streamlined licensing requirements. While deregulatory in orientation, the framework preserves key consumer protection statutes, such as the Arizona Consumer Fraud Act, and subjects' participants to ongoing oversight, recordkeeping duties, and structured exit plans to ensure an orderly transition to full compliance.

structural limitations of a decentralized, state-driven approach to regulatory experimentation in the United States context.

Among the states that followed Arizona's lead in adopting regulatory sandboxes, Wyoming represents a paradigmatic case in the American regulatory sandbox landscape, not merely for establishing a sandbox per se, but for embedding it within a broader, strategic legal architecture designed to attract blockchain-based financial innovation.

The Wyoming Financial Technology Sandbox Act, enacted in 2019 and operationalized the same year, established a dedicated regime for testing novel financial products and services that may not fit neatly within existing statutory definitions.[70]

The sandbox does not operate in isolation; it is part of a coherent legislative suite that includes the Wyoming Utility Token Act,[71] the Digital Asset Custody Framework,[72] and the Special Purpose Depository Institution regime, [73] all designed to create a comprehensive legal ecosystem for digital assets, smart contracts, and blockchain-based financial services.

Under the sandbox program, participants may apply for targeted relief from specific statutory and regulatory requirements, provided they demonstrate that the innovation is in the public interest, that the firm has a credible business plan, and that adequate consumer safeguards are in place.[74]

Testing periods can last up to 24 months, with a maximum customer exposure of 10,000 individuals, subject to extension and case-by-case discretion by the state's Commissioner of Financial Institutions.

Wyoming is distinctive in its willingness to reshape substantive financial law in parallel with procedural sandbox exemptions. Statutory reforms define three categories of digital assets: i) digital consumer assets, ii) digital securities, and iii) virtual currencies and grant custodial authority to eligible institutions.[75]

This framework has attracted firms to obtain the Special Purpose Depository Institution charter.[76] The sandbox operates as a complementary mechanism; firms that do not yet qualify for full SPDI status can pilot their business models under sandbox protections, enabling incremental compliance and iterative regulatory learning.

Despite these innovations, Wyoming's approach has faced criticism. The lack of integration with federal frameworks, especially regarding the SEC's treatment of digital securities and the unsettled regulatory status of certain crypto-assets, creates legal uncertainty and the potential for regulatory arbitrage.

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[70] *Cf.* Bill No. HB0057, Enrolled Act No. 34, House of Representatives, Sixty-Fifth Legislature of the State of Wyoming, 2019 General Session, codified at Wyo. Stat. §§ 40-29-101 to 40-29-109.

[71] *Cf.* Wyo. Stat. §§ 34-29-101 et seq.

[72] *Ibidem.*

[73] *Cf.* Wyo. Stat. §§ 13-12-101 et seq.

[74] *Cf.* Wyo. Stat. §§ 40-29-104.

[75] *Cf.* Wyo. Stat. §§ 13-12-101 et seq.

[76] SPDIs are state-chartered depository banks that, unlike traditional commercial banks, are prohibited from lending and must maintain 100 % reserves against deposits. This model is designed to provide blockchain and crypto-asset firms with secure custodial and payment solutions while navigating around certain federal banking barriers, such as FDIC insurance requirements.

In addition, although the state has embedded consumer protection measures within its sandbox design, oversight capacity remains limited, raising questions about the adequacy of real-time supervision for high-risk deployments.[77]

Utah's regulatory sandbox regime was created by H.B. 378, Regulatory Sandbox, signed on March 25, 2019, establishing the nation's third sandbox program for innovative financial products after Arizona and Wyoming.[78]

The 2019 law authorized the Utah Department of Commerce, in consultation with the Department of Financial Institutions, to allow participants to temporarily test innovative financial products or services on a limited basis without otherwise being licensed or authorized to act under the laws of the state.

In 2021, the legislature repealed the sector-specific scheme and created the Utah Office of Regulatory Relief within the Governor's Office of Economic Opportunity (formerly the Governor's Office of Economic Development), consolidating authority over the new General Regulatory Sandbox Program.[79]

This reform broadened the sandbox beyond fintech to encompass any "offering" with a regulatory nexus, including financial services, insurance, health care, and, via a separate judiciary-run initiative, the Legal Services Innovation Sandbox administered by the Utah Supreme Court, extended through August 2027.[80]

The statutory framework permits eligible firms to demonstrate innovative offerings for 12 months, extendable for an additional 12 months.[81] Applicants must establish a physical or virtual location in Utah,[82] a departure from the 2019 law's physical-only requirement, and submit a detailed application including: the laws or regulations they seek to have waived, the consumer benefits, risk assessments, a demonstration plan, and an exit strategy.[83]

The Office consults with all "applicable agencies" regulating the applicant's business, and each agency must identify any non-waivable laws or significant consumer protection concerns.[84]

Consumer protection obligations include pre-transaction disclosures (name/contact, sandbox authorization, unlicensed status if applicable, testing risks, lack of state endorsement, expected end date, complaint process) and acknowledgment of receipt for online transactions.[85] Participants must keep business records and submit quarterly

[77] See: G. Frazier, N. Walter, *Regulatory Sandboxes: How Federal Agencies Can Take Part in Cooperative Federalism and Catalyze Innovation and Economic Growth through Exercise of Their Exemptive Authority*, cit., 62 ff.
[78] *Cf.* H.B. 378, 2019 Gen. Sess., codified at former Utah Code Ann. §§ 13-55-101 et seq.
[79] *Cf.* Utah Code Ann. §§ 63N-16-101 et seq.
[80] Utah Office of Legal Services Innovation, Legal Services Innovation Sandbox, Utah Supreme Court, available at: https://utahinnovationoffice.org, the Utah Supreme Court's sandbox represents a judiciary-administered regulatory experiment allowing nontraditional legal service providers, including entities with nonlawyer ownership or investment, to deliver legal services under monitored conditions. The program's extension to August 2027 reflects a commitment to ongoing data collection and evaluation of its impact on access to justice and consumer protection.
[81] *Cf.* Utah Code Ann. §§ 63N-16-205.
[82] *Cf.* Utah Code Ann. §§ 63N-16-201(4)(b),
[83] *Cf.* Utah Code Ann. §§ 63N-16-201(9),(13).
[84] *Cf.* Utah Code Ann. §§ 63N-16-103.
[85] *Cf.* Utah Code Ann. §§ 63N-16-203.

reports, which are shared with applicable agencies to inform potential statutory or regulatory reform.[86]

The Utah sandbox provides for multi-agency licensing exemptions during the demonstration, subject to federal law compliance, but allows agencies to reinstate rules if consumer protections are deemed inadequate.

Reciprocity agreements with other state or federal regulators are authorized, though as of 2025, no formal interstate recognition is in force.[87]

In 2023, Utah supplemented the sandbox ecosystem with a Noncustodial Blockchain Registry for blockchain companies that do not hold users' private keys, reinforcing the state's openness to blockchain-based innovation alongside sandbox operations.[88]

As of the 2025 General Session, the Utah Office of Regulatory Relief also conducts proactive regulatory reviews and submits annual reports with recommendations for permanent legal reforms, integrating sandbox lessons into broader deregulatory strategies.[89]

Florida's adoption of a regulatory sandbox reflects a statute-based, legislature-driven model, in which regulatory discretion is carefully circumscribed by detailed legislative parameters.

The program was established in 2020 through the Financial Technology Sandbox Act, codified in Chapter 559, Florida Statutes,[90] which empowers the Office of Financial Regulation to grant temporary, conditional exemptions from specific provisions of the Florida Money Transmitters' Code[91] and the Consumer Finance Act.[92]

Unlike Arizona or Wyoming, Florida's regime rests on a formal legislative enactment. The statute specifies in detail the eligibility criteria, the range of permissible exemptions, consumer protection obligations, and the procedures governing duration, extension, and termination.

Participating firms may test innovative financial products or services for 24 months, with a possible 12-month extension.[93] An initial limit of 15,000 consumers applies during the first phase, but, following submission of the first semi-annual report, this cap may be increased automatically to 25,000 consumers if the Office of Financial Regulation determines that adequate risk controls and operational capacity are in place. [94]

The Florida sandbox's substantive scope covers activities in money transmission, payments, lending, and other digital financial services, while exemptions may only be granted from provisions explicitly enumerated in the statute.

This effectively excludes domains such as securities and insurance, which remain under the authority of separate state regulators. The design thus concentrates the Office of Financial Regulation's oversight on well-defined areas but narrows the sandbox's reach at

[86] *Cf.* Utah Code Ann. §§ 63N-16-206(3).
[87] *Cf.* Utah Code Ann. §§ 63N-16-103(4)(a).
[88] *Cf.* Utah Code Ann. §§ 63N-16-401 to 403, Enacted by Chapter 77, 2023 General Session.
[89] *Cf.* Utah Code Ann. §§ 63N-16-302, Amended by Chapter 512, 2025 General Session
[90] *Cf.* Florida Statutes, Chapter 559.952 – Financial Technology Sandbox
[91] *Cf.* Chapter 560, Fla. Stat.
[92] *Cf.* Chapter 516, Fla. Stat.
[93] *Cf.* Florida Statutes, Chapter 559.952(7)
[94] *Cf.* Florida Statutes, Chapter 559.952(4)(5)

a time when convergence between financial, insurance, and digital identity services is accelerating.

Florida's model is distinguished by the centrality of the regulator's individualized assessment.[95] The statutory discipline reflects Florida's administrative law tradition, in which agencies operate under precise legislative mandates to avoid unconstitutional delegation.[96]

Consumer protection provisions are stringent. Participants must file a consumer protection plan, make the mandatory pre-transaction disclosures, maintain records accessible to the Office of Financial Regulation, and submit semi-annual reports detailing financial data, consumer counts, and any identified risks.

Consumers must be clearly informed that the product or service is operating under temporary authorization, may be modified or discontinued, and is not endorsed by the State of Florida.[97]

According to the Office of Financial Regulation's 2024 Biennial Report, nine businesses have applied for a sandbox license since the program's inception, but none have completed the process. Applicants have either withdrawn to pursue a standard money services business license under Chapter 560, Florida Statutes, or abandoned the licensure process altogether.

The report attributes this outcome to a cumbersome and restrictive application process, including requirements to demonstrate a physical presence in Florida, maintain minimum net worth and bonding thresholds, and limit activities to those covered under Chapters 516 and 560.[98]

An additional consideration concerns the confidentiality provision in § 559.952(5)(h), which shields specified application materials from Florida's public records regime pursuant to the Open Government Sunset Review Act. The potential lapse of confidentiality could materially reduce the sandbox's attractiveness to firms whose competitive advantage depends on proprietary business models, particularly in sectors such as algorithmic lending and blockchain-based identity solutions.

In the wake of Arizona's pioneering initiative and subsequent other expansions, several other US states have introduced their versions of regulatory sandboxes. While these

[95] Under § 559.952(5)(c), in deciding whether to approve or deny an application, the Office of Financial Regulation must consider a comprehensive set of factors, including: (1) the nature and technical details of the proposed innovative financial product or service; (2) potential consumer risks and proposed protection and complaint-resolution methods; (3) the applicant's business plan, market analysis, and financial viability; (4) the adequacy of personnel and technical expertise to test, monitor, and assess the product or service; (5) whether any control person has certain disqualifying criminal or regulatory histories; (6) the disclosures to be provided to consumers; (7) the financial responsibility history of the applicant and control persons; and (8) any other factor the Office deems relevant.

[96] In literature, see: J. E. Fennelly, *Non-Delegation Doctrine and the Florida Supreme Court: What You See Is Not What You Get*, in *St. Thomas Law Review*, Vol. 7, 1995, observing how Florida's adherence to the strict non-delegation doctrine historically required the legislature to articulate clear and definite standards delimiting agency discretion, both to prevent arbitrary or corrupt exercises of power and to preserve the separation of powers mandated by Article II, section 3 of the Florida Constitution.

[97] *Cf.* Florida Statutes, Chapter 559.952(6)(b) and (8)

[98] State of Florida Office of Financial Regulation, Biennial Report December 2024, 9 ff.

initiatives often follow the same basic model, temporary regulatory relief, agency supervision, and consumer protection, they differ significantly in scope, ambition, and institutional design.

Among these jurisdictions, Kentucky, Nevada, and Hawaii have established sandbox regimes through legislative enactments, though with varied degrees of implementation and impact. Collectively, they reflect the experimental heterogeneity that characterizes the American state-level approach to regulatory innovation.

Kentucky's contemporary approach to regulatory experimentation began with the creation of the General Regulatory Sandbox Program in March 2024, established within the Office of Regulatory Relief pursuant to Ky. Rev. Stat. § 15.268.

The statute provides a structured mechanism for authorizing the temporary suspension or waiver of specific administrative regulations to facilitate the testing of innovative products, services, or business models that would otherwise be subject to licensing or other legal requirements.[99]

Access to the program is conditioned on the applicant's jurisdictional nexus with Kentucky, demonstrated through a physical or virtual presence in the state, and on the maintenance of all relevant records and data within its territory.

Applications must include a detailed description of the innovation, an identification of the regulatory barriers encountered, an assessment of consumer benefits and risks, a defined demonstration plan with specified commencement and completion dates, and a commitment to comply with the full regulatory framework at the conclusion of the testing period.

The Office is empowered to conduct pre-application consultations to determine whether the general sandbox or a sector-specific program offers the most appropriate environment for the proposed demonstration.

In March 2025, the Kentucky legislature enacted House Bill 184, significantly extending and enhancing the insurance regulatory sandbox.[100] This reform prolonged the program's operation until 31 December 2030, expanding its scope to allow both Insurtech firms and established insurers to trial novel insurance products under tailored regulatory relief, including the issuance of no-action letters. In parallel, the law introduced strengthened protections for financial contracts in cases of insurer insolvency, thereby reinforcing consumer confidence and market stability.

The coexistence of the General Regulatory Sandbox Program with an enlarged insurance-specific sandbox reflects Kentucky's strategic decision to adopt a dual-track model: a broadly applicable experimental regime capable of accommodating cross-sectoral innovation, alongside targeted sectoral frameworks designed to address the distinctive risk profiles and regulatory challenges of particular industries.

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[99] *Cf.* General Regulatory Sandbox Program, Ky. Rev. Stat. § 15.268.

[100] *Cf.* House Bill 184, Amends KRS 304.3-705 to extend the insurance regulatory sandbox program until December 31, 2030; amends KRS 304.3-735 to extend the commissioner's reporting requirement; creates a new section of Subtitle 33 of KRS Chapter 304 to define terms; establishes rights and requirements relating to netting agreements and qualified financial contracts in a delinquency proceeding against an insurer; and amends KRS 304.33-050, 304.33-170, 304.33-240, 304.33-260, 304.33-290, 304.33-300, 304.33-310, and 304.33-330 to conform.

This layered approach situates Kentucky among the United States jurisdictions experimenting with sandbox structures that balance market liberalization with sustained consumer protection.

Nevada's regulatory sandbox was established in 2019 through Senate Bill 161 and is codified under the Nevada Revised Statutes (NRS) §§ 657A.100–657A.620 under the name of Regulatory Experimentation Program for Product Innovation.

Administered by the Nevada Department of Business and Industry, the program authorizes eligible firms to test innovative products or services within the financial services sector, such as those related to banking, lending, mortgage brokering, and money transmission, under temporary exemptions from certain state licensing and regulatory requirements.

The statutory scheme reflects an intention to position Nevada as a jurisdiction supportive of fintech experimentation, granting participants up to two years of testing under defined supervisory conditions.

Access to the program is conditioned on the submission of a detailed application, including a description of the innovation, an explanation of the statutory or regulatory provisions from which relief is sought, and a plan addressing consumer protection, risk management, and complaint resolution.[101]

Despite the breadth of the statutory authorization, the sandbox has experienced limited uptake. Official reports from the Department indicate that only a small number of applications have been received since inception.[102] Experts have attributed this underutilization to factors such as the narrow sectoral scope, the absence of explicit cross-sector coordination mechanisms, and potential uncertainty among applicants regarding post-sandbox regulatory pathways.[103]

Nevertheless, the legislative framework remains one of the more detailed among United States state-level sandboxes, providing a foundation that could support more robust experimentation should policy priorities or market conditions shift.

Hawaii's experimentation with regulatory sandbox concepts has taken a pilot-based, rather than legislative, form through the Digital Currency Innovation Lab. Launched in March 2020 as a collaborative initiative between the Division of Financial Institutions within the

[101] The Department retains discretion to impose limits on the number of clients served, transaction values, or other operational parameters during the test period, and participants are required to maintain certain financial safeguards.

[102] *Cf.* Nevada Department of Business and Industry, Annual Report on the Regulatory Experimentation Program for Product Innovation, 2022, available at: https://www.leg.state.nv.us/Division/Research/Documents/RTTL_NRS657A.530_2022.pdf. As of the most recent reporting year, only one firm had completed its participation in the program.

[103] C. Belt, *State Permissions vs. Market Possibilities: Regulatory Sandboxes in Nevada*, in Nevada Policy, 2023, the report underscores how Nevada's sandbox has remained largely dormant due to structural limitations. In particular, the narrow fintech scope, the lack of institutional mechanisms for inter-agency cooperation, and uncertainty regarding regulatory treatment after the sandbox period are identified as critical deterrents. This highlights that underutilization is not merely a matter of weak entrepreneurial demand but a reflection of design flaws that restrict the sandbox's capacity to function as an effective bridge between innovation and regulation.

Department of Commerce and Consumer Affairs and the Hawaii Technology Development Corporation.[104]

The Digital Currency Innovation Lab initially admitted twelve companies (including notable names such as Gemini, Robinhood Crypto, and several startups) in its first cohort, followed by an additional four in 2021.[105]

Participating firms could conduct digital currency transactions in Hawaii without a money transmitter license, under "no action" assurances issued by the Division of Financial Institutions. Within the pilot period, companies were required to submit detailed operational metrics, consumer disclosures, and support consumer protection oversight.

Originally set to conclude in mid-2022, the Digital Currency Innovation Lab was extended through June 30, 2024, in light of significant transaction volumes and consumer engagement, over 134,000 consumers and more than $800 million in transactions by the end of 2021.[106]

However, by its conclusion in June 2024, the program's findings led the Division of Financial Institutions and Hawaii Technology Development Corporation to recommend that digital asset firms no longer require money transmitter licenses under Hawaii law, allowing them to continue operations without state-level authorization, though they remain subject to applicable federal regulations administered by bodies such as FinCEN and the SEC.[107]

Several other United States states, including North Carolina[108], Alabama, and South Carolina[109], have introduced sandbox-enabling bills or feasibility studies, though none have yet operationalized a fully functioning sandbox regime. These initiatives often cite the success of Arizona and Wyoming as reference models, but face political, fiscal, or administrative obstacles to implementation.

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[104] The program leveraged regulatory discretionary authority under HRS Chapters 412 and 489D to exempt selected firms from Hawaii's money transmitter licensing obligations for the purpose of testing digital currency services, a field otherwise highly constrained under state law.

[105] *Cf.* Digital Currency Innovation Lab Report December 2022, by Hawaii Division of Financial Institutions.

[106] Hawaii Department of Commerce and Consumer Affairs, Digital Currency Innovation Lab Extended Two Years, News Release, June 2022.

[107] Annual Compliance Resolution Fund Report, Department of Commerce and Consumer Affairs, State of Hawaii, December 2024. Analyst observations and official reports highlight key challenges and limitations: the lab lacked a statutory basis, relied on the exercise of regulatory discretion rather than legislative authority, and generated enduring legal uncertainty. This structural fragility inhibited prospects for permanence, despite the DCIL's value in informing policy and regulatory capacity-building. In this regard, see: Digital Currency Innovation Lab Report December 2022, by Hawaii Division of Financial Institutions.

[108] *Cf.* North Carolina General Statutes, Chapter 169, "North Carolina Regulatory Sandbox Act of 2021," § 169-1 et seq. In literature, see: J. W. Harris, *NC Regulatory Sandbox Act: Encouraging Innovation Despite Missing Some Opportunities*, in *North Carolina Banking Institute*, Vol. 26, No. 1, 2022, 301 ff., explaining that the North Carolina Regulatory Sandbox Act, positions the state among a growing number of United States jurisdictions adopting such frameworks to foster innovation in financial, insurance, and blockchain sectors. While recognizing its potential to attract innovators, he underscores that the Act omits lessons from earlier sandbox implementations elsewhere, suggesting that future refinements, either through the Innovation Council's discretionary adjustments or legislative amendments, will be essential to maximize its effectiveness.

[109] *Cf.* S.C. Bill 4351, 123rd Gen. Assemb., Reg. Sess. (2019) ("South Carolina Financial Technology Sandbox Act"), codified at S.C. Code Ann. §§ 34-49-10 et seq.

The analysis of Arizona, Wyoming, Utah, Florida, Kentucky, Nevada, and Hawaii reveals the heterogeneity of state-level sandbox frameworks in the United States, both in terms of regulatory design and strategic orientation.

From a structural perspective, these jurisdictions may be grouped along two principal axes. The first concerns the scope of applicability. Arizona, Florida, and Nevada have opted for sector-specific sandboxes largely confined to financial services, though with notable distinctions: Arizona's broad fintech remit is counterbalanced by Nevada's narrower banking-lending focus and Florida's strict statutory limits on permissible exemptions. Conversely, Utah and Kentucky have shifted towards general regulatory sandbox models, capable of accommodating innovation across multiple sectors - financial, insurance, health, and legal services - reflecting a legislative intention to embed sandbox mechanisms into wider deregulatory strategies.

The second axis pertains to the integration with broader legislative ecosystems. Wyoming represents the paradigmatic case of a sandbox embedded within a comprehensive digital-asset regulatory infrastructure, including substantive redefinitions of property and custody rules. Kentucky's dual-track model, combining a general sandbox with an expanded insurance-specific framework, illustrates a layered strategy to reconcile cross-sectoral flexibility with targeted risk management. In contrast, Hawaii's approach was experimental and pilot-based, confined to digital currencies, and ultimately led to permanent deregulatory outcomes outside a formal sandbox statute.

In terms of regulatory discretion and procedural formalism, Florida and Nevada exemplify highly codified legislative frameworks with detailed statutory eligibility criteria and constrained agency discretion, consistent with their respective administrative law traditions. By contrast, Arizona and Utah afford regulators broader operational latitude, facilitating adaptive oversight but potentially creating variability in the application of consumer-protection standards.

The efficacy and market uptake of these sandboxes diverge markedly. Arizona and Wyoming have attracted measurable entrepreneurial activity, leveraging their competitive federalism strategies. Utah and Kentucky are still in an early consolidation phase but show potential for multi-sector engagement. Florida and Nevada, despite formal enactments, have seen limited uptake, suggesting that procedural burdens and narrow sectoral confines can outweigh the appeal of regulatory relief. Hawaii's Digital Currency Innovation Lab stands out for significant transactional volumes, though its deregulatory legacy has effectively transcended the sandbox framework itself.

Overall, the diffusion of sandbox legislation across the United States has thus occurred in a non-uniform, jurisdictionally contingent manner. This regulatory pluralism reflects the broader constitutional architecture of the United States, but also raises critical questions about access, fairness, and systemic efficiency.[110]

[110] See: F. Arena, N. Dean, J. Wood, *Regulatory Sandboxes: Encouraging Compliance While Supporting Innovation*, cit.; and G. Frazier, N. Walter, *Regulatory Sandboxes: How Federal Agencies Can Take Part in Cooperative Federalism and Catalyze Innovation and Economic Growth through Exercise of Their Exemptive Authority*, cit., 62 ff.

Firms that succeed in one sandbox may find themselves unable to scale operations across state lines without reapplying under divergent criteria, while consumers receive uneven levels of protection and oversight depending on jurisdiction.

While the majority of regulatory sandbox activity in the United States has emerged at the state level, federal agencies have, since the late 2010s, developed a parallel infrastructure of innovation facilitators, often termed innovation offices, no-action letters, or compliance assistance programs.

Unlike the binding sandbox regimes adopted by states such as Arizona or Florida, these federal instruments operate on the basis of soft law, informal guidance, and discretionary exemptions, reflecting both the limits of federal authority and a historically cautious approach toward experimental regulation in financial services.[111]

The Consumer Financial Protection Bureau has been at the forefront of this cautious innovation. In 2019, the Bureau launched its Compliance Assistance Sandbox and revised its No-Action Letter Policy, with the explicit goal of providing firms with regulatory certainty during the development and early deployment of innovative consumer financial products. These tools allow the Consumer Financial Protection Bureau to signal its intent not to initiate enforcement actions for specific conduct, provided that applicants comply with pre-approved terms and monitoring obligations.[112]

Other federal agencies have pursued similar soft-facilitator models. The Office of the Comptroller of the Currency established its Office of Innovation in 2016, providing a platform for engagement with fintech companies, but has not launched a formal sandbox.[113] The Securities and Exchange Commission maintains its Strategic Hub for Innovation and Financial Technology - FinHub - which engages with startups and offers informal guidance, particularly in the context of blockchain and tokenized assets.[114]

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[111] H. J. Allen, E*xperimental Strategies for Regulating Fintech*, in *Journal of Law & Innovation*, Vol. 3, 2020, 19 ff, highlights that federal facilitators generally take the form of guidance and individualized forbearance (e.g., innovation offices and no-action mechanisms), whereas state sandboxes like Arizona's rest on explicit statutory authorizations and confer time-bound, binding permissions to test in-market.

[112] *Cf.* Consumer Financial Protection Bureau. (2019, September 13). Policy on the Compliance Assistance Sandbox. Federal Register, 84, 48246. The policy formalizes the Bureau's capacity to issue binding approvals and safe-harbor assurances for specified conduct, contingent on adherence to predefined conditions and reporting requirements, thereby reducing legal uncertainty for innovators without altering underlying statutory mandates. It positions the Compliance Assistance Sandbox alongside the No-Action Letter framework as part of a broader strategy to balance market experimentation with statutory consumer-protection goals. In this regard, see: H. J. Allen, E*xperimental Strategies for Regulating Fintech*, cit., 21 ff., situating the Compliance Assistance Sandbox within a spectrum of innovator-supporting regulatory tools that rely on agency discretion and interpretive guidance, underscoring both their flexibility and their limited ability to resolve structural compliance burdens in the absence of legislative change.

[113] Recommendations and Decisions for Implementing a Responsible Innovation Framework (OCC, October 2016), The Office of the Comptroller of the Currency framed the Office of Innovation as a coordination, outreach, and technical assistance hub rather than a venue for regulatory experimentation. While the report acknowledged industry calls for "sandbox" style pilots, the agency opted for a facilitative, non-binding model grounded in dialogue, guidance, and interagency collaboration, preserving existing supervisory decision-making channels.

[114] In this regard, see: A. R. McClean, M. L. Bouton, *SEC Releases Framework for Analysis of whether Digital Assets are Regulated as Securities and Issues a No-Action Letter applying the Framework*, in *LEGALcurrents* (Harter Secrest & Emery LLP), 2019, stressing that FinHub's activities exemplify the SEC's preference for providing interpretive tools and fact-specific no-action relief rather than creating formal sandbox programs. In the digital asset context, this includes issuing guidance to help market participants evaluate whether token

Similarly, the Commodity Futures Trading Commission operated LabCFTC, a dedicated innovation office that facilitates dialogue with market participants and published several white papers outlining regulatory approaches to AI, digital identity, and DeFi.[115]
These initiatives, while valuable in terms of regulatory learning and industry engagement, do not offer the testing relief or experimental immunity typically associated with sandbox regimes.
Rather, they reflect a legal landscape in which federal preemption is politically constrained and administrative agencies are cautious about granting blanket exemptions without explicit congressional authorization. As such, the federal response to fintech innovation has remained fragmented, sector-specific, and advisory in nature, rather than legally experimental.[116]
A notable, though still limited, attempt at federal coordination has been the establishment of the Federal Financial Institutions Examination Council Fintech Subcommittee, which began meeting in 2022 to explore shared principles for innovation facilitation.
According to the Federal Financial Institutions Examination Council Annual Report 2024, the Council's current interagency technology work has evolved into targeted working groups focusing on supervisory technology, digitalization of banking and credit union services, data collection, and appraisal bias mitigation. However, these efforts remain advisory in nature and have not produced binding interagency protocols or a harmonized federal sandbox framework.[117]
As of today, no United States agency has committed to a multilateral sandbox arrangement with enforceable legal effect, and federal engagement remains exploratory.
From a comparative perspective, the US federal posture could be described as one of proceduralized non-engagement: regulators acknowledge the strategic importance of

offerings constitute securities under the Howey test, and offering non-enforcement assurances conditioned on strict limitations to ensure consumptive use rather than speculative investment.

[115] Commodity Futures Trading Commission Release No. 8613-22 (October 20, 2022), confirms that LabCFTC has evolved into the Office of Technology Innovation to strengthen its policy impact and integration within the Commission's operations. This office continues LabCFTC's mandate to facilitate dialogue with innovators, conduct outreach, and produce thematic white papers, such as on AI in derivatives markets, digital identity frameworks, and the regulatory considerations of decentralized finance, framing them as tools to inform Commodity Futures Trading Commission oversight and market integrity.

[116] See: H. J. Allen, E*xperimental Strategies for Regulating Fintech*, in *Journal of Law & Innovation*, cit., emphasizing that United States federal innovation programs function primarily as platforms for engagement and interpretive guidance rather than as mechanisms conferring time-bound regulatory immunity; M. M. Piri, *The Changing Landscapes of FinTech and RegTech: Why the United States Should Create a Federal Regulatory Sandbox*, in *Business & Finance Law Review*, Vol. 2, No. 2, 2019, noting that without explicit statutory authorization, agencies cannot replicate the binding relief offered in state sandbox models; and G. Frazier, N. Walter, *Regulatory Sandboxes: How Federal Agencies Can Take Part in Cooperative Federalism and Catalyze Innovation and Economic Growth through Exercise of Their Exemptive Authority*, cit., 64 ff., adding that the absence of broad exemptive powers, combined with the political sensitivity of federal preemption, has entrenched a fragmented, sector-specific approach to fintech oversight.

[117] *Cf.* Federal Financial Institutions Examination Council (FFIEC) Annual Report 2024, underscores that while the Fintech Subcommittee has fostered structured dialogue and thematic collaboration across federal financial regulators, its remit is limited to non-binding coordination. Current working groups primarily serve as forums for knowledge exchange, rather than as vehicles for implementing harmonized innovation testing frameworks or binding supervisory standards.

innovation, establish engagement platforms, and issue guidance, but stop short of embedding formal experimental regimes into law.

This stands in contrast to the European Union's progressive codification of sandbox mechanisms and to the People's Republic of China's top-down, centrally mandated pilot programs implemented at the provincial level with substantial state support.

Scholarly analysis attributes this restraint to deep structural constraints, observing that United States federal regulators face both statutory limitations and political risks in adopting experimental governance tools. The risk of post-crisis backlash, reputational harm, or judicial invalidation discourages departures from conventional rulemaking.

Moreover, the absence of a general administrative exemption clause, akin to the EU's "pilot regime" model, means that regulatory relief must be grounded in narrow statutory authority, often tied to consumer-protection or systemic-risk mandates.[118]

Nonetheless, federal innovation offices have contributed meaningfully to regulatory capacity-building.

In 2024, the Commodity Futures Trading Commission's Technology Advisory Committee issued a report on responsible AI in derivatives markets, proposing supervisory models for controlled testing, calibrated data-access protocols, and algorithmic accountability measures.[119]

In January 2025, the Consumer Financial Protection Bureau reinstated its Compliance Assistance Sandbox and No-Action Letter policies, restoring mechanisms originally launched during the first Trump Administration but rescinded under the Biden Administration.

The revised framework provides statutory safe harbors for approved activities to the fullest extent permitted under the relevant provisions, subject to a two-year term (extendable upon application). Eligibility requires that the proposed innovation address an unmet consumer need without undermining competition; minor product modifications do not qualify.

The Consumer Financial Protection Bureau will not grant exclusive approvals to a single firm and will actively invite competitors to apply on the same topic. Applications are posted on a public docket for a 60-day comment period, and recipients must accept the Bureau's supervisory authority.

Additional safeguards include: a ban on advertising program participation; ineligibility for firms prosecuted for consumer financial law violations within the preceding five years; and a prohibition on representation by former Consumer Financial Protection Bureau attorneys. Approvals may be revoked if the product or service materially changes, and

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[118] See again: H. J. Allen, E*xperimental Strategies for Regulating Fintech*, in *Journal of Law & Innovation*, cit., analyzing why United States federal agencies have been reluctant to adopt experimental governance tools, pointing to the absence of broad statutory exemption authority, the risk of political and judicial pushback, and the sectoral fragmentation of regulatory mandates.

[119] *Cf.* U.S. Commodity Futures Trading Commission, Technology Advisory Committee, Minutes of the May 2, 2024 Meeting of the Technology Advisory Committee, 2024. The Subcommittee Report outlines a structured approach to AI oversight in derivatives markets, combining scenario-based testing environments with proportionate data-access governance and embedding fairness, robustness, and explainability into supervisory expectations. While advisory in nature, these proposals are intended to inform future Commodity Futures Trading Commission policy development and interagency coordination.

knowingly submitting false or misleading applications may trigger legal action, a feature some commentators warn could deter participation.

However the programs' future is uncertain: given that they were adopted without formal rulemaking, the Trump Administration could readily revise or terminate them.[120]

This uncertainty is intrinsic to soft law initiatives, which the Administration has actively targeted in other domains, revoking or suspending various guidance documents and executive orders from the prior administration. Simultaneously, the Administration has demonstrated strong conceptual support for regulatory sandboxes, endorsing proposals such as the SANDBOX Act (S.2750) for Artificial Intelligence that aims to establish similar experimental regimes across other federal sectors to accelerate innovation and deregulation.[121]

In sum, the federal layer of the United States sandbox ecosystem is transitioning from a cautious, structurally reactive posture to one of politically driven, pro-innovation enablement. While the system remains fragmented with plural initiatives, reliance on soft-law instruments and discretionary guidance, though fostering low-risk engagement, still deprives innovators of the legal certainty and operational scope offered by structured sandbox regimes abroad.

Without a finalized, interoperable federal framework or congressional enabling legislation, such as the proposed SANDBOX Act, the United States will likely continue to rely heavily on its state-level "laboratories of innovation", a model abundant in experimentation but deficient in coordination and effectiveness.

IV. Regulatory Sandbox in China

The People's Republic of China represents a paradigmatic case of regulatory adaptation in the face of rapid financial technological change. The regulatory sandbox model, initially conceptualized in Western jurisdictions such as the United Kingdom, found fertile yet distinctively complex terrain in China, where state-led innovation policy intersects with centralized political authority and asymmetric market liberalization.

The first official acknowledgment of the sandbox approach in China occurred in December 2019, when the People's Bank of China announced the launch of a FinTech

[120] *Cf.* Ballard Spahr LLP, CFPB Re-establishes Regulatory Sandbox and No-Action Letter Programs, Consumer Finance Monitor (Jan. 15, 2025), available at: https://www.consumerfinancemonitor.com/2025/01/15/ cfpb-re-establishes-regulatory-sandbox-no-action-letter-programs/, outlining how the Consumer Financial Protection Bureau's revised framework reinstates its innovation facilitation tools with more stringent eligibility criteria, enhanced transparency measures, and explicit competition safeguards. These include a public application docket, a bar on exclusivity, and restrictions on applicants with recent enforcement histories or ties to former Bureau attorneys. While the policies aim to encourage responsible market entry, their discretionary, non-rulemaking basis leaves them vulnerable to rapid modification or repeal in response to political change.

[121] S. 2750, Strengthening Artificial intelligence Normalization and Diffusion By Oversight and eXperimentation (SANDBOX) Act, 119th Cong. (2025).

innovation supervisory pilot in Beijing, marking the first experimental deployment of sandbox-like regulatory infrastructure on the mainland.[122]

This early Chinese iteration of the sandbox was not a mere replication of the UK's model but rather a policy transplant with significant institutional adaptation, rooted in China's hybrid governance style, combining principles of party-state control with experimental administrative decentralization.[123]

Unlike the Financial Conduct Authority's functional independence and emphasis on market-driven compliance incentives, the Chinese sandbox emerged as a centrally coordinated pilot program, guided by People's Bank of China circulars, multi-stakeholder oversight, and a gradualist rollout across select pilot zones.[124]

The regulatory instruments underpinning China's sandbox initiatives remain, as of today, non-legislative in nature. Unlike the European Union's move toward harmonised and codified sandbox regulation, such as the DLT Pilot Regime or AI Act, the Chinese system continues to rely predominantly on soft law instruments, pilot guidelines, and administrative communications issued by the People's Bank of China and regional financial bureaus.

In particular, four key documents structure the current regime: the Beijing FinTech Development Plan 2018/2022[125] as the first public document to advocate the regulatory sandbox model; the People's Bank of China FinTech Development Plan 2019/2021[126], calling for a shift from ex-post to ex-ante and real-time financial supervision; the

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[122] See: Y. Chang, J. Hu, *Research on Fintech, Regtech and Financial Regulation in China: Taking the "Regulatory Sandbox" of Beijing Fintech Pilot as the Starting Point*, in *Open Journal of Business and Management*, Vol. 8, 2020, 370 ff., emphasizing that the decision of the People's Bank of China in December 2019 to initiate the Beijing FinTech innovation supervisory pilot was explicitly framed as the "Chinese version of the regulatory sandbox," designed to balance flexibility with prudential oversight. Their account underlines the political embedding of the initiative within the Fintech Development Plan (2019–2021) and the State Council's broader service-industry opening strategy.

[123] M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, in *International Journal of Law and Society*, Vol. 5, No. 4, 2022, 395 ff., stresses that, despite this pioneering step, the Chinese sandbox lacked a mature legislative framework and operated largely through policy experimentation. The early pilots in Beijing, followed by successive batches in 2020–2022, illustrate both the state's commitment to controlled financial innovation and the persistent ambiguity in entry standards, project review, and consumer protection mechanisms.

[124] M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, in *Revista Chilena de Derecho*, Vol. 49, No. 2, 2022, 194 ff., underscore that China's sandbox differs fundamentally from the Financial Conduct Authority model, operating as a state-directed pilot embedded in the People's Bank of China's regulatory strategy rather than as an autonomous innovation hub. They highlight how the initiative relies on centrally issued circulars, collaborative supervision among ministries and financial regulators, and a phased rollout across pilot cities, reflecting China's preference for gradualist and coordinated experimentation over market-led self-regulation.

[125] Beijing Municipal Financial Regulatory Bureau, *Plan for Promoting the Development of FinTech in Beijing (2018–2022)*, 2018. The Beijing Plan represented the first official policy document explicitly referring to the regulatory sandbox as a tool to foster controlled financial innovation, signaling local authorities' willingness to experiment with flexible supervisory approaches. Available at: https://english.beijing.gov.cn/investinginbeijing/inv_BeijingFinTech/.

[126] People's Bank of China, *FinTech Development Plan (2019–2021)*, 2019. This plan called for a transition from ex-post to ex-ante and real-time supervision, embedding the sandbox initiative within a broader agenda of smart regulation and regulatory digitalization designed to address asymmetries of information and regulatory lag. Available at: http://www.pbc.gov.cn/en/3688110/3688172/4048311/3880801/index.html.

Announcement on the First Batch of FinTech Innovation Supervision Pilot 2020[127]; and the People's Bank of China FinTech Development Plan 2022/2025[128], setting out future strategies for regulatory digitalization and sandbox evolution.

Although these documents constitute a strategic framework, they do not possess binding legislative force, nor do they establish explicit legal rights or obligations for applicants, regulators, or consumers. This lack of codification introduces both regulatory flexibility and institutional opacity, a condition that scholars such as Mi Wang have identified as a critical obstacle to sandbox efficacy and legitimacy.[129]

Moreover, regulatory authority is concentrated in the hands of the People's Bank of China, which oversees sandbox pilots through regional branches and in cooperation with municipal governments. The China Securities Regulatory Commission and other sectoral regulators have also launched sandbox-like mechanisms in their respective domains, though without a unified cross-sectoral framework.[130]

This institutional fragmentation reflects a dualist structure of economic governance: on one hand, centralized supervision of financial stability; on the other, decentralized experimentation with innovation policy.[131]

Between 2019 and 2022, China launched four waves of sandbox pilots, spanning major cities and financial centers including Beijing, Shanghai, Guangzhou, Chengdu, and Hangzhou. By April 2022, over 113 projects had been approved across the various regional sandboxes, with 218 institutions participating in the pilots, including 121 banking

[127] People's Bank of China, *Announcement on FinTech Innovation Supervision Pilot (First Batch in 2020)*, 2020. This Announcement by the People's Bank of China formally launched the first batch of FinTech Innovation Supervision Pilots in early 2020, identifying initial trial projects that would test the regulatory sandbox framework under controlled conditions. It established the procedural and evaluative mechanisms for sandbox participation, thus operationalizing the transition from policy vision to practical experimentation within China's fintech regulatory structure. Available at: http://shanghai.pbc.gov.cn/fzhshanghai/113574/4060114/index.html.

[128] People's Bank of China, *FinTech Development Plan (2022–2025)*, 2022, setting out the forward-looking strategy for China's fintech regulation, stressing digital transformation, risk-based regulatory technologies, and the continued institutionalization and evolution of the sandbox regime within the People's Bank of China's policy toolkit.

[129] In literature, see: M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, cit., 399 and 403, emphasizing that the existing Chinese framework consists merely of normative policy documents lacking binding legislative force or detailed operating rules. This regulatory vacuum generates flexibility but simultaneously undermines transparency and legitimacy, thereby reinforcing the call for a dedicated "Fintech Sandbox Regulation" to clarify rights, obligations, and procedural safeguards.

[130] *Ibidem*., noting that sandbox pilots in China are predominantly administered by the People's Bank of China through its regional branches in cooperation with municipal authorities, thereby concentrating supervisory power within the central bank. He also documents how the China Securities Regulatory Commission and other agencies have initiated sandbox-style projects in specific sectors, yet in the absence of a unified cross-sectoral architecture, raising concerns about fragmentation and regulatory overlap.

[131] See: M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, cit., 197 ff., stressing that the sandbox in China operates as a pilot program, consistent with the country's broader trajectory of market-oriented reform, where central regulators prioritize systemic stability while allowing local authorities to pursue decentralized experimentation. This "gradualist" approach reflects what the authors describe as the coexistence of ongoing regulatory reforms with sharp rises of FinTech activities, managed through carefully staged and territorially confined trials.

and financial institutions, 52 technology companies, and a smaller number of credit scoring and payment service providers.[132]

According to official announcements reported in January 2020, the first batch of sandbox projects selected by the People's Bank of China included a mobile point-of-sale application jointly developed by China UnionPay, Xiaomi, and JD.com, a microloan product piloted by the Agricultural Bank of China, a supply chain financing initiative based on Internet-of-Things technology introduced by the Industrial and Commercial Bank of China, and a smart token solution involving CITIC Bank, China UnionPay, Duxiaoman, and Ctrip.

These initiatives demonstrate that the Chinese sandbox has been driven primarily by collaborations between licensed financial incumbents and large technology platforms, revealing a strong preference for incumbent-led experimentation.[133] In this respect, the Chinese model diverges significantly from that of jurisdictions such as the United Kingdom or Singapore, where regulatory sandboxes are more explicitly designed to empower start-ups and non-bank innovators.[134]

The sandbox model in China is thus marked by a high degree of selectivity, with priority given to projects that: operate under state-affiliated or state-licensed entities; align with macroeconomic policy objectives such as financial inclusion, SME credit access, and digital RMB experimentation; utilize technologies consistent with the People's Bank of China's strategic objectives (e.g., AI, blockchain, cloud-native architectures).

The Chinese sandbox is not a general-purpose innovation accelerator, but a policy tool embedded in the broader logic of financial stability, technological sovereignty, and controlled liberalization.[135]

China's proactive approach to regulatory sandboxes is closely tied to its state-led innovation system. Research and development intensity has rapidly grown, with annual

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[132] See: M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, cit., 398, detailing that between 2019 and 2022, China carried out four successive batches of regulatory sandbox pilots, culminating in April 2022 with 113 approved projects and the participation of 218 institutions. He specifies that 55.5 percent of participants were banking financial institutions, 23.9 percent were technology companies, while the remainder consisted primarily of payment and credit investigation providers, underscoring the dominance of traditional financial actors in the Chinese sandbox ecosystem.

[133] *Cf.* Caixin Global, *PBOC Selects Six Pilot Projects Under Fintech Development Plan*, 2020, available at: https://www.caixinglobal.com/2020-01-15/pboc-selects-six-pilot-projects-under-fintech-development-plan-101504207.html. the pilot projects selected in the inaugural batch underscore how the Chinese sandbox was conceived less as a space for start-ups to experiment and more as a platform for established financial institutions and technology conglomerates to align innovation with state-led priorities. This orientation confirms that the sandbox in China functions not only as a regulatory tool but also as an instrument of industrial policy, integrating financial reform with the broader strategy of digital transformation.

[134] The UK's Financial Conduct Authority pioneered the sandbox specifically to empower fintech start-ups and other non-traditional actors, while Singapore's Monetary Authority has progressively expanded participation through initiatives such as Sandbox Express and Sandbox Plus. Both models illustrate a deliberate strategy of opening regulatory experimentation to smaller, innovative firms, thereby contrasting with China's incumbent-led approach.

[135] See: M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, cit., 200 ff., underscore that the Chinese sandbox must be understood as a selective and policy-driven mechanism. Rather than functioning as a broad-based accelerator for startups, it channels experimentation toward projects consistent with the central bank's strategic priorities, including SME financing, digital trials, and the deployment of AI and blockchain applications. In this sense, the sandbox consolidates China's approach of combining financial stability with technological sovereignty and gradual, state-managed liberalization.

expenditures increasing at nearly double-digit rates over the past decade, and China now leads the world in patent applications.

Sandboxes are seen not only as regulatory tools but also as policy instruments aligned with national strategic goals such as digital currency and AI development. This top-down model allows the central government to pilot technologies with commercial and geopolitical significance, reinforcing its innovation industrial policy.[136]

The structure and operation of China's regulatory sandbox model is deeply shaped by its entry mechanisms, procedures that determine who may access the sandbox, under what conditions, and subject to which supervisory arrangements. Although the People's Bank of China and relevant regional authorities have issued multiple policy documents framing sandbox access, the absence of a unified, codified legislative framework continues to raise concerns regarding transparency, equal treatment, and regulatory discretion.[137]

At present, entry into the sandbox is formally reserved for licensed financial institutions, as defined by the national banking and securities regulatory frameworks. This includes commercial banks, state policy banks, payment service providers, and other regulated financial entities. Technology companies may participate only as joint applicants or technical partners of licensed institutions. No provision currently exists for non-licensed fintech start-ups or independent tech innovators to apply autonomously. This results in a structural bias that privileges incumbent institutions and restricts the scope of disruptive innovation.[138]

By contrast, as mentioned, comparative experience from jurisdictions such as the United Kingdom and Singapore demonstrates the strategic benefits of open eligibility criteria, including the admission of unlicensed firms, cross-sector consortia, and early-stage start-

[136] National Bureau of Statistics of China (NBS), *China's Expenditure on Research and Experimental Development (R&D) Exceeded 3.6 Trillion Yuan in 2024*, 2025. According to the latest communication, China's total R&D expenditure reached 3.613 trillion RMB in 2024, marking an 8.3% year-on-year increase. The country's R&D intensity, measured as a share of GDP, rose to 2.68%, underscoring the state's continued commitment to high-technology innovation and its alignment with the objectives of the 14th Five-Year Plan. These figures illustrate China's rapid expansion of its national innovation system and sustained double-digit growth trends over the past decade; and World Intellectual Property Organization (WIPO), *World Intellectual Property Indicators 2024*, 2024, in which the WIPO confirms that China remains the world's leading source of patent applications, accounting for the largest share of global filings in 2023. This reflects the maturation of China's innovation ecosystem and the centrality of intellectual property generation within its industrial and technological policy. The report highlights that Chinese applicants, particularly in digital technologies and artificial intelligence, are driving the global increase in patent activity.

[137] See: M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, cit., 395 ff., stressing that although the People's Bank of China and regional governments have issued several policy documents governing sandbox access, these remain normative rather than legislative in nature. The lack of codified entry rules creates scope for discretionary approvals, risks of power rent-seeking, and limited transparency, ultimately undermining equal treatment of applicants and reducing institutional trust in the sandbox mechanism.

[138] M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, cit., 213 ff., notice that access to China's regulatory sandbox is strictly limited to licensed financial institutions, while technology firms may only participate as joint applicants or technical partners; and *Ibidem*, explaining that current regulations do not provide any unambiguous authorization for non-licensed entities to apply independently, thereby prohibiting them from directly offering services within the sandbox. This design produces a structural bias favoring incumbent financial institutions and restricting opportunities for disruptive innovation.

ups with novel technologies. In those systems, the emphasis lies in assessing the public interest value, technological novelty, and regulatory uncertainty of the project, rather than the institutional status of the applicant.

China's exclusion of non-licensed actors, thus, appears out of step with international best practices and risks entrenching market incumbents at the expense of more agile and innovative entrants.

Another critical concern lies in the review and selection process itself. Although official discourse often references innovation, compliance, and consumer protection as guiding principles, in practice, the standards applied to determine entry remain opaque, and the process lacks independent oversight. Applications are reviewed internally by a combination of the People's Bank of China's regional branches and local financial regulators, often in cooperation with provincial government departments.

While this model allows for rapid deployment and vertical integration, it also gives rise to risks of regulatory capture, rent-seeking behavior, and political favoritism, issues highlighted in recent Chinese academic literature.[139]

Indeed, reports from sandbox rounds between 2020 and 2022 suggest that the overwhelming majority of successful applicants were either state-owned banks, large tech-fin conglomerates, or entities with prior cooperative relationships with local governments. Smaller firms, despite demonstrable technological innovation, often lack the institutional access or political capital necessary to pass the entry threshold.

This dynamic challenges the very rationale of the sandbox as a tool to democratize access to financial experimentation, and instead reinforce hierarchical patterns within the Chinese financial ecosystem.[140]

The public supervision mechanism integrated into the sandbox application process has further generated critical commentary. In theory, sandbox applicants must publish summary information about their project before formal admission, allowing the public to submit objections or whistleblowing reports to the supervising authorities. If substantiated, such reports may disqualify a project from entry.

Some scholars highlighted that while this mechanism was designed to enhance transparency and legitimacy, in practice, it functions more as a procedural filter than a substantive accountability device. Public feedback is rarely disclosed, and there is no guarantee that objections are reviewed independently or objectively. Moreover, the absence of clear criteria for disqualification raises the possibility that public input may be

[139] *Ibidem*., observing that the standards governing the review of sandbox applications remain vague, with approval authorities often unable to evaluate the innovativeness of projects objectively. This opacity, coupled with the lack of independent oversight, generates a high possibility of power rent-seeking and undermines public trust. The author further cautions that China's reliance on a public supervision mechanism introduces additional risks, as non-professional assessments may mistakenly disqualify legitimate innovations or endorse fraudulent ones.

[140] See: M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, cit., 214 ff., highlighting that the projects admitted during successive sandbox rounds were overwhelmingly initiated by state-owned banks and major technology-finance conglomerates, often those with established relationships to municipal governments. They note that smaller fintech firms, despite innovative potential, faced significant barriers to entry, resulting in a sandbox practice that consolidated the influence of incumbents rather than broadening access to experimental finance.

disregarded where projects align with broader policy goals or strategic technological interests.[141]

Other scholars have also stressed a lack of transparency regarding sandbox rejection rates, evaluation criteria, and post-entry assessments. Authorities provide only aggregate data on approved projects, without offering detailed justifications for admission or exclusion.

This secrecy stands in contrast to models such as the UK Financial Conduct Authority, which publishes annual sandbox reports, including selection criteria, sectoral trends, case studies, and lessons learned. The absence of such reporting in China undermines the epistemic function of the sandbox, limiting the extent to which regulatory knowledge is diffused among market actors, academics, and policymakers.[142]

From a governance perspective, the Chinese sandbox regime lacks an institutional mechanism for judicial or administrative review of entry decisions. Applicants denied access have no formal appeal rights, nor is there a dedicated oversight body to ensure procedural fairness or monitor regulatory discretion.

This lacuna raises concerns under international best practice standards for good regulatory governance, particularly with regard to non-arbitrariness, proportionality, and transparency in innovation facilitation.[143]

To date, there has been no official attempt to legislate a comprehensive sandbox entry statute, nor to codify clear eligibility criteria applicable across all sectors. Instead, each sandbox round is governed by new administrative notices, tailored to the economic objectives and industrial policy priorities of the local authority involved.

While this allows for context-sensitive experimentation, it also inhibits regulatory consistency, comparability of outcomes, and interregional coordination, all of which are essential for an effective national sandbox strategy.

In light of these shortcomings, several Chinese scholars have called for a formalization of sandbox entry criteria through a unified FinTech Regulatory Sandbox Regulation, which

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[141] See again: M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, cit., 400 ff., explaining that China's sandbox entry procedure requires project publicity and a stage of public supervision, during which citizens may complain to regulators about pre-applied projects. While intended to enhance legitimacy, this mechanism introduces potential risks: non-professional assessments may wrongly eliminate genuine innovative projects or, conversely, allow fraudulent initiatives to proceed. In this sense, public supervision functions more as a procedural filter than as a substantive safeguard of accountability.

[142] See: M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, cit., 214 ff. who highlight that the Chinese sandbox model suffers from limited publicly available information about the criteria of testing and the internal arrangement. Moreover, due to the lack of essential information, their effects cannot be reliably assessed. Above all, huge efforts are needed from regulators and policymakers to improve transparency and accountability.

[143] OECD, *Recommendation of the Council for Agile Regulatory Governance to Harness Innovation*, OECD/LEGAL/0464, 2021, available at: https://www.ceer.eu/wp-content/uploads/2024/06/OECD-LEGAL-0464-en.pdf, stressing that agile governance must rest on institutional arrangements that ensure transparency, proportionality, and fairness in regulatory decision-making. It calls on adherents to establish oversight mechanisms, stakeholder engagement procedures, and quality control reviews so as to avoid arbitrariness and strengthen trust in innovation-related regulation. The absence of such review structures in China's sandbox framework, therefore, falls short of these internationally recognized best practices.

would clarify eligibility requirements, procedural steps, the role of public input, and the oversight obligations of regulatory agencies.[144]

Such a statute could draw upon comparative experiences, including the principle of innovation neutrality, ensuring that sandbox access is determined not by institutional identity, but by the potential of the project to deliver public benefit, regulatory insight, and technological advancement.

Without such reform, the risk remains that China's sandbox regime, despite its scale and institutional backing, may fail to achieve its most transformative goals, specifically, to stimulate decentralized innovation, improve regulatory learning, and enhance the responsiveness of financial supervision to technological change.

The Chinese regulatory sandbox regime is not merely an instrument for facilitating innovation in financial services; it serves as a strategic policy tool embedded in the state's broader goals of technological sovereignty, financial stability, and political-economic governance.

Its functional characteristics, when contrasted with sandbox models in liberal-democratic jurisdictions, reveal a distinct orientation toward state-driven innovation, in which regulatory experimentation is subordinated to national policy agendas and institutional hierarchies.

Whereas in other jurisdictions regulatory sandboxes are often framed as instruments of market liberalization and regulatory learning, the Chinese model places greater emphasis on disciplining innovation within established legal and institutional parameters.

This distinction emerges clearly in the sandbox evaluation metrics adopted by the People's Bank of China and its regional branches. Admission decisions are based not only on the novelty or risk profile of the proposed technology but also on its alignment with industrial policy objectives, its potential to serve real-economy needs, and its compliance with political considerations.[145]

In functional terms, the sandbox serves three primary purposes. First, it acts as a testing ground for regulatory adaptability, enabling supervisory authorities to experiment with new models of risk calibration, data governance, and real-time monitoring. Second, the sandbox enables the validation of policy technologies. Third, and more subtly, the sandbox regime operates as a mechanism for bureaucratic integration and interagency coordination. China's banking regulatory architecture is fragmented across the People's Bank of China, the China Securities Regulatory Commission, the China Banking and Insurance Regulatory

[144] In literature, see: M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, cit., 404 ff., explicitly calling for the issuance of a dedicated Sandbox Regulation in China, stressing that such legislation should clarify entry standards, expand the diversity of applicants, enhance the transparency of project review, introduce independent expert evaluation, and strengthen consumer protection. This, he argues, would provide greater certainty to applicants and a clearer benchmark for regulatory authorities.

[145] See: N. Lei, *Analysis of China's FinTech Regulatory Sandbox: Development History and Future Prospects*, in *International Journal of Global Economics and Management*, Vol. 3, No. 1, 2024, 390 ff., explaining that China's sandbox is conceived primarily as a regulatory tool to balance fintech innovation with risk management, emphasizing financial stability, consumer protection, and alignment with broader industrial policy objectives. Rather than serving as a liberalization mechanism, the sandbox channels experimentation into a safe and orderly environment consistent with established legal and institutional parameters.

Commission - now merged into the newly established National Financial Regulatory Administration - and municipal fintech offices.

The sandbox format allows for horizontal cooperation among these institutions under the supervision of the central government, while also facilitating vertical communication between national policy goals and local experimentation. It thus represents not only a regulatory tool, but a bureaucratic innovation in itself, one that seeks to reconcile central authority with localized implementation.[146]

Despite these advantages, scholars have noted that the Chinese sandbox model may suffer from functional overload. Unlike leaner sandbox regimes designed narrowly to test specific regulatory hypotheses or technologies, the Chinese approach burdens the sandbox with multiple and sometimes conflicting objectives: fostering innovation, maintaining financial stability, asserting sovereign control over digital infrastructures, and promoting domestic technological development in sectors such as AI and blockchain.

This multiplicity of goals can lead to institutional diffusion, where no single objective is clearly prioritized, and where regulators may struggle to balance prudential concerns with innovation mandates.[147]

Additionally, the sandbox's close alignment with state-favored technology platforms and quasi-public enterprises raises critical concerns regarding competition, neutrality, and regulatory arbitrage. This asymmetry risks turning the sandbox into an extension of industrial policy favoritism, rather than a neutral arena for regulatory experimentation.[148]

The People's Bank of China's FinTech Development Plan 2022/2025 situates fintech development within a broader policy and ideological framework. The Plan explicitly links financial digitalization to the objectives of the 14th Five-Year Plan 2021/2025 and to the long-range national development goals for 2035[149], under the guidance of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era.[150]

In this perspective, financial innovation is not merely a technical or supervisory experiment, but an instrument embedded in a comprehensive developmental strategy that

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[146] M. Han, D. Xu, *The Sandbox Approach to FinTech Regulation: A Case Study of China*, cit., 214 ff., describe the sandbox not only as a regulatory experiment but also as a bureaucratic innovation embedded in China's gradualist tradition. They emphasize that sandbox pilots enable institutional coordination across central and local levels, facilitating both horizontal cooperation among agencies such as the PBoC, CSRC, and CBIRC (now NFRA), and vertical communication between national policy objectives and local implementation.

[147] *Ibidem*.

[148] *Ibidem*., emphasizing that sandbox pilots have been dominated by state-owned banks and major technology platforms, reflecting a structural preference for incumbent-led projects rather than start-up experimentation.

[149] State Council of the PRC, *The Outline of the 14th Five-Year Plan for Economic and Social Development and the Long-Range Objectives Through the Year 2035*, Beijing, 2021, setting out China's major objectives for the 14th Five-Year Plan period, including accelerated innovation, structural modernization, ecological conservation, and improved wellbeing, while also articulating long-range goals through 2035, when China aims to achieve socialist modernization with significantly enhanced economic, technological, and governance capacities.

[150] Xi Jinping, *Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era*, authoritative English translation by CASI, 2023, available at: https://www.airuniversity.af.edu/Portals/10/CASI/documents/Translations/2023-10-30%20ITOW%20Xi%20Jinping%20Thought%20on%20Socialism%20with%20Chinese%20Characteristics%20for%20a%20New%20Era.pdf.

combines technological modernization with social and political objectives, including the pursuit of "common prosperity."

The Plan outlines eight key tasks: (i) strengthening FinTech governance and ethics; (ii) enhancing data capacity and secure data sharing; (iii) building digital infrastructures, including green and energy-efficient data centers; (iv) fostering technological transformation and cooperative innovation; (v) developing integrated business-technology-data platforms; (vi) expanding inclusive, green, and human-centered digital financial services; (vii) scaling RegTech and "look-through" supervision capabilities; and (viii) cultivating FinTech talent while refining standards and legal frameworks.[151]

As of today, the Chinese regulatory sandbox should be understood not only as a mechanism of innovation facilitation, but also as an instrument of strategic economic governance. Its functional logic is not liberal-democratic, but technocratic and policy-integrated, with innovation tolerated insofar as it can be rendered legible, manageable, and consistent with the goals of the party-state apparatus. Whether this model can sustain decentralized, competitive innovation in the long term, without undermining pluralism or limiting the ecosystem of actors, remains an open question. One of the central dilemmas facing the future of the Chinese sandbox lies in the tension between formal legal codification and continued reliance on soft law instruments. While this flexibility has allowed regulators to respond swiftly to technological developments and to experiment with supervisory frameworks in a low-risk setting, it also generates legal uncertainty for participating firms, limits judicial review, and weakens predictability in rule application.[152]

This framework prompted calls from Chinese scholars and legal reform advocates for the enactment of a FinTech Innovation Regulation Law, which would formally define the legal status of sandbox programs, codify entry and supervision criteria, and articulate the relationship between sandbox authorizations and other layers of financial and digital regulation.

Such a statute could also embed procedural safeguards, including rights to appeal, disclosure obligations, and post-participation obligations, thereby enhancing the legitimacy, transparency, and accountability of the sandbox regime.[153]

From a theoretical perspective, the evolution of China's sandbox raises important

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[151] People's Bank of China, FinTech Development Plan (2022–2025), 4 January 2022, available at: http://www.pbc.gov.cn/en/3688110/3688172/4437084/4441980/index.html, stressing that fintech development must be guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, and aligned with the 14th Five-Year Plan and the 2035 long-range objectives, thereby embedding technological modernization in a strategy aimed at systemic stability and common prosperity.

[152] The lack of formal legal grounding is not an incidental feature of the Chinese sandbox; rather, it reflects a broader characteristic of China's financial regulatory governance. The preference for experimental, non-binding tools over legislative reform is consistent with the model of "regulation through administrative experimentation", which allows the central state to monitor innovation without committing to irreversible legal change. However, as fintech activities increasingly involve personal data processing, algorithmic decision-making, and cross-border services, the limitations of this discretionary approach become more apparent.

[153] See: M. Wang, *Regulation Paths of Regulatory Sandbox Entry Mechanism in China*, cit., 404 ff., explicitly calls for the issuance of a dedicated Sandbox Regulation in China, stressing that such legislation should clarify entry standards, expand the diversity of applicants, enhance the transparency of project review, introduce independent expert evaluation, and strengthen consumer protection. This, he argues, would provide greater certainty to applicants and a clearer benchmark for regulatory authorities.

questions regarding the future of experimental governance in authoritarian and developmental states.

Can sandbox models serve as vehicles for regulatory pluralism, or will they remain embedded within state-directed industrial policy logics? Can the Chinese model sustain meaningful innovation and experimentation without judicial guarantees, competitive neutrality, or open eligibility? Will the sandbox act as a bridge toward more adaptive regulatory frameworks, or simply reproduce the asymmetries and controls of the existing financial regime?

The coming years will likely determine whether the Chinese sandbox will evolve into a fully institutionalized mechanism, capable of supporting not only compliance flexibility but also regulatory learning, technological plurality, and participatory governance. Alternatively, it may remain a targeted, elite-centred policy tool, reserved for strategically important firms and technologies deemed vital to national economic security and digital sovereignty.

In sum, the Chinese regulatory sandbox represents an ambitious, state-led model of innovation governance, characterized by scale, institutional integration, and alignment with national development goals. Its future depends not only on its capacity to manage technological risk, but also on its willingness to open up to greater legal codification, normative transparency, and international engagement.

V. Sandbox Approaches and Future Perspectives: A Comparative Framework

The comparative analysis of regulatory sandboxes across the European Union, the United States, and the People's Republic of China reveals a fundamental divergence in regulatory architectures, institutional motivations, and legal modalities. Each system, in fact, reflects the broader structural features of its legal and political order.

In the European Union, the sandbox is gradually moving from a constellation of national-level pilots toward a harmonized regulatory instrument, embedded in formal law through instruments such as the EU Regulation 2022/858 and, more significantly, the EU Regulation 2024/1689.

This shift reflects the Union's effort to align innovation facilitation with constitutional principles such as proportionality, legal certainty, and rights protection, and to ensure that sandbox experimentation does not erode the foundational safeguards of the internal market or the Charter of Fundamental Rights. The European Union's model is thus increasingly normatively constrained, institutionally integrated, and supranationally coordinated.

By contrast, the United States exhibits a federal, pluralistic, and largely decentralized approach, in which state-level initiatives serve as primary laboratories of experimentation. While states such as Arizona, Utah, Florida, and Wyoming have developed functionally sandbox regimes, the absence of federal coordination, uniform eligibility standards, and interoperable compliance pathways limits the model's effectiveness at scale.

The United States' federal agencies, such as the Consumer Financial Protection Bureau, the Securities and Exchange Commission, and the Office of the Comptroller of the Currency, have relied on soft law mechanisms without institutionalizing sandbox regimes within their formal administrative processes.
The result is a fragmented ecosystem, rich in diversity but weak in cross-jurisdictional legal predictability.
The Chinese model, finally, is characterized by a high degree of central coordination, legal flexibility, and alignment with strategic state objectives. The sandbox is not a market-oriented mechanism, but a state-integrated policy tool embedded in the broader vision of technological sovereignty, financial stability, and regulatory control. Innovation is permitted to the extent that it advances national priorities, is operationalized through state-favored institutions, and remains transparent to the party-state apparatus. Legal codification is limited; administrative experimentation dominates.
These structural differences have profound implications for the legitimacy, scalability, and normative content of sandbox-based regulation in each jurisdiction.
This tripartite comparison shows that divergences in sandbox design stem from both institutional architecture and the maturity of national innovation ecosystems. While institutional traditions shape regulatory styles - supranational in the European Union, federal in the United States, and centralized in China - innovation systems condition the strategic use of sandboxes. Jurisdictions with strong technological capacity and capital markets tend to view sandboxes as competitive accelerators, whereas others adopt them more cautiously to balance innovation with constitutional safeguards.
Each sandbox regime brings with it a set of distinctive benefits and systemic limitations. In the EU, the major advantage lies in its ability to institutionalize sandbox experimentation within the formal legal framework, thereby ensuring legal certainty, judicial reviewability, and compliance with fundamental rights.
The integration of sandbox mechanisms within binding legislation demonstrates a commitment to embedding innovation governance within democratic accountability structures.
Yet, this model may suffer from bureaucratic inertia, delayed implementation, and the risk of over-formalization, which can reduce the agility necessary for timely experimentation, particularly in fast-moving sectors like artificial intelligence.
The United States state-level model, conversely, offers regulatory agility, jurisdictional competition, and low entry thresholds, particularly for early-stage firms and technological outsiders. Sandboxes in states like Utah and Wyoming have pioneered innovative models of experimental relief, sectoral focus, and agency discretion.
However, the absence of harmonized criteria, the lack of post-sandbox continuity, and concerns over regulatory capture and competitive distortion undermine long-term legal predictability and systemic fairness. Moreover, the failure of federal regulators to articulate a unified approach fragments the legal space and exposes firms to multi-state compliance risk.
China's sandbox regime offers a distinct form of state-centric scalability, combining political prioritization, bureaucratic integration, and technological deployment at the

national scale. It enables controlled trials of strategic innovations while minimizing institutional resistance.

On the other side, the Chinese model remains exposed to risks of institutional opacity, entry asymmetry, and non-neutral access, privileging state-favored firms and technologies over more disruptive or pluralistic alternatives. Its reliance on soft law and administrative discretion limits transparency, judicial redress, and horizontal knowledge diffusion, reducing its value as a general tool for regulatory learning.

Despite these divergences, convergence pressures are emerging across all three systems. Increasing cross-border fintech activity, demands for regulatory interoperability, and growing recognition of sandbox limitations are driving efforts toward cross-jurisdictional dialogue and normative convergence.

In particular, within the European Union, a networked framework of regulatory sandboxes is being implemented, building on existing initiatives that aim to facilitate cross-border testing and the mutual recognition of outcomes. This perspective reflects a distinctive European approach to regulatory experimentation.

The comparative analysis permits the articulation of a typology of sandbox models along two dimensions: the legal degree of formalization (soft law vs. hard law) and the institutional logic of control (market-driven vs. state-driven).

Along these axes, the European Union model represents a high-formalization, rights-oriented approach; the United States model a low-formalization, market-competitive approach; and the Chinese model a low-formalization, state-coordinated approach.

These models are not converging toward a single standard; rather, they reflect endogenous responses to regulatory, political, and economic constraints.

This framework provides a useful lens for evaluating potential regulatory transplants, legal harmonization efforts, and the risks of conceptual misappropriation.

Looking forward, several normative priorities and regulatory reforms emerge as essential for a sandbox governance across systems:

I) Procedural transparency in sandbox admission, supervision, and evaluation. This includes publication of selection criteria, public reporting on outcomes, and independent oversight mechanisms.

II) The integration of data protection, algorithmic accountability, and fundamental rights safeguards must become a core condition of sandbox testing, especially for high-risk AI systems and digital identity platforms.

III) Regulators should develop post-sandbox transition frameworks, including streamlined pathways to licensure and mechanisms for continuity of consumer protection after experimentation ends.

IV) At the international level, the systems would benefit from a mutual recognition standard, sandbox-to-sandbox coordination protocols, and common taxonomies of innovation-related risk.

Such mechanisms could facilitate regulatory learning across borders and reduce the risk of jurisdictional arbitrage.

In a context where empirical evaluations are still limited, some early findings suggest that sandbox participation can enhance firms' access to investment. For instance, the Bank for International Settlements reported that firms admitted to the UK's Financial Conduct Authority sandbox raised, on average, 15 percent more funding than comparable firms outside the program. Likewise, the World Bank noted that sandboxes are often perceived as credibility-enhancing mechanisms by both investors and regulators.[154]

Policymakers should recognize that sandboxes are not substitutes for regulatory reform, but rather instruments of transition, serving as tools that allow institutions to test new rules, technologies, and supervisory practices before they are formalized.

As such, their legitimacy depends not only on their progressive effectiveness but also on their integration within a broader rule of law framework, one that is responsive to evolving markets and accountable to public values.

[154] See: Cornelli et al., *Regulatory sandboxes and fintech funding: evidence from the UK*, in *Bank for International Settlements (BIS)*, 2020, No. 901. Their analysis shows how sandbox participation correlates with higher funding volumes and a greater likelihood of attracting new and foreign investors, particularly among younger and smaller firms. These findings suggest that sandbox regimes can mitigate information asymmetries and regulatory uncertainty, thereby enhancing early-stage firms' credibility in capital markets.