

A Comparative Analysis of Regulatory Sandboxes: Models, Evolution, and Strategic Implications in the UAE and Singapore*

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Table of contents

1. Introduction: Research Objective and Scope. – 2. Regulatory Sandboxes in the United Arab Emirates. – 3. Regulatory Sandbox in Singapore. – 4. Approaches and Future Perspectives: a Comparative Framework.

1. Introduction: Research Objective and Scope

The comparative analysis of legal systems proposed in this paper examines how different legal systems respond to the challenges posed by technological innovation.

In civil law jurisdictions, regulatory models typically originate from codified statutes and institutional frameworks, whereas in common law systems, such as that of Singapore, the legal order is fundamentally shaped by case law, judicial precedent, and incremental development.

Despite these structural differences, both traditions are increasingly influenced by transnational commercial practices and technological standards, often conceptualized as a form of *lex mercatoria*¹ or, more recently, *lex digitalis*.²

* L'articolo è stato sottoposto, in conformità al regolamento della Rivista, a referaggio anonimo.

While maintaining unity, paras. 1 and 4 are to be attributed to Andrea Stazi, 2 and 3 to Riccardo Jovine.

¹ In literature, see B. Goldman, *La lex mercatoria dans les contrats et l'arbitrage internationaux: réalité et perspectives*, in *Droit international privé: Travaux du Comité français de droit international privé*, 2^e année, 1980, 221 ff., stressing that the *lex mercatoria* constitutes an autonomous and evolutionary body of rules grounded in commercial custom and transnational arbitral legitimacy.

² In literature, see C. Reed – A. Murray, *Rethinking the Jurisprudence of Cyberspace*,

These norms, shaped by market actors, technological innovations, and industry standards, tend to evolve outside formal legal systems and frequently outpace legislative processes.

Such a dynamic creates a recurring tension between legal certainty and innovation. As technological advancements emerge, regulatory frameworks often lag behind, resulting in a regulatory gap that must be bridged to facilitate innovation while preserving public interest objectives such as market integrity, consumer protection, and systemic stability.

In this context, the concept of “sandbox”,³ intended as “regulatory sandbox”, represents an innovative and growing approach to managing the intersection of technological advancement and existing regulatory frameworks.

The concept of regulatory sandboxes emerged in 2015 with the UK’s Financial Conduct Authority (FCA), which launched the first formalized regulatory sandbox to foster fintech innovation while managing risks to consumers and markets.⁴

Unlike traditional innovation models driven by private-sector competition, sandboxes represent a paradigm shift in regulatory philosophy, emphasizing collaboration between regulators, companies, and IT specialists to

Cheltenham, 2018, stressing that digital normativity increasingly emerges outside traditional state-based legal systems, through technical standards, platform rules, and code-based architectures, a phenomenon that can be conceptualized as *lex digitalis*.

³ See National Institute of Standards and Technology (NIST), “*Sandbox*”, in *csr.nist.gov*, 6 February 2026, defining the concept of sandbox as: «A system that allows an untrusted application to run in a highly controlled environment where the application’s permissions are restricted to an essential set of computer permissions. In particular, an application in a sandbox is usually restricted from accessing the file system or the network».

⁴ Cfr: Financial Conduct Authority (FCA), *Regulatory Sandbox*, in *fca.org.uk*, 2015, 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. 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 FCA’s recommendations also consider potential legislative changes that could provide greater regulatory flexibility to sandbox participants. The report underscores the FCA’s commitment to balancing financial innovation with consumer protection, ensuring that regulatory frameworks evolve alongside technological advancements.

test novel products in controlled environments.

This way, instead of rigidly applying pre-existing regulations to new business models or technologies, sandboxes create a controlled experimentation space where companies can test their innovations under the supervision of regulatory authorities.⁵

This testing environment enables the evaluation of a new product or service's innovative potential and adherence to current regulations, allowing for adjustments and changes that would not be possible under normal operating conditions.

This methodology is particularly relevant in highly regulated sectors such as finance, energy, real estate, and healthcare, where regulation is intense and innovation may encounter obstacles due to the rigidity of regulation.⁶

The concept of regulatory sandbox can be interpreted as a practical application of the adaptive regulation theory, which recognizes how regulations must evolve in response to new technological challenges and opportunities.⁷

Rather than defining static and immutable rules, sandboxes facilitate the process of mutual learning between innovators and regulators.⁸

Developers have the opportunity to test their creations in a real-world context, receiving direct feedback on the practical implications of their ideas, while regulators become familiar with new technologies, gaining a more accurate understanding of the associated risks and benefits.

In this sense, the sandbox acts as a laboratory for regulatory experimentation, where different regulatory approaches are studied to understand which are most efficient and effective in fostering innovation and protecting

⁵ See R. Plato-Shinar, *The Contribution of the Regulatory Sandbox to the Development of Artificial Intelligence Applications in the Financial Sector*, in the journal *Law, Society and Culture*, Vol. H, 2024, stressing how entrepreneurs gain mutual learning opportunities with the regulator, studying its approach to develop products tailored to regulatory requirements. At the same time, the regulator learns about new products early in their development, enabling a better understanding of their nature and the level of regulation needed.

⁶ In this regard, see R. Markellos – S. Ennis – B. Enstone – A. Manos – D. Pazaitis – D. Psychoyios, *Worldwide Adoption of Regulatory Sandboxes: Drivers, Constraints and Policies*, in *JSRN*, 2024, 10 ff., stressing the relevant role of regulatory sandboxes in enabling innovation within highly regulated sectors such as finance, energy, healthcare, and transport, providing a space to test new products or services under controlled conditions, allowing adjustments that would be unfeasible under usual regulatory constraints. Conversely, this approach addresses systemic challenges where rigid rules often stifle experimentation. In this regard, see H. J. Allen, *Regulatory Sandboxes*, in *The George Washington Law Review*, 2019, 579 ff.

⁷ See I. Ayres – J. Braithwaite, *Responsive regulation: Transcending the deregulation debate*, Oxford, 1992, 162, highlighting the relevance of participatory models in regulatory design by fostering collaboration between regulators and industry stakeholders.

⁸ See R. Plato-Shinar, *The Contribution of the Regulatory Sandbox to the Development of Artificial Intelligence Applications in the Financial Sector*, cit., 6.

public interests.

The theory behind regulatory sandboxes acknowledges the importance of regulatory flexibility for technological advancement. Instead of blocking innovation with outdated rules, sandboxes allow regulatory authorities to adopt a more open and collaborative approach.

This creates an environment where industry operators can experiment, learn, and refine their strategies without being immediately constrained by existing rules. Such a model is particularly useful in areas such as artificial intelligence or blockchain, where the pace of change is so rapid that traditional regulatory frameworks struggle to keep up.⁹

In this sense, sandboxes are not considered spaces for deregulation but controlled environments for experimentation, where the main goal is to identify the right balance between promoting innovation and protecting the public through the direct observation of the effects of new technologies.

Thus, the sandbox acts as a bridge between theory and practice, providing an empirical basis for developing regulations that effectively foster innovation while ensuring the safety and transparency of markets.¹⁰ This approach aims for evidence-based regulation, where rules are shaped by direct observation of the impacts of new technologies and by experience gained in the sandbox.

The controlled testing environment can also allow the development of “regulation as code”, embedding regulatory obligations directly into the computer code of the tested products and services, and so enhancing adherence to the rules.¹¹

This study undertakes a comparative analysis of the regulatory sandbox frameworks in the United Arab Emirates and Singapore, with the aim of examining how differing legal traditions, institutional configurations, and governance models in successful pro-innovation countries shape the desi-

⁹ See.: T. Moraes, *Regulatory Sandboxes as Tools for Ethical and Responsible Innovation of Artificial Intelligence and their Synergies with Responsive Regulation: The Quest for AI Sovereignty, Transparency and Accountability - Official Outcome of the UN IGF Data and Artificial Intelligence Governance Coalition*, in SSRN, 2023, 8.

¹⁰ In this regard, see.: L. M. Santos – J. M. Rožanec, *Fostering Research & Innovation in AI through Regulatory Sandboxes*, in *16th International Technology Transfer Conference, Ljubljana, October 11th 2023*, 2023, 4, stressing how regulatory sandboxes facilitate evidence-based lawmaking, providing flexibility, adaptability, and innovation-friendliness required by new technologies.

¹¹ See also A. Stazi, *Smart Contracts and Comparative Law: A Western Perspective*, Cham, 2021, stressing how smart contracts and distributed ledger technologies facilitate legal and regulatory compliance automation. These mechanisms, by embedding legal obligations directly into their execution framework, present new regulatory challenges and require controlled testing environments to ensure adherence to existing legal frameworks.

gn, implementation, and evolution of regulatory sandboxes.

The central objective of the research is to identify and critically assess how these frameworks reconcile the dual imperatives of fostering technological innovation, particularly in fast-evolving sectors such as fintech, blockchain, and artificial intelligence, while safeguarding regulatory stability and systemic integrity.

Through this analysis, the study seeks to extract key insights and best practices that may inform the development of future regulatory strategies in diverse jurisdictions, offering a normative and practical contribution to the broader discourse on innovation governance in a comparative legal context.

The choice of the United Arab Emirates and Singapore as case studies is both deliberate and methodologically strategic. These jurisdictions, while sharing a common ambition to position themselves as global hubs for technological innovation, represent two distinct legal systems and regulatory philosophies.

The UAE operates within a mixed legal system: it combines elements of civil law, influenced by continental European legal traditions, with features of common law in certain emirates, and incorporates aspects of Sharia law in its broader legal landscape. Its regulatory architecture is characterized by a polycentric and pluralistic model, in which multiple sector-specific sandboxes, overseen by different regulatory bodies, coexist within a federal framework that promotes localized experimentation while aligning with national strategic objectives in digital transformation and economic diversification.¹²

By contrast, Singapore's legal system is firmly rooted in the common law tradition, and its regulatory sandbox model is governed in a centralized manner by the Monetary Authority of Singapore.

This monocentric approach reflects a regulatory philosophy grounded in standards-based, experimentalist governance, emphasizing regulatory coherence, transnational interoperability, and iterative learning.

Singapore's model is frequently cited as a benchmark for regulatory innovation in the Asia-Pacific region, while the UAE's multi-layered governance structure offers a unique laboratory for examining how legal pluralism

¹² In literature, see D. Zetzsche – R. P. Buckley – D. W. Arner – J. N. Barberis, *Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation*, in *Fordham Journal of Corporate & Financial Law*, 23(1), 2017, 45 ff. This observation aligns with a growing trend in jurisdictions such as the UAE, where regulatory sandboxes are not only used to test novel technologies, but are embedded within broader national strategies for economic diversification, foreign direct investment attraction, and post-oil development models. By offering controlled legal environments with temporary regulatory relief, these frameworks serve as catalysts for cross-sectoral innovation and long-term structural change.

interacts with regulatory experimentation.¹³

The comparative analysis of these two jurisdictions thus provides a compelling framework for exploring how legal traditions, institutional configurations, and strategic priorities shape the operation and impact of regulatory sandboxes.

By juxtaposing the UAE's polycentric and sectoral approach with Singapore's unified, standards-driven model, the study aims to elucidate the strengths and confines of each system, offering a nuanced understanding of how sandbox frameworks function not merely as regulatory tools but as instruments of broader economic, technological, and geopolitical strategy. Ultimately, the research seeks to contribute to the practice of a comparative regulatory innovation, highlighting how legal systems can adapt to the challenges of the digital age by designing sandbox models that balance flexibility and oversight, experimentation and stability, innovation and public interest.

2. Regulatory Sandboxes in the United Arab Emirates

The United Arab Emirates has emerged as a regional and global leader in developing regulatory sandboxes that support innovation, entrepreneurship, and digital transformation in finance and other high-tech sectors.

As a federation composed of seven emirates, each with considerable autonomy, the UAE's regulatory sandbox landscape reflects a combination of national-level strategy and emirate-specific initiatives.

Since the mid-2010s, the UAE government has pursued a coordinated approach to regulatory innovation, driven by federal entities such as the Central Bank of the United Arab Emirates, the Securities and Commodities Authority, and the Telecommunications and Digital Government Regulatory Authority, alongside pioneering efforts by individual emirates like Abu Dhabi and Dubai.

In November 2016, the Abu Dhabi Global Market introduced its regulatory sandbox through the Financial Services Regulatory Authority.

The Abu Dhabi Global Market RegLab provided a key node in the UAE's sandbox ecosystem, with a strong focus on digital banking, sustainable finance, and cross-border innovation.

The Financial Services Regulatory Authority encouraged experimentation

¹³ *Ibid.*, 40 ff. This regulatory design embodies a shift away from static rule-making toward iterative and empirical governance, whereby regulators observe, evaluate, and recalibrate rules in response to real-time feedback from sandbox participants. Such a model not only facilitates more nuanced risk assessment but also allows legal systems to co-evolve with technological change, enabling the emergence of more agile and context-sensitive regulatory responses.

while maintaining strong consumer protection and AML/CFT standards, and it regularly coordinated with international regulators.¹⁴

This initiative positioned Abu Dhabi as an early leader in regulatory innovation, aligning closely with the UAE's broader national objectives.

A major milestone in the UAE's regulatory sandbox journey followed in 2017, with the launch of the Innovation Testing Licence by the Dubai Financial Services Authority within the Dubai International Financial Centre. The Innovation Testing Licence was designed to provide fintech firms with a structured, controlled environment in which to test innovative products, services, and business models under tailored regulatory oversight. This initiative mirrored the sandbox model first introduced by the UK's Financial Conduct Authority, but it was adapted to Dubai's legal and business environment, emphasizing international best practices, business-friendly regulation, and technology-driven growth.¹⁵

¹⁴ Applications to the ADGM RegLab are accepted in cohorts, with the ADGM announcing publicly when each new application window opens. The RegLab is open to all entities operating in the FinTech sector, ranging from startups to established, regulated firms. To be eligible, FinTech applicants must present an innovative technological solution that is sufficiently developed and ready for testing. Additionally, the solution should support the advancement of the UAE's financial sector. As outlined in the Financial Services Regulatory Authority, *FinTech Regulatory Laboratory Guidance*, in [assets.adgm.com](https://assets.adgm.com/2016/3/ff/), 2016, 3 ff., this framework demonstrates ADGM's commitment to enabling innovation in financial technology by offering a controlled environment where eligible firms can develop and live-test innovative solutions under customized regulatory requirements. By adopting a tailored, risk-based approach to regulation, the RegLab not only fosters market entry and experimentation but also ensures critical safeguards are in place to protect consumers, maintain market integrity, and support compliance with international standards such as anti-money laundering and counter-terrorism financing measures.

¹⁵ Dubai Financial Services Authority, *Innovation Testing Licence*, in dfs.ae, 2017 (updated May 2025). The Innovation Testing License (ITL) is a restricted financial services license that functions as Dubai's formal regulatory sandbox, allowing eligible firms to test innovative financial products, services, or business models in or from the Dubai International Financial Centre without being subject to the full regulatory requirements normally imposed on Authorized Persons. As detailed, firms must demonstrate a genuine need for testing, the use of innovative technology, operational readiness, and an intention to scale following successful testing. The ITL process comprises several structured stages: pre-application, full application with a detailed test plan, supervised live testing under a simplified regulatory framework, and exit, either through graduation to an unrestricted license or a controlled withdrawal. The DFSA may grant temporary waivers or modifications to certain regulatory rules (e.g., capital requirements, conduct rules) while maintaining essential obligations related to integrity, consumer protection, and anti-money laundering. The test plan must outline risk mitigation strategies, customer engagement practices, performance benchmarks, and contingency measures. Typically, the ITL is valid for 6-24 months, during which firms are closely supervised by the DFSA. After the testing phase, firms must either prove readiness for full authorization or cease operations, thus ensuring a robust but flexible regulatory approach that encourages innovation without compromising market integrity or consumer safety.

The Innovation Testing Licence process included defined stages, from application and evaluation to restricted live testing and potential graduation to full regulatory licensing, allowing firms to innovate safely while offering regulators insights into how emerging technologies function in real-world conditions.¹⁶

Dubai's regulatory sandbox quickly became a magnet for firms in the Fintech, Insurtech, and RegTech sectors, including digital payment providers, AI-driven risk platforms, and blockchain startups.

In this framework, artificial Intelligence represents a key area of focus for sandbox-enabled innovation. The UAE National Strategy for Artificial Intelligence 2031, launched in 2018, emphasized regulatory flexibility as a prerequisite for AI development across multiple sectors, including finance, transportation, and healthcare.¹⁷

A foundational component of the UAE's regulatory innovation strategy is RegLab, the national Regulations Laboratory launched in 2019 in partnership with the Dubai Future Foundation.

Designed to pre-emptively craft legislation for emerging technologies, RegLab has played a pivotal role in piloting projects such as electric cargo aircraft, self-driving vehicles, fractional bonds, and national health data

¹⁶ DFSA, *DFSA Annual Report 2019*, in *dfs.ae*, 2019, 4-5, 8-9, 42-43. The 2019 Annual Report provides a detailed account of the DFSA's continued commitment to fostering innovation through its regulatory sandbox framework, specifically the ITL program. In 2019, the DFSA admitted eight new applicants to the ITL, reflecting a steady interest in the program across diverse fintech verticals, including digital payments, robo-advisory, RegTech, and crowdfunding. The report notes that the ITL follows a structured yet flexible process comprising pre-application, application, restricted live testing, and eventual exit, either through full authorisation or withdrawal. One significant milestone highlighted in the report was the successful graduation of a property crowdfunding firm from the ITL to become a fully authorised entity, illustrating the programme's role as a launchpad for innovative business models. The DFSA underscores its dual role in encouraging fintech innovation and ensuring consumer protection, financial stability, and market integrity. The DFSA's engagement with the Global Financial Innovation Network (GFIN) and its leadership in cross-border testing initiatives also exemplify how the ITL contributes to international regulatory harmonisation. The Annual Report also emphasizes how the DIFC's geographic and strategic positioning has made it an attractive jurisdiction for firms aiming to scale across the Middle East, Africa, and South Asia (MEASA) region. Through its sandbox, the DFSA gathers valuable regulatory insights, enabling it to assess potential policy adaptations in response to emerging financial technologies and business models.

¹⁷ UAE Government, *UAE National Strategy for Artificial Intelligence 2031*, in *u.ae*, 2018, 22–25, 40, 42–43. The strategy identifies regulatory flexibility as a critical enabler for the development and deployment of AI across sectors, including finance, transportation, and healthcare. It promotes the UAE as a global testbed for AI by encouraging adaptive governance, sector-specific pilot programs, and collaborative efforts through the UAE Artificial Intelligence and Blockchain Council.

registries.¹⁸

Its mission to align regulation with innovation directly has supported the UAE's role as a global testbed for future technologies.

In response, the Dubai Financial Services Authority expanded the Innovation Testing Licence in 2021 to include AI-powered financial tools, such as algorithmic trading systems, credit scoring engines, and customer service chatbots.¹⁹

¹⁸ UAE Regulations Lab, or RegLab, was created to spark new markets in the UAE by fast-tracking the adoption of emerging technology. It's where regulators enable new business activity based on agile regulations. RegLab aligns the government with the private sector's intent to create regulatory frameworks that accelerate Industry 4.0. Launched in Jan 2019 in partnership with DFE, collaborates with business leaders and tech innovators, works closely with lawmakers from local and federal authorities to develop legislation governing technology, incubates and creates new markets based on technology pilots, supports the UAE's role as a testbed for emerging technology. Among its key initiatives is the licensing of electric cargo aircraft, granted in March 2023, as part of a national push toward sustainable and environmentally friendly transportation. This move aims to reduce carbon emissions in the logistics sector by encouraging the use of clean energy and reimagining traditional freight practices through innovation. In parallel, RegLab issued a temporary licence to UPS to test electric vertical takeoff and landing (eVTOL) aircraft within the UAE. This initiative is designed to support the development of new, sustainable air cargo solutions while establishing a legislative framework that can accommodate next-generation aviation technologies. It reflects the UAE's broader commitment to environmentally conscious economic competitiveness. Within the healthcare sector, the Ministry of Health and Prevention, in collaboration with RegLab, launched two pioneering projects: a national health data repository and a disease registry system. The repository seeks to connect stakeholders and harness advanced tools such as artificial intelligence to conduct data-driven health studies. The disease registry focuses on improving the quality and comprehensiveness of national patient data, beginning with developing interactive dashboards and progressing toward automated reporting systems. The UAE also took a significant step in mobility by approving a temporary licence to test self-driving vehicles, making it the first country in the Middle East and the second globally to do so. This initiative underlines the country's dedication to integrating advanced technologies into public infrastructure and transport systems. In financial innovation, a pilot licence was issued for the fractional bonds project under the oversight of the Securities and Commodities Authority. This initiative aims to introduce flexible, secure financial instruments that meet investor needs while adhering to international standards of transparency and confidentiality. In this regard, see UAE, *Regulatory sandboxes in the UAE*, in *u.ae*, 2024.

¹⁹ See R. Plato-Shinar, *The Contribution of the Regulatory Sandbox to the Development of Artificial Intelligence Applications in the Financial Sector*, cit., providing a comparative and conceptual analysis of how regulatory sandboxes, particularly in tightly regulated sectors such as finance, have become essential for fostering responsible innovation in AI. It highlights the sandbox's role in enabling AI-based services such as algorithmic trading, credit scoring, robo-advisory, and chatbots, under the regulator's oversight. The author emphasizes the sandbox's mutual-learning dynamic: while startups gain insight into compliance needs, regulators observe emerging technologies early and adapt rules accordingly. These insights reinforce the expanded scope of sandboxes like the DFSA's

The establishment of the Artificial Intelligence Lab at the Dubai International Financial Centre FinTech Hive provided a dedicated venue for simulating and assessing AI-driven use cases before full-scale deployment, thereby integrating regulatory foresight with technical experimentation.

The Emirate of Dubai's broader innovation ecosystem, which includes the Dubai Future Accelerators²⁰, the Smart Dubai initiative²¹ and the Dubai Universal Blueprint for AI²², complements the regulatory sandbox model by promoting collaboration between startups, regulators, and government agencies involved in implementing, overseeing, or complementing these programs such as the Dubai Future Foundation, Digital Dubai Authority, Dubai Centre for Artificial Intelligence and the Dubai Financial Services Authority.

This integrated approach is further formalized by the launch of Sandbox Dubai in August 2024 by the Dubai Future Foundation. Conceived under the ambitious Dubai Economic Agenda D33,²³ this initiative represented a major step toward a unified regulatory experimentation framework for

ITL, which began with fintech and evolved to accommodate AI-driven financial solutions.

²⁰ Dubai Future Accelerators is a government-led initiative designed to foster collaboration between startups, private entities, and government agencies to address specific challenges through innovative technologies. While DFA is not a regulatory sandbox like the DFSA's Innovation Testing Licence (ITL) program, it plays a complementary role by facilitating the development and testing of cutting-edge solutions, including blockchain technologies, within Dubai's innovation ecosystem. Startups participating in DFA have the opportunity to work closely with government entities, which can pave the way for regulatory engagement and potential integration into programs like the ITL.

²¹ Following the successful implementation of its initial goal to transform the city into a Smart City by 2017, the Dubai Government advanced its digital agenda by launching the "Smart Dubai 2021 Strategy". This comprehensive strategy aimed to elevate the city's standing by focusing on four strategic pillars designed to enhance the quality of life and business environment. Specifically, the strategy was structured around making services "Seamless", by providing integrated daily life services; "Efficient", by optimizing the use of city resources; "Safe" by anticipating risks and protecting people and information; and "Personalised", by enriching life and business experiences for all. The launch of this strategy provided a clear roadmap for the emirate's continued digital transformation, building directly on the foundation laid by its predecessor. In this regard, see UAE, *Smart Dubai 2021 Strategy*, in *u.ae*, 2024

²² See UAE, *Dubai Universal Blueprint for Artificial Intelligence*, in *u.ae*, 2024, a comprehensive plan designed to accelerate the adoption of AI applications across the emirate. As a key part of the Dubai Economic Agenda D33, it aims to boost Dubai's economy by an annual AED 100 billion and increase productivity by 50% through innovative digital solutions. The blueprint serves as a roadmap to enhance the quality of life by incorporating AI across all strategic sectors, attracting global AI talent and companies, delivering superior government services, and transforming Dubai into a global hub for AI governance and legislation. Initial actions include appointing a Chief AI Officer in every government entity and introducing a specialized AI commercial license.

²³ Government of Dubai, *Dubai Economic Agenda D33*, in *u.ae*, 2023.

emerging technologies. Spearheaded by the Dubai Future Foundation in collaboration with various government entities, Sandbox Dubai was designed to foster innovation in key areas such as AI, Web3, biotechnology, the metaverse, and sustainability. Unlike traditional regulatory sandboxes limited to a single sector or authority, Sandbox Dubai functions as a cross-sector, multi-stakeholder platform that facilitates public-private collaboration in both testing new technologies and co-developing adaptive regulatory frameworks.²⁴

Notably, Dubai's Blockchain Strategy, launched in 2016, set the ambitious target of becoming the first city powered entirely by blockchain technologies.²⁵ While full implementation was not achieved by the original 2020 deadline, significant strides were made, with blockchain-based firms admitted into the Innovation Testing Licence sandbox to explore applications such as decentralized finance, supply chain verification, and tokenization. The UAE's commitment to innovation-friendly regulation was reinforced with the creation of the Virtual Assets Regulatory Authority in Dubai in

²⁴ Dubai Future Foundation, *Sandbox Dubai*, in sandboxdubai.gov.ae, August 2024. The Sandbox Dubai initiative, launched in August 2024 by the Dubai Future Foundation, is a specialized digital hub designed to enhance the effectiveness of the Emirate's regulatory ecosystem. Its creation is explicitly tied to the goals of the Dubai Economic Agenda D33, which seeks to double Dubai's economic size and cement its position among the world's top three urban economies by 2033. The sandbox aims to achieve this by acting as a central mechanism to connect innovators, regulators, and investors, significantly streamlining the process from innovative ideation to achieving formal regulatory approval. By late 2024, thematic sandboxes had already been launched under its umbrella, including for the Gig Economy and PropTech, demonstrating early implementation success. In 2025, Sandbox Dubai entered a phase of full-scale operation, signing its first international memorandum of understanding with the Artificial Intelligence Center Hamburg, and establishing itself as a global reference point for scalable experimental governance. The platform reinforces Dubai's vision of becoming a leading urban testbed for future technologies, while aligning regulatory flexibility with economic transformation.

²⁵ Smart Dubai, *Dubai: The First City on the Blockchain*, in digitaldubai.ae, January 2017, outlining the launch and ambition of the Dubai Blockchain Strategy, introduced in October 2016 with the goal of making Dubai the first city fully powered by blockchain technology by 2020. Developed jointly by the Smart Dubai Office and the Dubai Future Foundation, the strategy is built on three pillars: government efficiency (implementing blockchain in public sector services), industry creation (fostering a blockchain ecosystem with startups, accelerators, and regulatory support), and international thought leadership (positioning Dubai as a global hub for blockchain knowledge and innovation). The document stresses implementation plans involving over a dozen government entities and outlines a governance framework to support pilot projects in sectors such as energy, tourism, real estate, and health. Also describes Dubai's plans for policy development, global startup competitions, training programs, and public-private collaboration through the Global Blockchain Council. The strategy reflects Dubai's broader vision of embracing emerging technologies to transform government operations, stimulate economic growth, and export its blockchain model globally.

2022.

As a specialized body dedicated to the oversight of virtual assets, the Virtual Assets Regulatory Authority has introduced a bespoke regulatory framework covering crypto-assets, NFTs, and emerging use cases such as metaverse platforms.

Operating independently from the Dubai Financial Services Authority, but aligned with the UAE's overarching legal and compliance objectives, VARA enables sector-specific regulation while addressing the unique risks posed by decentralized digital economies.²⁶ This layered, multi-regulator model supports adaptive and coherent regulatory responses, even as technologies evolve at different speeds across domains.

At the federal level, regulatory sandboxes are increasingly being used in the UAE to facilitate innovation across sectors beyond finance. These initiatives are guided by principles of transparency, proportionality, risk mitigation, and inter-agency collaboration, enabling faster regulatory learning and agile policy responses to emerging technologies.

The UAE has rapidly expanded its capacity for regulatory innovation, moving beyond simple frameworks to establish comprehensive ecosystems that actively shape its future economy. In 2020, the Central Bank of the UAE significantly amplified these efforts by launching a broad regulatory sandbox program to support advancements in banking, payments, and open finance.

Crucially, this drive extended to targeted sectoral transformation. The

²⁶ Law No. (4) of 2022 Regulating Virtual Assets in the Emirate of Dubai. The law states that the Dubai Virtual Assets Regulatory Authority (VARA) is established as an independent public authority affiliated with the Dubai World Trade Centre Authority, endowed with legal personality and financial and administrative autonomy (art. 4). Its jurisdiction covers all virtual asset activities in the Emirate of Dubai, excluding the Dubai International Financial Centre (art. 3). The stated objectives of VARA include promoting Dubai as a regional and global hub for virtual assets, encouraging innovation and investment in the sector, and developing a digital economy (art. 5). To achieve these objectives, VARA is empowered to issue permits for a defined set of virtual asset-related activities, such as the operation of exchanges, custodianship, wallet provision, and token issuance, and to supervise compliance through ongoing regulatory oversight (Arts. 15-16). Of particular relevance to innovation governance, the law enables VARA to classify new activities and define regulatory requirements accordingly, allowing for adaptive responses to emerging technological developments (art. 16(c)). Moreover, VARA has the authority to suspend activities or trading operations if public interest or market integrity so requires (art. 18), reflecting a responsive and risk-sensitive regulatory posture. The legislation further mandates coordination with domestic and international stakeholders, and expressly empowers VARA to propose new legislation and establish legal entities to support its regulatory functions (art. 6(11), 6(14), 6(15)). Taken together, these provisions form a flexible regulatory infrastructure that, while not explicitly labeled a "sandbox," mirrors the structure and purpose of regulatory sandboxes by enabling limited, supervised experimentation in rapidly evolving domains such as digital assets, blockchain technologies, and related fintech innovations.

Central Bank of the UAE simultaneously introduced a specialized insurance sandbox, not merely to test products, but with the stated ambition of turning the entire insurance sector into a smart, technology-driven marketplace. The initiative is highly strategic, focused on both safeguarding consumers and actively nurturing Emirati FinTech leadership in the Insurtech space. The focused regulatory experimentation allows the Central Bank of the UAE's Insurance sector to gain vital insight into the risks of new digital products, ensure customer protection, and foster an innovation-friendly environment that collaborates with FinTech firms, as detailed in the Sandbox Conditions Regulation.²⁷

Such a spirit of proactive, collaborative regulation has only intensified. In January 2024, the United Arab Emirates demonstrated its international leadership by launching the Global TradeTech Sandbox in partnership with the Ministry of Economy, the Abu Dhabi Department of Economic Development, and the World Economic Forum. Such a move positions the Emirates at the forefront of establishing global best practices for trade technology adoption, underscoring the country's commitment to international regulatory cooperation.

The focus on enabling technological growth continued into February 2024, when the Telecommunications and Digital Government Regulatory Authority introduced the ICT Regulatory Sandbox. This initiative directly addresses the backbone of the digital economy by fostering a proactive legislative environment necessary for developing and deploying innovative Information and Communications Technology services, ensuring the long-term sustainability and growth of the digital sector itself. Together, these sandboxes form a cohesive targeted strategy to ensure that regula-

²⁷ The Central Bank of the UAE introduced its regulatory sandbox within the insurance sector as part of its response to the fast-paced digital transformation reshaping the global economic and financial environment. These technological advancements, driven primarily by the private sector and global digitization trends, are revolutionizing industries while also presenting both opportunities and challenges for insured individuals, policyholders, beneficiaries, companies, stakeholders, related professionals, and regulators alike. To address these shifts, the Central Bank's Insurance Sector has implemented the Sandbox Regulation, which outlines the regulatory framework governing the operation and oversight of this experimental environment. The key objectives of this initiative include: Gaining insight into new insurance products and identifying associated risks to ensure customer protection and satisfaction during testing phases; Transitioning the UAE insurance market into a smart, technology-driven marketplace; Encouraging the growth of emerging Emirati FinTech firms; Establishing a supportive, innovation-friendly environment for the insurance industry, one that fosters collaboration with FinTech companies, enhances regulatory practices, and contributes to broader economic development and effective risk management. Central Bank of the U.A.E., *Sandbox Conditions Regulation*, in rulebook.centralbank.ae, April 15, 2024

tion is a catalyst, not a constraint, for the nation's economic ambitions.²⁸ As of today, the UAE's regulatory sandbox ecosystem stands as one of the most sophisticated and integrated in the world.

Rather than treating sandboxes as isolated experiments, the UAE embeds them into a national innovation framework that includes accelerator programs, public-private partnerships, and strategic legal reforms. Each emirate contributes to this ecosystem in alignment with federal priorities, creating a collaborative environment for testing, learning, and scaling innovation.

The country's proactive, forward-looking approach to sandbox governance, anchored in flexibility, inclusivity, and international best practice, has positioned the UAE as a global reference point for smart regulation in the digital age.

While the United Arab Emirates' framework is undeniably comprehensive, the challenge lies in its very sophistication. The proliferation of specialized and geographically distinct sandboxes, such as those managed by the Dubai Financial Services Authority, the Central Bank of the United Arab Emirates, the Telecommunications and Digital Government Regulatory Authority, and the newly established Sandbox Dubai, presents a critical operational hurdle.

The major ongoing challenge is managing decentralization and ensuring seamless modernization and cooperation, in line and on top of what increasingly occurs among companies²⁹, authorities and sandboxes.

True systemic success requires these regulatory and governmental autho-

²⁸ TDRA, *ICT Regulatory Sandbox*, in tdra.gov.ae, February 2024, emphasizing that the initiative is a strategic regulatory tool developed to support the UAE's national priorities by enabling safe experimentation with emerging ICT technologies in a controlled environment. It stresses the importance of regulatory agility to accommodate innovation without compromising consumer protection or market stability. The Sandbox offers selected participants, particularly start-ups and SMEs, a temporary regulatory respite to test novel digital services and business models, provided they deliver clear added value and meet specific eligibility and performance criteria. Through a structured lifecycle and with TDRA's oversight, the initiative gathers evidence to shape future regulatory frameworks, ensuring that technological advancement proceeds in tandem with responsible governance.

²⁹ See G. Ghidini – A. Stazi, *Coopetition: the role of IPRs*, in *Innovation, Competition and Collaboration*, 2015, 15 ff., which highlight that effective cooperation and collaboration among competitors, or coopetition, is increasingly essential for innovation and business in complex technological environments. It emphasizes the creation of value networks that reduce costs, foster R&D, expand markets, address technological challenges, and comply with regulations developing new industry standards. The authors frame coopetition as a balanced interaction of competition and collaboration, grounded in contractual freedom and legal protections, which provides a strong basis and incentive for decentralized actors such as authorities and sandboxes to modernize and cooperate effectively.

rities to not merely cooperate with the external private companies utilizing the sandboxes, but to effectively cooperate with each other.

Without robust, standardized protocols for sharing data, findings, and best practices across different jurisdictions and specialized regulators, the risk of fragmentation remains.

Overcoming this internal coordination complexity is the key to maintaining the ecosystem's agility and ensuring that the United Arab Emirates' impressive regulatory innovation framework truly functions as a cohesive national model.

3. Regulatory Sandbox in Singapore

Singapore's regulatory sandbox framework has become one of the most influential and widely cited models globally, embodying the city-state's proactive and strategic approach to financial and technological innovation. The origins of Singapore's sandbox can be traced back to November 2016, when the Monetary Authority of Singapore launched its original FinTech Regulatory Sandbox initiative. This move was part of a broader national agenda to position Singapore as a global FinTech hub, articulated under the Smart Financial Centre vision.³⁰

Unlike many early sandbox models focused narrowly on financial products, the Monetary Authority of Singapore's initiative was deliberately broad in both scope and participation. It permitted experimentation not only across financial sectors – such as payments, wealth management, insurance, and even RegTech – but also among a wide range of actors, including not just traditional financial institutions, but also FinTech start-ups and professional services firms partnering with them.

³⁰ Monetary Authority of Singapore, *FinTech Regulatory Sandbox Guidelines*, in [mas.gov.sg](https://www.mas.gov.sg), November 2016, defining the sandbox as a regulatory tool to support experimentation with innovative financial services in a live environment, while maintaining safeguards to contain failure. MAS outlines key objectives such as enhancing efficiency, managing risk, creating new opportunities, and improving lives through technology-driven financial innovation. MAS sets eligibility criteria – including the novelty of the solution, consumer benefit, readiness for market, and risk mitigation plans – and clarifies which regulatory requirements may be relaxed (e.g., capital adequacy, licensing fees), and which must remain in place (e.g., anti-money laundering, customer data confidentiality), reflecting MAS's strategic vision of building a Smart Financial Centre by fostering safe and agile FinTech development. Monetary Authority of Singapore, A Smart Financial Centre (Speech by Mr. Ravi Menon, Managing Director, MAS), MAS, 2015. In this foundational speech, Menon outlines Singapore's vision to become a global fintech hub by integrating innovation and technology into the financial system, emphasizing regulatory flexibility, experimentation, and collaboration as key enablers of a “Smart Financial Centre”.

A distinctive feature of Singapore's first sandbox was its flexibility: regulatory requirements could be adjusted on a case-by-case basis, depending on the nature, risk profile, and maturity of the innovation being tested.³¹ Nonetheless, the Monetary Authority of Singapore remained prudent in its allocation of sandbox approvals.³²

As early as 2019, learning from practical experience, the Monetary Authority of Singapore introduced the Sandbox Express, a faster-track version of the original framework designed for lower-risk activities such as insurance brokering, and recognized market operators dealing with simple products.³³

This initiative significantly reduced approval timeframes from months to

³¹ Monetary Authority of Singapore, *FinTech Regulatory Sandbox Guidelines*, cit., as stated in para. 2.2, MAS invites not only licensed financial institutions but also other interested firms – including FinTech start-ups and technology service providers – to apply for sandbox entry, provided their activities fall under MAS's regulatory remit. In para. 6.2(a), MAS highlights that applications should involve genuinely novel financial services, either by introducing new technologies or by applying existing ones in an innovative way. In para. 5.5, MAS makes it clear that sandbox applications replicating existing services in Singapore will only be considered if applicants can demonstrate a distinct technological or operational differentiation. Furthermore, as in para. 5.5 (b), the firm must show evidence of due diligence, including prior testing in a controlled environment and understanding of relevant legal and regulatory obligations. MAS does not restrict the sandbox to specific sectors, as noted implicitly in para. 4.1; instead, it assesses applications across a broad spectrum, provided they aim to improve efficiency, manage risk, create new opportunities, or enhance consumer outcomes (para. 5.2). Para. 6.2 (c - g) outline the operational evaluation criteria, such as the firm's ability and intent to scale the service in Singapore post-sandbox, the definition of test scenarios and success indicators, the articulation of boundary conditions (including limits on time, customers, and transactions), and the presence of robust risk mitigation and exit strategies. Importantly, para. 2.3 and Annex A emphasize MAS's case-by-case approach to regulatory relief: certain requirements (e.g., capital adequacy, license fees) may be temporarily relaxed, while core obligations related to customer protection and financial integrity (e.g., AML/CFT compliance, data confidentiality) must remain in force. As indicated in para. 7.3 - 7.5, successful completion of the sandbox requires the firm to either transition to full compliance for broader market deployment or exit the sandbox in a manner that ensures all customer obligations are fulfilled.

³² See C. C. Chen, *Regulatory Sandboxes in the UK and Singapore: A Preliminary Survey*, in *papers.ssrn.com*, 2020, which highlighted that MAS had only awarded six sandboxes by the end of 2018, showed that half of these (three out of six) were related to the insurance sector, namely, PolicyPal, Inzsure, and MetLife. The remaining sandboxes focused on other areas: one in digital advisory services (Krystal Advisors), one in money changing (Thin Margin), and one in cross-border remittance (TransferFriend).

³³ Monetary Authority of Singapore, *Sandbox Express Guidelines*, in *mas.gov.sg*, 2019 (updated January 2022), 3, aiming to streamline the testing of innovative financial products by offering standardized constructs for lower-risk services, significantly reducing the time and resources required for market entry.

as little as 21 days, thereby enhancing Singapore's appeal to innovators seeking rapid market testing. By streamlining the regulatory process, the Monetary Authority of Singapore fostered a conducive environment for fintech growth, contributing to the establishment of over 1.000 fintech firms in Singapore by 2022.³⁴

Blockchain technology soon became a key area of focus within Singapore's broader regulatory innovation framework. Notably, Project Ubin – a collaborative initiative led by the Monetary Authority of Singapore and major financial institutions to explore blockchain-based clearing and settlement – reflected the Monetary Authority of Singapore's commitment to fostering experimentation with distributed ledger technology under controlled, collaborative settings akin to sandbox principles.³⁵

Building on these foundations, the Monetary Authority of Singapore welcomed applications from blockchain startups into its regulatory sandbox, facilitating experimentation in areas such as tokenization, decentralized finance, and cross-border payment solutions.³⁶

Furthermore, the city-state demonstrated exceptional foresight with the enactment of the Payment Services Act 2019, which introduced a modular licensing framework for digital payment services – including crypto and blockchain firms – informed in part by the regulatory insights gained through earlier sandbox trials.³⁷

With regard to artificial intelligence, Singapore has taken a similarly syste-

³⁴ Singapore Fintech Association – PwC, *FinTech's state of play: Taking stock of Singapore's FinTech landscape*, in *pwc.com*, 2022, 9. This growth reflects Singapore's strong regulatory support and its attractiveness as a regional base for innovation and expansion into ASEAN markets. At the same time, Singapore's fintech sector is maturing, moving from a start-up phase to a scale-up phase, offering a fertile environment for both local and international players.

³⁵ See: Monetary Authority of Singapore, *Project Ubin: Central Bank Digital Money using Distributed Ledger Technology*, in *mas.gov.sg*, 2024. Project Ubin, launched by the Monetary Authority of Singapore in 2016, was a multi-phase collaborative initiative exploring the use of blockchain (distributed ledger technology) for clearing and settlement of payments and securities. While not part of the formal MAS regulatory sandbox, Project Ubin served as a parallel innovation initiative allowing real-world experimentation in a controlled environment. Its design echoed sandbox principles by enabling public-private sector collaboration and live testing of blockchain use cases without full-scale deployment risks. The project informed both MAS's approach to financial infrastructure innovation and its broader regulatory stance on digital assets and decentralized technologies.

³⁶ Singapore's regulatory sandbox has supported several blockchain-focused startups aligned with MAS's innovation agenda. For example, ADDX (formerly iSTOX) became the first platform to graduate from the sandbox in 2020, going on to operate under a Recognised Market Operator (RMO) license to enable tokenization and fractional trading of private market securities.

³⁷ *Singapore Parliament, Payment Services Act 2019 (No. 2 of 2019). Enacted on 14 January 2019.*

matic and forward-looking approach. The National Artificial Intelligence Strategy, launched in 2019, emphasized the importance of “AI model governance” and regulatory experimentation to support safe AI deployment.³⁸

The Monetary Authority of Singapore has supported this development through the regulatory sandbox, in collaboration with AI-driven fintech firms working in areas such as credit scoring, fraud detection, and robo-advisory services, where regulatory clarity and consumer impact warrant controlled testing.³⁹

In parallel, the Monetary Authority of Singapore launched the Veritas initiative to develop frameworks and open-source tools for implementing ethical AI in finance, aligned with the FEAT principles (Fairness, Ethics, Accountability, and Transparency). These tools may be adopted by firms testing AI solutions, including in sandbox environments, before wider deployment.⁴⁰

A notable example is Kristal.AI, a digital wealth management platform that participated in the Monetary Authority of Singapore’s FinTech Regulatory Sandbox to test its AI-driven robo-advisory services. Utilizing machine learning algorithms, Kristal.AI offered personalized portfolio recommendations and streamlined investor onboarding processes.

This participation demonstrated how AI-powered financial solutions

³⁸ See Smart Nation – Digital Government Office, *National Artificial Intelligence Strategy*, in file.go.gov.sg, 2019, 64 ff., setting out a whole-of-nation approach to AI deployment, including ethical model governance, public-private collaboration, and regulatory support for test-bedding AI systems. The strategy emphasizes responsible innovation and the need to adapt regulatory structures in tandem with technological advances; and B. Do – S. Gray, *Balancing Innovation and Oversight: Regulatory Sandboxes as a Tool for AI Governance*, in *Future of Privacy Forum*, 2025, which stress that regulatory sandboxes can stimulate AI development, enhance consumer protections, and help regulators develop more effective policies, as evidenced by Singapore’s proactive AI governance testing efforts through the Infocomm Media Development Authority and AI Verify Foundation.

³⁹ See K. Lee, *Singapore Expands Its AI Governance Approach to Include Generative AI*, in *Lanflash*, 2024, that highlight the expansion of Singapore’s AI governance framework with the introduction of the Model AI Governance Framework for Generative AI in 2024, which builds on earlier principles to address evolving AI risks, including bias, misuse, and lack of explainability.

⁴⁰ Smart Nation – Digital Government Office, *National Artificial Intelligence Strategy*, cit., 67. While the Veritas initiative is not part of the MAS regulatory sandbox itself, it plays a complementary role by addressing a major barrier to the responsible scaling of AI technologies – translating ethical principles into practical, testable standards. In the context of regulatory sandboxes, Veritas offers participating firms a structured way to evaluate and validate AI models during the experimentation phase. This alignment strengthens the sandbox’s value not just as a testing ground for innovation, but as a mechanism for embedding governance and trust into AI-driven financial services from the outset.

could be responsibly trialed within a controlled regulatory environment, underscoring the importance of aligning innovative technologies with regulatory expectations and consumer protection standards⁴¹.

Complementing these regulatory efforts, the Monetary Authority of Singapore also initiated Project Orchid, which explores the technical infrastructure for a potential digital Singapore dollar.

A key innovation under this initiative is Purpose Bound Money, which allows conditions to be embedded within digital currency, enabling targeted disbursements like government vouchers or subsidies. Purpose Bound Money has been tested in sandbox settings, offering regulators and innovators a safe environment to explore programmable digital money while preserving financial integrity and user protection.⁴²

Singapore's sandbox ecosystem did not remain static. In 2021, the Mo-

⁴¹ See L. Lin, *Regulating FinTech: The Case of Singapore*, in *SSRN Electronic Journal*, 2019, 94 ff., stressing that the sandbox model exemplifies Singapore's "innovator-centered" regulatory approach, where experimental financial services are trialed under relaxed requirements to evaluate regulatory fit while maintaining consumer safeguards and policy oversight. Kristal.AI's successful graduation from the sandbox illustrates how this framework facilitates FinTech development while ensuring regulatory integrity.

⁴² Monetary Authority of Singapore, *Project Orchid: Programmable Digital SGD*, in *mas.gov.sg*, November 2022 and Monetary Authority of Singapore, *Purpose Bound Money (PBM): Technical Whitepaper*, in *mas.gov.sg*, June 2023. The Report served as a forward-looking exploration into the viability of a programmable digital Singapore dollar, with a specific emphasis on the concept of Purpose-Bound Money. This initiative did not set out to launch a retail central bank digital currency (CBDC) immediately but aimed instead to establish the foundational infrastructure and technical competencies required should the need for such a currency arise in the future. Project Orchid marked an extension of earlier experimentation by MAS into the retail space, having previously focused on wholesale digital currency solutions through initiatives such as Project Ubin. The 2022 report laid out a vision deeply aligned with Singapore's broader digital innovation goals, responsible financial governance, and inclusion. It emphasized that while Singapore's electronic payment systems were already advanced, the dynamic nature of the global digital asset landscape necessitated proactive research and preparedness. At the heart of Project Orchid was the idea of Purpose-Bound Money, a digital protocol that enabled money to be encoded with specific rules governing its use. This concept merged the strengths of programmable payment systems and programmable money, offering the ability to not only automate payments based on predefined conditions but also bind the money itself to its intended purpose. Such technology presented compelling opportunities across various domains, including government assistance programs, corporate incentives, charitable donations, and pre-paid consumer services. A notable aspect of the initiative was its inclusive approach to digital currencies. Rather than relying solely on a future CBDC, Purpose-Bound Money was designed to work with various digital instruments including securely backed stablecoins and tokenised bank deposits. This made the framework flexible and adaptable to different future scenarios. MAS clearly communicated that it did not yet see an urgent need for a retail CBDC, but the knowledge gained through Project Orchid would ensure that Singapore was prepared to move decisively if such a need emerged.

netary Authority of Singapore introduced the Sandbox Plus framework, enhancing support for early-stage Fintech startups. This initiative offers funding grants, regulatory guidance, and partnership opportunities through the Monetary Authority of Singapore Innovation Lab. Notably, Sandbox Plus introduced tiered levels of regulatory support, distinguishing between firms with lower regulatory risks and those requiring customized regulatory guidance.

This graduated approach underscores Singapore's progression from a sandbox pioneer to a sophisticated regulatory innovator, adept at tailoring interventions across a diverse technological landscape.⁴³

Today, Singapore's regulatory sandbox infrastructure continues to serve as a global exemplar of progressive financial regulation. The Monetary Authority of Singapore operates the enhanced Sandbox Plus framework, which provides tailored support to startups innovating in fintech, blockchain, AI, and digital assets.

Complementary initiatives such as Project Guardian – a live industry pilot exploring asset tokenization and institutional DeFi – create sandbox-like environments for real-world experimentation involving regulated financial institutions.⁴⁴

Furthermore, Singapore's leadership in cross-border regulatory cooperation, exemplified by its role in the Global Financial Innovation Network, enables firms to trial their solutions across multiple jurisdictions simultaneously, significantly lowering barriers to international market entry.

Thus, Singapore's approach has evolved beyond mere regulatory tolerance for innovation: it has become a dynamic ecosystem combining proactive regulation, public-private collaboration, and international interoperability. The city-state's continued success in sandbox regulation can be attributed to its unwavering commitment to maintaining a delicate balance between enabling technological breakthroughs and ensuring systemic resilience, consumer protection, and market integrity.

⁴³ Monetary Authority of Singapore, *MAS Enhances FinTech Regulatory Sandbox with Sandbox Plus*, in *mas.gov.sg*, 2021, reflecting MAS's recognition of the need for a more flexible, scalable regulatory environment as fintech innovation matures. By offering differentiated support based on firms' risk profiles and readiness levels, Sandbox Plus not only fosters experimentation but also aligns regulatory efforts with national priorities in digital finance, such as cross-border payments, green finance, and financial inclusion.

⁴⁴ Monetary Authority of Singapore – BIS, *Project Guardian: Enabling Open and Interoperable Networks*, in *mas.gov.sg*, 2023, initiative in collaboration with regulated financial institutions and international partners, designed to explore asset tokenization, open interoperable networks, and institutional DeFi protocols through live industry pilots. While not formally a regulatory sandbox, it facilitates real-world experimentation under supervisory conditions.

4. Approaches and Future Perspectives: a Comparative Framework

The comparative analysis of regulatory sandbox frameworks in the United Arab Emirates and Singapore reveals two distinct yet complementary models of innovation governance, each reflective of their unique legal, institutional, and geopolitical contexts. The UAE's polycentric approach, characterized by federal-emirate synergies and sector-specific sandboxes in domains such as finance, ICT, and TradeTech, leverages the country's federal structure to create a dynamic and adaptive regulatory ecosystem. Here, regulatory experimentation occurs across multiple jurisdictional levels, reflecting a regulatory pluralism that allows for sectoral specialization and localized innovation while maintaining alignment with national priorities, such as those articulated in the UAE National Artificial Intelligence Strategy 2031, and the Emirates Blockchain Strategy 2021, or at the emirate-level, the Dubai Economic Agenda D33.

This model resonates with Teubner's theory of legal pluralism, wherein multiple normative orders coexist and interact, fostering a regulatory environment that is both flexible and responsive to technological disruption.⁴⁵ Its evolution, from the 2016 FinTech Sandbox to Sandbox Plus and Project Guardian, illustrates a transition from reactive regulatory accommodation to proactive ecosystem design.

This trajectory aligns with Sabel and Zeitlin's "experimentalist governance", where iterative learning, feedback loops, and decentralized implementation inform adaptive regulatory policymaking.⁴⁶

Both jurisdictions aim to balance innovation and systemic stability, but diverge in methodology.

The UAE leverages regulatory sandboxes to support geostrategic diversification, positioning itself as a global hub for emerging technologies such

⁴⁵ See G. Teubner, *Global Bukowina: Legal Pluralism in the World-Society*, in G. Teubner (ed.), *Global Law Without a State*, Dartmouth, 1996, 3 ff., that develops the notion of transnational legal pluralism, highlighting how autonomous regulatory subsystems, such as the *lex mercatoria*, interact with formal legal orders while maintaining its own internal logic; and A. Stazi, *Smart Contracts and Comparative Law: A Western Perspective*, cit., emphasizing how the automatic execution of smart contracts, with the relative trend towards a reduced use of the legal system, is in line with the general phenomenon of the increase in rules and private institutions which is giving rise to a gradual loss of relevance of state law.

⁴⁶ C. F. Sabel – J. Zeitlin, *Experimentalist Governance*, in D. Levi-Faur (ed.), *The Oxford Handbook of Governance*, Oxford, 2012, 169 ff., describing a model of governance in which central authorities set broad policy goals, while decentralized actors experiment with implementation. These practices are subject to iterative review and revision, a dynamic particularly relevant to Singapore's sandbox evolution from rule-based accommodation to adaptive regulatory design.

as blockchain, AI, and virtual assets, in line with its broader economic transformation agendas.⁴⁷

Singapore, differently, adopts a standards-based and risk-calibrated approach, advancing regulatory exportability and ethical governance, as evidenced by the “Fairness, Ethics, Accountability, and Transparency” principles for AI and its leadership in the Global Financial Innovation Network.

Remarkably, while the UAE’s multi-regulator model enables sectoral specialization, it risks fragmentation without strong inter-agency coordination, a challenge mitigated through federal oversight bodies like the Central Bank.

Singapore’s regulatory approach, centered around the Monetary Authority of Singapore, effectively ensures regulatory coherence across the financial sector. However, the system must maintain flexibility to prevent this centralization from inadvertently stifling niche innovations (smaller, specialized, or unconventional financial technologies) that might not neatly fit established frameworks.

The comparative analysis underscores a key insight: while legal tradition, whether civil law, common law, or a hybrid system, provides the foundational context for regulatory design, it is the institutional configuration – polycentric versus monocentric – and the regulatory philosophy – sectoral pluralism versus unified governance – that most directly shape the sandbox’s effectiveness as a governance tool.

The UAE’s decentralized model fosters sectoral innovation and localized responsiveness but requires strong coordination to avoid regulatory fragmentation.

Singapore’s centralized framework ensures coherence and regulatory clarity, but it must guard against rigidity that could stifle niche or frontier innovations.

Thus, regulatory sandboxes are not merely technical instruments for market experimentation, but they serve as strategic platforms for legal and policy learning, enabling jurisdictions to manage the complex interplay

⁴⁷ UAE, *We the UAE 2031*, in *u.ae*, 2022. This national strategy articulates the UAE’s developmental trajectory for the next decade, with the ultimate aim of positioning the country as a global leader by its centennial in 2071. *We the UAE 2031* outlines four strategic pillars, Forward Society, Forward Economy, Forward Diplomacy, and Forward Ecosystem, that encompass a wide range of priorities, including social empowerment, digital infrastructure, environmental sustainability, and international influence. Central to its economic vision is a highly diversified, innovation-driven economy that leverages cutting-edge technologies such as artificial intelligence, blockchain, and digital assets. The plan envisions a competitive private sector, a strong R&D ecosystem, and legislative agility that supports future industries. Regulatory sandboxes and innovation-friendly governance are explicitly framed as mechanisms for enabling this transformation. It is within this framework that the UAE uses its policy tools to achieve geostrategic diversification and economic resilience while maintaining systemic stability.

between innovation, risk, and regulation in a globalized technological landscape.

By juxtaposing the UAE's multi-level, sectoral model with Singapore's unified, standards-driven approach, this research provides valuable elements for other jurisdictions.

The comparison between the United Arab Emirates and Singapore reveals that institutional architecture, rather than legal tradition alone, determines the regulatory system's capacity to manage technological innovation.

The UAE's polycentric experimentation, rooted in the interaction between federal and emirate-level authorities, produces regulatory diversity and sectoral responsiveness but requires sophisticated coordination mechanisms to prevent fragmentation.

Singapore's monocentric experimentalism, by contrast, consolidates regulatory authority within the Monetary Authority of Singapore, ensuring coherence, predictability, and international interoperability, though at the risk of limiting unconventional or niche innovation.

Rather than representing opposing poles, the two systems illustrate complementary pathways of regulatory learning: UAE exemplifies adaptive pluralism, where innovation is driven through distributed experimentation; Singapore embodies coherent agility, where innovation is guided through unified governance and iterative refinement.

Together, they demonstrate that effective sandbox governance does not lie in a universal blueprint, but in a jurisdiction's ability to calibrate coherence and flexibility, centralization and diversity, in accordance with its institutional capacities and strategic ambitions.

In this sense, the comparative analysis of the UAE and Singapore highlights two distinct yet mutually informative models of regulatory innovation, each offering valuable lessons for jurisdictions seeking to reconcile experimentation with stability in the digital economy.

Abstract

Regulatory sandboxes have emerged as pivotal instruments for reconciling technological innovation with legal stability, particularly in sectors characterized by high regulatory density, such as finance, artificial intelligence, and blockchain. This comparative analysis examines the regulatory sandbox frameworks of the United Arab Emirates and Singapore, two jurisdictions that exemplify distinct institutional responses to the challenges of innovation governance and have been methodologically selected due to their shared ambition to position themselves as global hubs for digital transformation, while representing structurally divergent legal systems and regulatory philosophies. The UAE adopts a polycentric and sectoral model rooted in regulatory pluralism, where emirate-specific initiatives operate within a broader federal strategy. This structure enables localized experimentation while aligning with national objectives in digital transformation and geostrategic positioning. Singapore's unified approach, anchored in the Monetary Authority of Singapore, reflects a model of experimentalist governance characterized by regulatory coherence, iterative learning, and transnational interoperability. Despite their structural peculiarities, decentralized versus centralized, both models converge in their strategic function: enabling adaptive regulation, fostering innovation ecosystems, and safeguarding systemic integrity. The analysis underscores how legal design, institutional configuration, and normative priorities shape the deployment and evolution of regulatory sandboxes as tools of comparative regulatory innovation.

Keywords

Regulatory Sandbox – FinTech – Blockchain – Artificial Intelligence – Comparative Law