

DIFFERENT PATHWAYS OF REGULATORY SANDBOXES IN EUROPE: LITERATURE REVIEW WITH A SPECIAL FOCUS ON CZECHIA

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Abstract

For more than forty-five years, there has been an instrument in Czech legislation allowing experimental verification of innovations in the public education system. Despite this fact and other recommendations, Czechia, in contrast to neighboring countries, has not yet implemented a true regulatory sandbox. The objectives of this article are (i) to describe the development of regulatory sandboxes in Czechia, (ii) to compare it with other European countries, and (iii) to provide recommendations for further steps in the responsibility of regulatory sandboxes and their establishment in the Czech legal environment. To achieve objectives, a review of literature and policy documents was conducted. Our analysis concluded that Germany is the clear leader among selected countries in regulatory sandboxes, followed by Austria.

Keywords: regulatory sandbox, Europe, Czechia, public sector, innovation

1. Introduction

Although the seven selected countries (Austria, Czechia, Germany, Hungary, Poland, Slovakia, and Slovenia) are adjacent, their development trajectories are very different¹. The question is to what extent this historical context is the reason for the various approaches to regulatory sandboxes, still a relatively young tool to help test and promote innovations of different types more effectively and quickly. This paper attempts to fill the gap in Czech research on regulatory sandboxes, which is scarce and does not attempt a comprehensive and contextualized characterization of this dynamically growing research topic so far. We aim to take an all-encompassing approach that includes legal issues and focuses on the various sectors that can benefit from introducing regulatory sandboxes into Czech legislation. One of them is the spa and balneology sector, where the research and application sector in Czechia is reviving. The article is a follow-up to the previously published fundamental research works done by Czech specialists from the Faculty of Law of Charles University, and it expands on their work in greater detail.

In the most general sense, regulatory sandboxes can be understood as testing an innovative product, process, or business model in a real-world setting with real users, with the possibility of regulatory relief to improve, update, or create new regulations (Alaassar et al., 2021; Johnson, 2023; Zetsche et al., 2017). The testing process, which takes place according to a pre-agreed plan that includes temporal and spatial (virtual or physical) boundaries, is overseen by a public regulator (ministry, state agency, or other public institution responsible for regulation) who can, among other things, provide various forms of support (Raudla et al., 2024; Sharp & Blahoudková, 2024). Securing the whole process for all stakeholders (public, users, innovators, and regulators) is also crucial. Regulatory learning, i.e., reflecting on the process and learning lessons for future

work, also plays an important role in the testing process (European Commission, 2023b). The founder of the concept of regulatory sandboxes is considered to be Mark Walport, former UK Government Chief Scientific Adviser, who published his ideas in the FinTech Futures review (Government Office for Science, 2015). Not long after, the first-ever regulatory sandbox was launched, the FCA, which acts as the UK's regulator for banking and hence FinTech, was in charge of it (Financial Conduct Authority, 2015).

Walport openly states that this concept was inspired by medicine or clinical trials (Leckenby et al., 2021). However, the very idea of testing and applying acquired knowledge despite partial or complete bans is much older (Ranchordás, 2021). The first experimental policies, laws, and regulations were introduced as early as the 17th century in France and later in parts of the British Empire (Ranchordás, 2014). These flexibility-allowing regulations were previously focused mainly on the public sector, and in the United States, they allowed national policies to be adapted to local needs and customs (Ranchordás, 2021). In 1932, Justice Louis D. Brandeis issued a decision in which he argued, among other things: "A State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country" (New State Ice Co. v. Liebmann). Experimental legal regimes that are directly linked to the testing of technological (i.e., tangible) innovations are introduced only later (Cortez, 2014; Crootof & Ard, 2021).

As more and more regulatory sandboxes are introduced and implemented, different perceptions of what a regulatory sandbox is and what it is not are becoming more prevalent, creating confusion in definitions (Leckenby et al., 2021). A key aspect that helps to differentiate similar tools is their relationship to regulation. Armstrong et al. (2019) distinguish three basic levels of regulation – advisory, adaptive, and anticipatory. The advisory approach includes tools that help to adapt a project to a given regulation, e.g., in an area where regulation is not clear enough, which is the case, for example, in the FinTech sector in Czechia (OECD, 2023). The adaptive approach is more flexible and encourages innovation by adapting regulations to the new product. The highest level is the anticipatory approach, which serves to future-proof regulation in a new sector through testing outputs. It, therefore, provides an improved understanding of the issue and the needs and visions of stakeholders. Regulatory sandboxes are potentially a tool with an anticipatory approach, which is underpinned by six principles: inclusive and collaborative, future-facing, proactive, iterative, outcomes-based, and experimental (Armstrong et al., 2019). A regulatory sandbox may or may not necessarily relax an existing restriction, but is distinguished from other approaches by the presence of a state regulator (European Commission, 2023b). Nevertheless, the regulatory sandbox is still heading towards a potential regulation adjustment. However, not all projects named regulatory sandbox meet the requirements above.

This article compares the approach to regulatory sandboxes and their evolution in selected countries in Europe with a particular focus on Czechia. Unlike its neighbors, the law in Czechia does not currently address the concept of regulatory sandboxes in any way and thus fails to create favorable conditions for their implementation despite the existence of experimental regimes within Czech legislation. Since the 1970s, the so-called experimental verification has been in operation here, made possible by the Education Actⁱ. This allows the Ministry of Education to try different forms or organizations of teaching. There is a lack of in-depth knowledge and experience in this country. Referring to this creates a research gap that we will try to fill with this article. In our work, we build

on the research done by Czech authors (Handrlica & Blahoudková, 2023; Sharp & Blahoudková, 2024; Tomčiak & Škrabka, 2024). This article aims to describe the complexly perceived "Czech way" in more detail and suggest possible procedures for implementing regulatory sandboxes into Czech legislation.

2. Methodology

Seven European countries (Austria, Czechia, Germany, Hungary, Poland, Slovakia, and Slovenia) were considered in the literature review. All the states are members of the European Union, which creates a similar and thus comparable legal environment. The methodology of the literature review was developed based on Alaassar et al. (2023) and Prastowo et al. (2024), who conducted a systematic review and literature review on regulatory sandboxes in FinTech. A comparative study of existing regulatory sandboxes in FinTech in China was also methodologically useful (Han & Xu, 2022).

The review first selected the industries where regulatory sandboxes are most commonly found. The European Commission Resolution further supplemented the knowledge from the literature (Council of the European Union, 2020), which also defines the fields of exploitation. Based on the authors' previous work, the fields of public administration (special economic zones) and education were further identified. Classification of the selected examples was undertaken for analysis. Here, the widely used NACE classification (its latest version) was chosen. For clarity, concise headings were then assigned to the categories.

Examples of regulatory sandboxes entering the analysis were identified using keywords within the Google search engine (websites of individual regulatory sandboxes) and the Web of Science database (scholarly articles referring to regulatory sandboxes). The keywords were based on three variables (see Table 1). The first key variable was "REGULATORY SANDBOX", the second key variable described a specific area such as the Financial Sector, and the third key variable focused on the geographical name of the country, and searches were conducted with or without its inclusion. All three variables were searched in English and the country's official language (German, Czech, Hungarian, Polish, Slovak, and Slovenian). Regulatory sandboxes from Germany were then mainly searched through a handbook published by the ministry (Federal Ministry for Economic Affairs and Energy, 2019). Based on the European Commission's statement, the authors also searched for legislation that addresses the topic of regulatory sandboxes within the European Union or is planned for the future. Despite the apparent incompatibility in terms of the legal framework and overall functioning, the European Union was eventually included in the search. As a result, the authors adopted the term "(regulatory) sandbox initiative" in the naming, which more accurately reflects the nature of the included examples, since both EU-based cases are either enacted laws or formal legislative proposals. Another reason was that the German and Austrian examples were/are one-off projects supported by public funds. The publication date and the year of start of the regulatory sandbox were not set as criteria, and all of them were included.

Keywords “Regulatory sandbox” (Variable 1)	Keywords “Themes” (Variable 2)	Keywords “Countries” (Variable 3)
Regulatory sandbox (EN); Reallabore (AT; DE); Regulatorische Sandkästen (AT;	Energetics; Financial Sector; Artificial Intelligence (AI);	Österreich/Austria; Česko/Czechia; Deutschland/German

DE); Regulatorní sandbox (CZ); Regulační pískoviště (CZ); Szabályozási tesztkörnyezetek (HU); Szabályozási sandbox (HU); Piaskownice regulacyjne (PL); Regulatorný & regulačný sandbox (SK); Regulačné pieskovisko (SK); Regulativni peskovnik (SL)	Information and communication technology (ICT); Mobility; Medicine; Healthcare; Education; Law; Special Economic Zone; Public Administration; + all official language modifications	y; Magyarország/Hungary; Polska/Poland; Slovensko/Slovakia; Slovenija/Slovenia
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Table 1: Overview of keywords

The following criteria were established for inclusion in the analysis. When a criterion involved two or more conditions, an "either-or" rule was applied-meaning it was sufficient for only one of the conditions to be met.

1) Name and nature of the initiative

- a) The initiative had the term "sandbox" in its name or short descriptionⁱⁱⁱ.
- b) The initiative had the term 'Reallabor(e)' in its name or short description (for German and Austrian initiatives).
- c) The initiative had the term 'Special/strategic/free economic zone' in the name or short description, including national language modifications.
- d) The initiative had terms such as 'verification, testing, trial, or experiment' in the title or short description, including national language modifications. At the same time, the initiatives were in the field of education, and secondly, the initiatives provided an exemption from the law^{iv}.

2) Location

- a) The initiative applies to the territory of at least one of the seven countries assessed (see Table 2).

3) Theme

- a) Based on their character, the initiative falls within the areas defined in Table 3 (according to the NACE classification).

4) Typical representative (applies only to Germany and Austria^v)

- a) The initiative represents a typical representative within the theme.

5) Sufficient information

- a) The following basic information can be found on the initiative beyond the previous criteria^{vi}:
 - i) Nature of the initiative (law, project, exemption from law, etc.)
 - ii) Relationship to regulation
 - iii) Regulator
 - iv) Duration
 - v) Inclusion of all parts of the process (application, plan development, testing, evaluation)

6) Frequency

- a) Within each theme, at least three initiatives from at least two different countries will be represented to allow for comparison.

After considering all criteria, 28 initiatives entered the analysis, as shown in Table 4. No sandbox initiative was excluded due to problematic content, missing information, or other reasons.

Country/region	Sandbox initiatives	Total of Sandbox initiatives
Austria	Energie.Frei.Raum; RIAMO; FMA Sandbox; Schulversuche	4
Czechia	FinTech Sandbox; Pokusné ověřování; Special economic zones	3
Germany	SINTEG; HEAT; Medifly Hamburg; Reallabor Robotische Künstliche Intelligenz; Schulversuche; TeleClinic; ROUTINE	7
Hungary	ESZT; Regulatory Sandbox MNB; Special economic zones	3
Poland	Piaskownice regulacyjne URE; Virtual Sandbox; Special economic zones; Eksperyment pedagogiczny	4
Slovakia	Regulačný Sandbox ÚRSO; AI Sandbox; Regulačný sandbox NBS; Experimentálne overovanie	4
Slovenia	ZUNPEOVE	1
European Union	Regulatory Sandboxes by AI Act; Reform of EU pharmaceutical legislation	2

Table 2: Overview of countries and their sandbox initiatives

3. Results: An overview of the attitude

The 28 sandbox activities included in the analysis vary greatly in nature. On the one hand, there are laws in force throughout the European Union that oblige the member states to set up regulatory sandboxes, then there are initiatives that operate as one-off projects supported by public money or tax-favored special economic zones, and at the other end of the scale, there are true regulatory sandboxes that provide an exemption from the law for a limited time. The included sandbox activities (without legislation) reached a maximum of the second level of the regulation approach. There were no examples of anticipatory approaches to regulation according to Armstrong et al. (2019).

NACE classification	Sandbox initiatives	Total of Sandbox initiatives
Energetics (NACE-D)	Energie.Frei.Raum; SINTEG; ESZT; Piaskownice regulacyjne URE; Regulačný Sandbox ÚRSO; ZUNPEOVE	6
Mobility (NACE-H)	RIAMO; HEAT; Medifly Hamburg	3
Information and communication technology (NACE-K)	Reallabor Robotische Künstliche Intelligenz; AI Sandbox; Regulatory Sandboxes by AI Act	3
Financial Sector (NACE-L)	FMA Sandbox; FinTech Sandbox; Regulatory Sandbox MNB; Virtual Sandbox; Regulačný sandbox NBS	5

Public Administration (NACE-P)	Special economic zones (CZ, HU, PL)	3
Education (NACE-Q)	Schulversuche (AT, DE); Pokusné ověřování; Eksperyment pedagogiczny; Experimentálne overovanie	5
Medicine (NACE-R)	TeleClinic; ROUTINE; Reform of EU pharmaceutical legislation	3

Table 3: Overview of the NACE classification and the sandbox initiatives included

Germany, due to its high number of initiatives, stands out as the clear leader in the implementation of sandbox initiatives, closely followed by Austria. In this article, seven sandbox initiatives from Germany and four from Austria were analyzed, but these countries have much more than that, and just typical representatives were chosen. Both countries did not go through a period of communist regime^{vii}. In terms of quantity, Slovenia has the fewest sandbox initiatives – only one – but its regulatory sandbox (ZUNPEOVE) includes an experimental clause that allows for legal exemptions, something not present in any of Czechia’s three sandbox initiatives.

During the analysis, the authors also identified two forthcoming laws in Germany and Austria (Bundesministerium für Wirtschaft und Klimaschutz, 2024; Zirm, 2023). These would legislate overarching standards for Reallabore/regulatory sandboxes and experimental clauses in both countries. Germany also plans to establish a coordination and contact point or portal (to be set up online) where insights gained from the regulatory learning process will be stored. Additionally, it intends to develop a mechanism that will look for opportunities to implement regulatory sandboxes into new legislation. Beyond these measures, the initiative is expected to bring new legal opportunities. The German draft law was presented in November 2024, while the Austrian draft is still in preparation.

The following chapter is divided into paragraphs according to the focus of the sandbox initiatives by the NACE classification. There is also an overview table at the beginning to help navigate the text more easily.

Regulatory sandbox	Approach to regulation	Regulator	Max. duration (in years)	Participants
Energie. Frei. Raum	Exemption from payment of the fee	Energy Regulatory Office (E-Control)	3 years	Enterprises, research institutions, NGOs, local authorities
SINTEG	Exemption from payment of the fee	Energy Regulatory Office (BNetzA)	Strictly 4 years (project)	Consortia of enterprises, research institutions, and public administration
ESZT	Exception to the law	Energy Regulatory Office (MEKH)	2+2 (electricity) 3+3 years (gas)	A legal and natural person

Piaskownica regulacyjna URE	Exception to the law	Energy Regulatory Office (URE)	3+3 years	Legal person
Regulačný sandbox ÚRSO	In line with the regulations	Energy Regulatory Office (ÚRSO)	23 months	Group of at least two entities (at least one of them is regulated by ÚRSO and the other is a research institution)
ZUNPEOVE	Exception to the law	Ministry for Energetics (MOPE)	5+2 years	A legal and natural person
RIAMO	Exception to the law	Ministry of Mobility (BMK)	Strictly 2 years and a half	Consortium of enterprises, research, and public institutions
HEAT	Exception to the law	Federal Motor Transport Authority (KBA)	Strictly 2 years	Consortium of enterprises, research and public institutions
Medifly Hamburg	Exception to the law	Air Traffic Control Office (DFS)	Strictly 2 years	Consortium of enterprises, research and public institutions
AI Sandbox	In line with the regulations	No regulator needed	4 months	Startups, enterprises of all sizes, or university projects
Reallabor Robotische Künstliche Intelligenz	In line with the regulations	Not defined	Strictly 4 years (project)	Consortium of research institutions, schools, and public open institutions
Regulatory Sandboxes by AI Act	Exception to the law	National institutions	Not defined	EU member states
FMA Sandbox	In line with the regulations	Financial Market Authority (FMA)	2 years (incl. prep-phase)	FinTechs or supervised institutions with FinTech business models
FinTech Sandbox	In line with the regulations	Ministry for Finance (MF), Financial Market Authority (FAÚ)	It has not been announced yet.	Small and medium enterprises
Regulatory Sandbox MNB	Exception to the law	National bank (MNB)	12+6 months	FinTech companies
Virtual Sandbox	In line with the regulations	Financial Market Authority (KNF)	3+1 month	Supervised entities, permit applicants, and start-ups

Regulačný sandbox NBS	In line with the regulations	National Bank (NBS)	6+6 months	Supervised entities (both foreign or future), permit applicants, service provider
Special economic zones (PL)	Exception to the law	Ministry of Development and Technology (MRiT)	Not defined	Enterprises (mainly big international companies)
Special economic zones (HU)	Exception to the law	Could not find	Not defined	Enterprises (mainly big international companies)
Special economic zones (CZ)	Could not find	Investment Office (CzechInvest)	Not defined	Enterprises (mainly big international companies)
Pokusné ověřování	Exception to the law	Ministry of Education (MŠMT)	Not defined	Schools
Schulversuche (AT)	Exception to the law	Ministry of Education (BBWF)	Not defined	Schools
Schulversuche (NRW)	Exception to the law	Ministry of Education (MSB)	Not defined	Schools
Eksperyment pedagogiczny	Exception to the law	Regional Education Boards (Kuratorium Oświaty)	Not defined	Schools (mentored by the university or other state research institution)
Experimentálne overovanie	Exception to the law	Ministry of Education (MŠVVM)	Not defined	Schools (mentored by the university or other state research institution)
TeleClinic	Exception to the law	State Medical Association (LÄKBW)	Strictly 2 years (project)	Consortium of one private telemedicine provider, private health insurers, regulatory authorities, technology & pharmaceutical partners
ROUTINE	In line with the regulations	Telemedicine Coordination Office (KTBW)	Strictly 2 years (project)	Consortium of enterprises, research institutions, hospitals, and public institutions
Reform of EU pharmaceutical legislation	Exception to the law	European Medicines Agency (EMA)	Not defined	Research institutions

Table 4: Overview of sandbox initiatives included and basic information about them

Energy (NACE-D)

The energy sector has long been, at least in Europe, very tightly regulated. Various exemptions from regulation go back even before 2016, which can be seen as the beginning of the "sandbox era" (Gangale et al., 2023). The only country where the regulatory sandbox, due to the lack of a legal framework, has not yet been in operation for a while is Czechia, even though the Government Digitalisation Programme 2018+ (Úřad vlády České republiky, 2023) has included objectives such as "supporting the introduction of regulatory sandboxes" for several years. In 2023, an Amendment to the Energy Act containing a regulatory sandbox was even introduced, which was immediately reviewed by legal academicians (Handrlica & Blahoudková, 2023). However, the approval of the amendment was later postponed, and then the article regarding so-called pilot projects was removed without a sound explanation from the amendment (Sharp & Blahoudková, 2024). Without using words like regulatory sandbox or pilot project, there is a use case of mixing hydrogen and gas used for cooking and heating in the peripheral city of Hranice, having characteristics of a sandbox approach (Česká televize, 2024). This attitude illustrates that in Czechia, the idea of experiments and innovations is welcomed, but the legal framework is still not implemented.

Slovakia stands out at first glance, as it is the only one of the six countries with experience with sandboxes in the energy sector where the regulatory sandbox has been abolished. The "Regulatory sandbox of ÚRSO" opened in 2021 but was immediately abolished in 2024 without further explanation by the new leadership of the regulator, which came with the change of political leadership in Slovakia. This also stopped the ongoing testing (Energia.sk, 2024).

An interesting stratification brings us a look at the relationship to regulation. On the one hand, there is the former "Regulatory Sandbox of ÚRSO", which was designed purely following existing laws and thus functioned more as a consultation, i.e., an adaptive approach according to Armstrong et al. (2019). Moreover, its aim was also "to better understand the needs and benefits of the proposed innovation by the regulator" (Úrad pre reguláciu sieťových odvetví, 2023). The Hungarian ESZT, which is currently only just getting underway, but will reportedly allow almost any exemptions from the law if sufficiently well argued, appears to be quite the opposite. The regulator has also promised regulatory learning and, thus, possible regulatory change (i.e. adaptive approach) based on the experience of participants (Holló, 2023; MEKH, 2025; Pék, 2022).

Between these extremes, the Austrian Energie.Frei.Raum programme (Bundesministerium für Klimaschutz, 2025; Die Österreichische Forschungsförderungsgesellschaft, 2025) and the German SINTEG (Bundesministerium für Wirtschaft und Klimaschutz, 2025) served as a kind of preparatory phase for true or more complex regulatory sandboxes. These sandboxes functioned as subsidy programmes or projects. Entry into a project immediately meant financial support (€200 million was distributed in SINTEG, €7 million in Energie.Frei.Raum). In addition, they provided participants with further financial compensation, Energie.Frei.Raum provided an exemption from the law just for the payment of the fee, while SINTEG participants could apply for money to make up for lost profits retroactively. ZUNPEOVE (Slovenia)^{viii} and Piaskownica regulacyjna URE (Poland)^{ix} are more aligned with the Hungarian model, as they provide innovators with a genuine exemption from the law (Sienkiewicz, 2023).

Regulatory sandboxes in the energy sector typically pursue three main objectives, which often overlap, with individual initiatives frequently addressing more than one goal. The first objective is to adapt to the dynamic development of the sector, followed by the opportunity to meet climate goals, and finally, the third goal is aimed at ensuring competitiveness and national energy security. The most frequently mentioned topics in the dynamic development of the sector are dynamic network charges, integration of renewable energy technologies, energy storage, and innovative business models. A significant focus on renewables is found in projects from Germany, Austria, and Slovenia.

SINTEG developed the concept of utilizing 100% use of electricity generated from renewable sources in five model regions. Within the framework of this project, extensive practical tests for the energy supply of the future were carried out in cooperation among companies, research institutions, and local authorities. Energie.Frei.Raum builds on the main objectives of the national energy strategy #mission2030 as well as the National Energy and Climate Plan. The Slovenian ZUNPEOVE Act says: *"For the purpose of testing innovative energy technologies (...) the government may (...) grant exemptions from specific provisions of the legislation in the fields of energy, spatial planning, construction, mining, environmental protection, nature conservation, water management, protection of cultural heritage and installation, operation and connection of electricity generation facilities that make it impossible or difficult to implement the project"*. It can, therefore, be seen as a means for the siting of renewable energy generation facilities. In this respect, mention should be made of the joint Slovenian-Austrian Interreg project H2GreenFuture, which, as the name suggests, is researching 'green' hydrogen technologies (National Institute of Chemistry, 2025).

All sandbox initiatives generally follow a course similar to that described in the literature. There are only two minor deviations. The first is Poland, where the President of the Energy Regulatory Office (URE) has a strong authority in the whole process and has a major say in the approval process. The President can also request an independent expert opinion that all the conditions for acceptance are met. This opinion must be secured and subsequently paid for by the participant. In Slovenia, on the other hand, the relevant ministry must post the draft initiative on an official notice board for a month, and there is an opportunity for public comment on the draft.

Due to the short time since the launch and the relatively long period during which testing can be carried out, no significant feedback is yet available. Some important points (e.g., too much bureaucracy or lack of interest from smaller players) have emerged from the already completed SINTEG and Energie.Frei.Raum programmes on the future setting of true regulatory sandboxes.

Mobility (NACE-H)

Mobility, especially autonomous mobility, has recently experienced an unusual boom. Two key examples of autonomous mobility are also mirrored in the initiatives presented in this chapter: regulatory sandboxes in the drone (Medifly Hamburg) and autonomous vehicle (HEAT and RIAMO) sectors. These projects have flexibly changed and may again change the relevant regulations in the future (Almenar-Muñoz, 2024). There have been and are many more projects in both sectors, so complex pressures have caused changes in regulations at different levels. See more in the handbook of the German Federal Ministry for Economic Affairs and Energy (Federal Ministry for Economic

Affairs and Energy, 2019). At the same time, they are all part of a larger system that is continuously working to develop innovations in these areas. They are also all linked by the fact that they were subsidized with public money and involved a wide range of public and private institutions; in the case of Medifly Hamburg, close cooperation with the regulator (Federal Aviation Authority) was also important.

HEAT featured a single public transport bus line in Hamburg's smart district HafenCity, which is served by an autonomous microbus with a maximum speed of 25 km/h (Hochbahn, 2025). The RIAMO project is still ongoing and operates as a demand-responsive public transport, which makes travel more efficient and faster as only those stops where someone intends to get on or off are served (Digitrans, 2025). Testing takes place in real conditions, with real passengers, among whom satisfaction and user experience surveys are regularly conducted. These aim, among other things, to increase acceptance of autonomous transport. In both cases, despite the full automation and advanced regulatory relaxation, staff was/is present and can start driving at a moment's notice. The objectives of both projects included both the development of the technical solution itself but also the development and evaluation of the interactions of the whole sustainable mobility planning process. Moreover, RIAMO is part of the so-called Digitrans region, where there is also the possibility to test other automated machines in the initial stages of development on the test track (Business Upper Austria, 2021).

The use of drones is less widespread compared to automated road transport, but many different projects have already been developed here as well. One of these is Medifly Hamburg, which focuses on the rapid transport of medical material as well as various blood or tissue samples (Medifly, 2025). For its innovation, the project was awarded the "Innovation Prize Regulatory Sandbox" in 2020. On the regulatory side, the greatest challenge in the drone industry lies in operating within corridors over built-up areas, which requires exemptions – these are granted, for example, to life-saving initiatives (Federal Ministry for Economic Affairs and Energy, 2019).

ICT (NACE-K)

Information and communication technologies (ICT), and in particular artificial intelligence (AI), represent another illustrative example of a modern, innovative field where regulation remains unsettled, offering significant potential for regulatory learning and for adapting existing laws or developing entirely new legislation. In this chapter, we look at three quite different initiatives. Initially, the Slovak AI Sandbox (Inovačné centrum Košického kraja, 2025), the German Reallabor Robotische Künstliche Intelligenz (Karlsruher Institut für Technologie, 2025) and the EU AI Act (EU Artificial Intelligence Act, 2024) were joined by the Polish Blockchain Sandbox, but during the writing of the article, it closed its website, and no further information could be found.

Each initiative is quite different from the others. At first glance, the distinctive nature of the AI Act is immediately apparent. It is the first EU law that deals with AI and sets some framework regulation for it. It is also the first law to introduce regulatory sandboxes (Chapter VI, Art. 57). These should be in place in EU Member States by August 2026 at the latest; none has been introduced in the countries we have studied so far. Through the AI Act, the European Commission aims to promote easier and faster deployment of innovative AI-based solutions in European markets, provide greater regulatory certainty, promote peer-to-peer sharing, increase European competitiveness, and contribute to regulatory learning for individual countries and their regulatory authorities (EU Artificial

Intelligence Act, 2025). It is worth noting that the final AI Act was preceded by a Spanish regulatory sandbox testing the regulation in question (European Commission, 2022).

The other two examples are compliant projects, as actual regulatory sandboxes in the field of AI have not yet been implemented in the selected countries. The more prominent of the two projects is the German Reallabor Robotische Künstliche Intelligenz, which, however, more closely resembles a living lab than a regulatory sandbox. Its goal is more general and aims at exchanging experiences and knowledge between science and society through the use of humanoid robots with implemented AI, and their interaction with humans. During the four-year duration of the project, many experiments have been carried out, e.g., in a school, kindergarten, museum, or hospital, as well as activities such as workshops, festivals, and seminars. These activities were aimed, among other things, at demythologizing AI because the fears arising from misunderstanding and ignorance cannot be overcome even by a regulatory sandbox. The insights gained, including the needs of stakeholders (e.g., patients in the hospital or museum visitors), were processed and used to further develop robots as well as regulatory learning. However, no exemption from the current regulation was granted. The entire project was funded by the Ministry for Science, Research and Arts of the Federal Republic of Baden-Württemberg (Karlsruher Institut für Technologie, 2025).

The second project was limited to the territory of the Košice region in Slovakia due to the administrator, which was a regional innovation center. The AI Sandbox aimed to test a private innovative solution in practice using the infrastructure of the Košice Region, with the potential to benefit this eastern Slovak region, which has long struggled with brain drain. Furthermore, the aim was to digitalize public administration and find barriers to the easier implementation of AI. In this hackathon of sorts, the selected participants were not only provided with a team of experts drawn from the partner organizations for testing but also with the opportunity to present their solutions at the prominent innovation platform Innovation Zurich. After a successful inaugural edition, when two projects (a tourism app using AI to generate personalized content and HR software) were selected for real-world testing, the initiative will continue in 2025 (Inovačné centrum Košického kraja, 2025).

Although the ICT sector, including AI, has so far been largely overlooked by regulatory authorities, we can expect to see many regulatory sandboxes emerging in this sector in the future – especially since all EU Member States will be required to establish them.

Financial Sector (NACE-L)

The origins of regulatory sandboxes are linked to the highly regulated financial technology (or FinTech) sector. Not long after the first regulatory sandbox was launched in the UK in 2016, FinTech sandboxes spread around the world (Jeník & Duff, 2020). The European Insurance and Occupational Pensions Authority even claims that by 2023, a true regulatory sandbox or "FinTech innovation hub" (not providing an exemption from the law) was operating in all countries of the European Union and the European Economic Area (European Insurance and Occupational Pensions Authority, 2023).

We selected five initiatives from the countries we assessed, including four projects that resemble FinTech innovation hubs, as they operate in full compliance with applicable legislation: the Austrian FMA Sandbox, the Czech FinTech Sandbox, the Polish Virtual Sandbox, and the Slovak Regulatory Sandbox of the NBS (Austrian Financial Market

Authority, 2025; FinTech Sandbox, 2025; Komisja nadzoru finansowego, 2025; Národná banka Slovenska, 2024). The Hungarian Regulatory Sandbox MNB is the only one that provides exemptions from the law, e.g., exemptions from detailed rules for remote customer identification, from some elements of the debt limitation rules, or from some payment rules (Magyar Nemzeti Bank, 2025). A true regulatory sandbox was also launched in Poland, even before the Virtual Sandbox, but progress on it subsequently stalled, and little information is available regarding its continuation. As a result, it was not included in our comparison. Instead, in February 2023, the UKNF (the regulator), in collaboration with the National Securities Depository, launched the Sandbox DLT (blockchain), which complements the Virtual Sandbox (Komisja nadzoru finansowego, 2023). Due to this complementarity, only the “original” Virtual Sandbox was chosen.

It turns out that Czechia is the least prepared for the “era of regulatory sandboxes” among selected European countries, as even its FinTech Sandbox has only generalities, but still lacks an implementation document with rules which should be announced later in 2025 (FinTech Sandbox, 2025). On the other hand, the analysis of the FinTech environment in Czechia done by OECD recommended considering the implementation of the experimental clause if the initial stage of complying with the regulation is successful (OECD, 2023). After two years of preparation, the FinTech Sandbox was supposed to be launched in 2020, but due to the then-pandemic of the COVID-19, the project was canceled and was not resumed until several years later (Zelenka, 2024). Regulatory sandboxes then occurred in the National Recovery Plan.

Most of the objectives of FinTech regulatory sandboxes remain similar - enabling testing of innovative solutions (Virtual Sandbox, Regulatory Sandbox NBS), beneficial and more efficient solutions for clients, i.e. citizens of the country (Regulatory Sandbox MNB), simplifying the implementation of FinTech or Distributed Ledger Technology (DLT) solutions (FinTech Sandbox), the competitiveness of the country and efforts to attract interesting companies in this sector (FinTech Sandbox) or better understanding of the needs of innovative companies by the state regulator (FMA Sandbox, FinTech Sandbox). A goal that is typical for the FinTech sector is to obtain a license to operate in this sector. However, from our selection, this only applies to the FMA Sandbox. The Austrians claim on their website that it is better to help these start-ups than to simplify the conditions for them, e.g., in a true regulatory sandbox (Austrian Financial Market Authority, 2025).

We find some differences in the process. A general specificity of this sector is the presence of a government support organization or a FinTech focal point, which all countries have in different forms. For all countries except Czechia, the sandbox is a natural culmination or higher level of this hub^x, which provides various advisory services or networking to businesses. Czechia has the Czech Fintech Association, a loose association within the commercial sector. Similar activities such as mentoring, networking, workshops, and general support for business development in Czechia will be provided by the FinTech Sandbox. It has CZK 150 million from the National Recovery Plan ready for this (FinTech Sandbox, 2025).

At first glance, it is somewhat surprising that all five initiatives include a testing phase, although, for four of them, the innovation must comply with existing regulations. Despite this requirement, the innovations can still be tested similarly. In Poland, testing takes place in a special artificial test environment that allows the simulation of selected

functions and services offered on the financial market. Also, thanks to this, the duration of the testing is reduced to three months with the possibility of extending it by one month, which is much shorter compared to other sandboxes.

To join the Hungarian Regulatory Sandbox MNB, an initial consultation is required, after which an application form and a testing plan are developed together with the regulator's representatives. Austria also has a more complicated admission process. In the case of the FMA Sandbox, the Regulatory Sandbox Advisory Board, which is established by the relevant ministry, comments on applications. This board is composed of representatives from the government (national banks, ministries, etc.), academia, and the private sector (Bundesministerium für Finanzen, 2023). While the regulator, FMA, must take the board's opinion into account, it retains the authority to make the final decision.

Feedback on the regulatory sandbox process is not available for any of the initiatives, even though, for example, the Regulatory Sandbox MNB has been in place for more than six years. Only the Slovak regulator has announced the name and focus of the company that first entered the testing phase in December 2024 (Národná banka Slovenska, 2024).

Public Administration (NACE-P)

In this article, the term Public Administration broadly encompasses the topic of special economic zones (SEZs), which represent a form of intangible innovation. It becomes evident that even in regional development, there are barriers to improving the quality of life in less developed regions. While education and the availability of public services play a crucial role, the economic prosperity of a region is equally important for its development. However, such efforts need to be promoted in the various disadvantaged regions. One of the tools is a special economic zone, which creates different tax and other conditions that favour businesses within the zone. Among the countries studied, these are present in Poland, Czechia, and Hungary. However, since 2020 Hungary's framework has been undergoing a continuous, inter alia, politically motivated reform (Balázs, 2024; Hungary Today, 2021; U.S. Department of State, 2024). Therefore, for the purpose of comparison, we will assess Hungary in its stabilized state as of 2020.

There are approximately ten strategic industrial zones in Czechia, which are covered by investment incentives provided by the Investment Incentives Act^{xi}. Since 2015, three of these areas have functioned as special economic zones, offering income tax rebates or other tax incentives (Česká televize, 2015; Holešov Industrial Zone, 2025). Currently, efforts are also underway in the peripheral Karlovy Vary Region to create a completely new type of economic zone, which would be linked to the upcoming law addressing the issue of regulatory sandboxes (Karchňáková, 2024). The aim of Czech special economic zones in the 1990s was to restructure industry after 40 years of communist central planning and also to reduce unemployment in specific regions. Today, it is more about supporting large strategic partners to bring jobs for more skilled employees to less developed regions suffering from brain drain. As in Poland and Hungary, all governance is transferred to a public body - whether a municipality, regional authority, or central government authority.

Internationally, Poland offers several successful examples. Its special economic zones, launched in the 1990s, provided a wide range of tax benefits and incentives for the creation of one job. Unlike most other countries, where support is rather subdued, 14 large regional special economic zones were active until 2018. Then, new provisions came into

force. They allow the exemption from income taxes throughout the country (not only in the areas covered by SEZs). However, this did not mean the liquidation of the zones, which are to operate until 31 December 2026 (GetSix, 2025). Hungary has followed the path of a large number of small zones, which always cover the whole municipality. However, the objective was slightly different. While Poland wanted to accelerate the economic development of the poorest regions, Hungary focused more on the unemployment indicator. In addition to various incentives, the zones in both countries also offered property tax, health and social insurance, or income tax exemptions (Jarosiński & Maśloch, 2016; Næss-Schmidt et al., 2020).

Education (NACE-Q)

Education is a field in which continuous innovation is essential to prepare pupils, students, and the education system in general for today's rapidly changing world. Innovation in this context is not limited to the “technological”; it can also be “social”, “cultural”, or “eco” (Edwards-Schachter, 2018). While none of the initiatives included in this area are formally labeled as regulatory sandboxes, they all function as genuine examples of such frameworks. Successful pilot projects are often incorporated into legislation or reflected in other policy documents.

All initiatives are similar – Czech “pokusné ověřování^{xiii}” (experimental verification), Slovak “experimentálne overovanie^{xiii}” (experimental verification), Polish “eksperyment pedagogiczny^{xiv}” (pedagogical experiment), and “Schulversuche” (school trials) operating in the Federal Republic of Nordrhein-Westfalen^{xv} and throughout Austria^{xvi}. They aim to verify the functionality of school innovations in the form of innovative forms, methods, educational content, educational organization, or management of school facilities through practical testing. In Czechia, combined teaching, i.e., face-to-face attendance with online learning, was recently tested in this way (Národní pedagogický institut České republiky, 2025); in Poland, the adaptation of teaching for co-education for children with some disabilities was tested (Kuratorium Oświaty w Szczecinie, 2025); and in Nordrhein-Westfalen, modifications to the system of teaching engineering towards technical and logical thinking and problem-solving were tested (Ministerium für Schule und Bildung des Landes Nordrhein-Westfalen, 2025a). In the German federal system, the law also permits the establishment of experimental schools. For example, five such schools are currently piloting an extension of common primary education to 10 years, along with a shortening of secondary education (Ministerium für Schule und Bildung des Landes Nordrhein-Westfalen, 2025b).

In all the countries studied, the history of testing in education spans more than a decade, meaning the concept predates the notion of the regulatory sandbox. In Czechoslovakia – under the former political system of what are now Czechia and Slovakia – experimental verification in education was officially introduced by education laws in 1978. This framework remains in effect today, with the only change being that Slovakia now uses a slightly modified term^{xvii}.

The Ministry of Education has traditionally played a fundamental role in initiating and approving educational experiments, though its influence now varies by country. In Austria, the current rule is that all Schulversuche have to be completed by August 2027, with further developments to be decided in 2026. The Austrian education system is very decentralized, and schools have significant autonomy, which allows most testing to be flexible, and only a small fraction is directly evaluated by the Ministry. Poland is also

moving towards decentralization – starting in 2025, authority over educational testing will shift to regional education boards (kuratorium oświaty) in the individual voivodeships (Kuratorium Oświaty w Rzeszowie, 2025). In both Poland and Slovakia, individual testing is mentored by research institutions, such as universities or institutes of the Academy of Sciences. By contrast, in Czechia, the Ministry of Education has a crucial role as the sole initiator and promoter of testing. The school itself cannot apply for experimental verification. Participation in testing is relatively broad in Czechia, while in Slovakia, it tends to be limited to a small number of schools, often just one.

Generally, it can be said that the testing of innovations in education is well-established and functional, and regulations or teaching organizations are changed regularly in the countries mentioned. Education is also an exemplary sector with “non-technical” innovations.

Medicine and Healthcare (NACE-R)

In healthcare, regulatory sandboxes can serve two main purposes. The first is to enable faster and less bureaucratically burdensome certification of innovative medical devices or pharmaceuticals (Guerraud, 2024; Leckenby et al., 2021) – a need also emphasized by stakeholders in the Czech spa industry (Bečvář, 2024). The second use involves the integration of modern technologies such as telemedicine or artificial intelligence. Examples include the German projects TeleClinic (Bundesministerium für Wirtschaft und Energie, 2017) and ROUTINE (Reallabor ROUTINE, 2025), both discussed in this chapter. While ROUTINE does not take the form of a classical regulatory sandbox or a specific project, it represents a forward-looking proposal for a future reform of EU pharmaceutical legislation. This proposed reform envisions, among other things, the introduction of regulatory sandboxes (European Commission, 2023a).

The proposal to reform EU pharmaceutical legislation is understandably quite different. Along with the AI Act, this proposal is one of the first ones to introduce the possibility of regulatory sandboxes into EU legislation, providing relief from existing regulations. This should lead to greater flexibility and less bureaucratic burden in the testing and introduction of new medicines, to increase drug self-sufficiency and hence EU competitiveness. The individual regulatory sandboxes would be approved by the European Commission, with the European Medicines Agency (regulatory authority) handling their administration, but with final responsibility resting with national institutions (European Commission, 2023a).

The older of the two German projects is TeleClinic, which operated in Baden-Württemberg from 2017 to 2019, although preparations for the provider platform had begun at least two years earlier. The project aimed to test telemedicine services in practice and to answer several key questions: What type of services can be effectively delivered through telemedicine? How do patients and doctors perceive the user experience and overall satisfaction? How should responsibilities be divided between general practitioners, who normally care for the patient, and the doctors providing online consultations? And finally, what barriers, regulatory or otherwise, hinder the development of this sector? The project, subsidized by the national ministry, initially had to navigate data protection regulations and healthcare laws – issues that were ultimately resolved through a legal exemption, as well as health laws, which were resolved by an exemption from the law. In the end, the project proved highly beneficial – patients, doctors, health insurance companies, and the state expressed satisfaction. The initiative

provided valuable insights that contributed to the further development of telemedicine, including adjustments to existing legislation. The success of the project was also helped by the broad consortium of involved entities from the private and public sectors, as shown in Table 4 (Bundesministerium für Wirtschaft und Energie, 2017).

A second project also took place in the same federal state, this time initiated by the local government. Again, it was a broad consortium, which was under the auspices of the Research Centre for Information Technology (Forschungszentrum Informatik), and it also involved private entities, hospitals, and other research institutions. The aim was to create an experimental environment for testing various AI-supported methods in healthcare and nursing, taking the form of various mobile apps, but also using AI to analyze intensive care data and thus enable better therapy. Operating between 2020 and 2024, the project stood on three pillars. The first focused on use cases and user journey, i.e., real-world applications of AI and the associated identification of the needs of future users of the regulatory sandbox. The second leg centered on prototyping a future true regulatory sandbox (in this case, everything was in line with current regulation) and recommendations for policymakers and regulatory authorities (Forschungszentrum Informatik, 2025; Reallabor ROUTINE, 2025). The third pillar emphasized outreach – AI skills and acceptance.

Nonetheless, the field of medicine has yet to fully harness the potential of regulatory sandboxes. One promising area is the spa industry and its long-overlooked research sector, which is beginning to gain renewed attention – particularly in Czechia.

4. Discussion and conclusion

Contemporary literature predominantly addresses the topic of regulatory sandboxes from a descriptive perspective, typically focusing on the analysis of a specific sandbox initiative (e.g., Handrlica & Blahoudková, 2023), a particular industry (e.g., Veseli et al., 2021), cross-country comparisons of sandboxes within the same sector (e.g., Everhart, 2020). This article aims to offer a listing of relevant sandbox initiatives, and it compares the general approach of the countries to the issue of regulatory sandboxes. We also aim to deepen the knowledge delivered by Czech authors (Handrlica & Blahoudková, 2023; Sharp & Blahoudková, 2024; Tomčiak & Škrabka, 2024).

The countries included in this comparison are now members of the EU and have to comply with its legislation, but at the same time, they have to deal with their own economic and social problems. This is also reflected in their legal culture or their relationship to regulation. New trends such as digitalization, green technologies, and financial innovation, but also the instability caused by the wars in Ukraine and the Middle East, are all coming into play. New innovative solutions are needed to capture and exploit trends' potential while minimizing their risks, e.g., for certain marginalized regions or groups, and be resilient to change (Huang et al., 2024). Even though each country approaches them differently, regulatory sandboxes have become a key tool to foster innovation while ensuring compliance with evolving legal frameworks (Nahtigal, 2022). Institutional innovations such as regulatory sandboxes can help further economic and social development through inclusive and tailored measures (Unger, 2019). These actions need to be flexible and decentralized to help meet local, often very different, economic and other needs, but centrally coordinated to collectively achieve global goals (Nahtigal, 2022).

Given that the primary aim of this article was to conduct a comparative analysis, Germany can be identified as the leader among the seven countries examined, followed by Austria. This claim is primarily supported by the number of implemented regulatory sandboxes, respectively Reallabore. Seven, respectively, four initiatives entered the analysis in the context of this article, but many others were not even analyzed, and only the most typical representatives were selected. This fact is confirmed by a new quantitative study that ranked Germany second in Europe, just behind the UK (Markellos et al., 2024). The success of both countries is also confirmed by the fact that these countries are the first in the pursuit of enacting the legislation creating a clear framework for regulatory sandboxes (Bundesministerium für Wirtschaft und Klimaschutz, 2024; Zirm, 2023). The initiatives also mostly met the definition of a regulatory sandbox, i.e., an environment in which innovations that otherwise do not comply with existing regulations can be tested under clear conditions. OECD countries, i.e., richer and more developed countries (the best predictor was the World Bank Competitiveness score), are up to 4.5 times more likely to adopt a regulatory sandbox than non-OECD countries (Markellos et al., 2024). The developed nature of both countries and their economies is largely due to the political developments in the second half of the 20th century, when both countries, unlike the other examined ones, were democratic, open, and capitalist.

Our research indicates that Slovenia and Czechia are least supportive of regulatory sandboxes among the countries analyzed. Although Czechia has launched three initiatives, none qualifies as a true regulatory sandbox, in contrast to Slovenia, which has implemented one genuine initiative. As the smallest country in the comparison (with only 2.1 million inhabitants), Slovenia illustrates a broader trend: smaller countries may face disadvantages in implementing regulatory sandboxes, as they lack regulatory capacity, financial resources, staff, expertise, and tools (Martin & Balestra, 2019). A study of three very similar Baltic countries suggests that the main reasons for not/implementing a regulatory sandbox in FinTech are mainly the efforts of policy entrepreneurs, mechanisms of policy diffusion, and perceived levels of regulatory capacity (Raudla et al., 2024). However, the authors do not forget to mention the importance of contextual and country-specific factors, such as recent political scandals or the experience of firms dealing with, in a way, experimental crypto-currencies. The type of legal culture is also a factor influencing the non/adoption of regulatory sandboxes; common law jurisdictions are more likely to implement regulatory sandboxes than civil law countries (Markellos et al., 2024). General overregulation also constitutes a major obstacle. Among other things, this overregulation is mentioned by Mario Draghi in his recently published report on European competitiveness and the future (Draghi, 2024). In the comparison of the countries analyzed, Poland, Slovakia, and Hungary form a middle group – countries for which true regulatory sandboxes are not a novelty. Slovakia, however, has abolished its own regulatory sandbox, unlike the other countries. Separate from this comparison are two legal sandbox initiatives launched by the EU and the European Commission, which differ significantly in their nature and scope.

Most The majority of sandbox initiatives (6 out of 28) are concentrated in the financial sector. While the dominance is less pronounced in our analysis, it aligns with global trends – according to a study (Markellos et al., 2024) up to two-thirds of the 199 regulatory sandboxes around the world operate within the financial sector. On the other hand, sandbox initiatives in the energy sector were included in this study, with 5 out of 28 (18%), while they account for less than 10% in the global survey. There may be several

reasons why this is the case. First and foremost, these are sectors that have been much talked about and in high demand recently, both by governments and private enterprises. FinTech is a relatively new and dynamic sector, with modern technologies such as blockchain and AI entering it, and so states are racing to attract interesting investors, as exemplified by the regulatory sandbox in Lithuania (Raudla et al., 2024). It is also empirically verified that participation in sandboxes marks a significant increase in capital and venture investments (Cornelli et al., 2024; Goo & Heo, 2020). In the European energy sector, the energy transition and increasing the share of energy coming from renewable sources, and the associated amount of innovation in this direction, are crucial (Aydn & Yardımcı, 2024; Beckstedde et al., 2023). At the same time, the financial sector is one of the most heavily regulated and centralized sector in Europe, which may pose certain challenges for future development (Correa et al., 2021; van der Waal et al., 2020). The energy market has also recently been strongly affected by the war in Ukraine (Xing et al., 2023). This fact explains why the global representation is smaller compared to the European one. In contrast to the global average, where education was not included due to a different methodology, five sandbox initiatives of this type were also analyzed in this paper. Four or three initiatives represented other sectors.

In a global comparison, affluent states and regions such as Europe hold a strong position in the development of regulatory sandboxes (Leckenby et al., 2021), largely due to the European Union's active support and the fact that the concept originated in the United Kingdom. Within Europe, there is a west-east gradient, meaning that Western countries are more likely to adopt a regulatory sandbox than Central and Eastern European countries. Our analysis provides basic confirmation of this. Although not all countries have fully implemented regulatory sandboxes, awareness and understanding of this particular regulatory environment is evident in all countries. Each country examined has at least one legal example where an exemption from regulation can be granted if certain conditions are met (e.g., a pedagogical experiment instead of a regulatory sandbox). Other sandbox activities do not allow an exemption but are, e.g., a preliminary experiment to get a true regulatory sandbox running.

The second aim of this paper was to provide a comprehensive overview of the development trajectory of the Czech approach to regulatory sandboxes. While the term regulatory sandbox may be relatively new, the underlying concept is not unfamiliar in the Czech context. Since the 1970s, the Czech Education Act has included provisions for so-called experimental verification, which enables the testing of pedagogical or organizational innovations. Examples include hybrid teaching models or the introduction of an accompanying teacher role. Since 2015, various references (such as the Government Digitalisation Programme 2018+) to the need to introduce this experimental approach have appeared in strategic documents, often under the Ministry of Industry and Trade. In 2023, an amendment to the Energy Act was introduced to put the planned regulatory sandbox into effect. However, this part of the amendment was removed without a sound explanation (Handrlica & Blahoudková, 2023). In 2024, two articles were published dealing with the implementation of the regulatory sandbox concept into Czech law. The first article analyzed the Czech legal environment and concluded that in the current situation, the regulator cannot decide to establish a regulatory sandbox of its own volition (Sharp & Blahoudková, 2024). The second one focused directly on the FinTech area and discussed the specific contours of a possible future regulatory sandbox (Tomčiak & Škrabka, 2024). The FinTech Sandbox has been operating in Czechia since 2024. The initial exploratory phase is gradually transitioning into practical

implementation (FinTech Sandbox, 2025). As a result, a domestic knowledge base is being established, the insights of which will provide valuable support for further development and effective implementation. Currently, an amendment to the Act on Support of Science and Research from Public Funds is in the Parliament of the Czech Republic, which includes the definition and legal anchoring of regulatory sandboxes. Even without the legal framework, the use cases having characteristics of a sandbox are working in Czechia, e.g., mixing the hydrogen with gas for heating and cooking in the city of Hranice (Česká televize, 2024). And this attitude could be called “the Czech way”.

Based on the findings of this article, we propose several recommendations. First of all, it is the adoption of the mentioned law that will anchor regulatory sandboxes in Czech legislation. However, unlike Tomčiak & Škrabka (2024), we conclude that the regulatory framework should be broad enough to cover not only areas with technological (tangible) innovations (FinTech, energy, or transport) but also to allow testing, e.g., social innovations or various measures for regional development and generally for the public sector. We also see potential in the Czech environment for regulatory sandboxes in the medicine and spa industry, where artificial intelligence, virtual reality, and telemedicine are already being used (Hloušková et al., 2025). We recommend moving in this direction also because research in the spa industry is gaining momentum and it represents an area in which Czechia holds a strong and historically rooted position. Once the law is passed, it is necessary to start preparing implementation documents at the level of the individual ministries that want to implement the regulatory sandboxes. These documents will set out the internal mechanisms of the ministries and the formal process of who is allowed to apply for participation in the sandbox, and how the process of negotiation, approval, and implementation is carried out. The very first law to introduce a regulatory sandbox is the aforementioned Energy Act. Our recommendation is based on the example of Germany, where a white paper was first prepared to define the framework and priorities, followed by the adoption of a specialized law.

This article aimed to compare the approaches of selected European countries to regulatory sandboxes, with a particular focus on Czechia. In the case of Czechia, however, we can talk about a superficial description of events and analysis of documents. The reason behind the country’s lag in this area, especially in comparison to Western and neighboring countries, remains unclear. In order to gain a deeper insight, a qualitative study involving interviews with individual stakeholders is recommended. Furthermore, we highlight the potential of regulatory sandboxes in the medicine and spa industries, which merit further exploration. Also, the Czech FinTech Sandbox and its practical impact remain an exciting project to focus on, and we see potential to investigate it further in the next stage of research, including mixed-methods approaches.

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ⁱ Poland, Czechoslovakia, which was further divided into Czechia and Slovakia in the 1990s, and Hungary were autonomous socialist republics in the second half of the 20th century, but they belonged to the sphere of influence of the Soviet Union. Slovenia was part of Yugoslavia, which also included the now-independent republics of Croatia, Bosnia and Herzegovina, Serbia, Kosovo, Montenegro, and North Macedonia. Yugoslavia retained a greater degree of independence and thus did not become part of the so-called Eastern Bloc. Today's Germany was divided into the so-called East (German Democratic Republic) and West (Federal Republic of Germany), with the West being pro-Western, democratic, and capitalist in orientation, while East Germany was ruled by a socialist (though democratic in name) regime linked to the Soviet Union. Austria, like the Federal Republic of Germany, was pro-Western in orientation. Since the 1990s, all countries have been free, but they differ greatly not only in their economic development as measured by GDP per capita – Austria \$52,004 x Poland \$17,928 (Worldometer, 2024), but also in their HDI – Germany 0.95 vs. Hungary 0.85 (United Nations Development Programme, 2022).

ⁱⁱ Zákon č. 561/2004 Sb. o předškolním, základním, středním, vyšším odborném a jiném vzdělávání (školský zákon) [Act No. 561/2004 Coll., Education Act], as amended.

ⁱⁱⁱ In the end, the word "regulatory" was not taken into account, as this would have prevented those initiatives that provide an exemption from the law but are named only as a "sandbox" from making the final cut.

^{iv} In the field of education, it was important to compare very similar initiatives in nature, as omitting any criterion would have multiplied the number of initiatives, and it would not have been possible to include all of them in the analysis.

^v In Austria and especially Germany, there are more sandbox initiatives than were included in the analysis, therefore, only typical representatives were included under the themes of Energetics, Mobility, ICT, and Medicine.

^{vi} Status as of 1 March 2025.

^{vii} Except for so-called East Germany, which only accounts for about 1/5 of the population.

^{viii} Zákon o uvajanju naprav za proizvodnjo električne energije iz obnovljivih virov energije - ZUNPEOVE (Uradni list RS, št. 78/23 z dne 19. 7. 2023) [Act No. 78/2023 Coll. on the Introduction of Equipment for the Production of Electricity from Renewable Sources], as amended.

^{ix} Prawo Energetyczne Dz. U. 1997 Nr 54 poz. 348 [Energy Law No. 54, item 348/1997 Coll.], as amended.

^x Countries use different terminology, but generally rely on combinations of terms such as "innovation hub" and "point of contact".

^{xi} Zákon č. 72/2000 Sb., o investičních pobídkách a o změně některých zákonů (Zákon o investičních pobídkách) [Investment Incentives Act No. 72/2000 Coll.], as amended.

^{xii} Zákon č. 561/2004 Sb. o předškolním, základním, středním, vyšším odborném a jiném vzdělávání (školský zákon) [Education Act No. 561/2004 Coll.], as amended.

^{xiii} Zákon č. 245/2008 Z. z. o výchove a vzdelávaní (školský zákon) [Education Act No. 245/2008 Coll.], as amended.

^{xiv} Prawo Oświatowe Dz. U. 2017 poz. 59 [Education Act Item 59/2017 Coll.], as amended.

^{xv} Each federal state passes its own laws, so education is not tightly centralised. (Schulgesetz Für Das Land Nordrhein-Westfalen (Schulgesetz NRW - SchulG) [Education Act for the State of North Rhine-Westphalia], as amended.

^{xvi} Rundschreiben Nr. 21/2021, Bundesministerium für Bildung [Circular of Ministry of Education No. 21/2021].

^{xvii} Zákon č. 63/1978 Sb. o opatřeních v soustavě základních a středních škol [Act No. 72/2000 Coll. on Measures in the System of Primary and Secondary Schools], as amended.