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Integrating Anticipatory Governance and Evidence-Informed Policymaking in Frameworks for Governance in European States

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Abstract

Anticipatory governance is regarded as an important governance approach that promotes strategic foresight and future-oriented policymaking under conditions of uncertainty. Following recent crises, European states continue to face challenges in bridging the gap between evidence and policymaking and in translating scientific knowledge into policy responses. This highlights the need to connect the anticipatory governance approach with evidence-informed policymaking to support more proactive, systematic, and informed policy processes. The aim of this research is to identify the strategic, legal, and institutional elements of governance frameworks that support the integration of anticipatory governance and evidence-informed policymaking in European states. The study compares Estonia, Lithuania, and Spain, three countries that have recently established dedicated science-for-policy structures, including science and innovation adviser roles within governmental institutions. A directed qualitative content analysis of selected strategic documents, legal acts, and institutional policy documents was conducted using deductively derived analytical categories. This was complemented by a quantitative keyword frequency analysis of selected studies of national science-for-policy ecosystems. The findings reveal both shared and country-specific elements that may support strategic foresight, evidence use, knowledge brokerage, stakeholder engagement, and collaboration between governmental and scientific communities. The study contributes a comparative analytical framework for examining how anticipatory governance and evidence-informed policymaking may be institutionally connected across different national policy ecosystems.

Keywords: anticipatory governance; evidence-informed policymaking; science-for-policy; Estonia; Lithuania; Spain



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1. Introduction

The enduring challenge of bridging the “evidence-policy gap” elucidates the difficulties faced by scientists in translating their findings into actionable policy changes (Cairney & Oliver, 2017). Despite a general commitment among decision-makers to “evidence-informed” policymaking, this ideal often proves elusive, frequently being influenced by cognitive shortcuts and the prioritisation of subjective judgement over objective scientific evidence (Cairney, 2022). Such inconsistencies necessitate an approach that encompasses both empirical evidence and the socio-political contexts within which policies are formulated (Head, 2013). The concept of anticipatory governance advocates for

the development of strategic foresight and future-oriented policymaking in addressing emerging challenges. Anticipatory governance enables a proactive stance in policymaking by fostering strategic foresight and the systematic consideration of potential future developments, which are crucial for managing uncertainties (Guston, 2014; Umbach, 2024; Morovat et al., 2026). When effectively institutionalised, this governance approach can guide decision-makers to act pre-emptively in light of potential future scenarios and to use evidence systematically. The anticipatory governance approach not only encourages the use of scientific evidence but also supports the anticipation of and proactive response to evolving societal needs. This dual emphasis on evidence and foresight is critical for fostering sustainable and effective governance in the face of complex and dynamic challenges and uncertainties. However, embedding the anticipatory governance approach and evidence-informed policymaking within coherent governance frameworks remains challenging.

Several European countries are institutionalising the science-for-policy approach by establishing dedicated roles within governmental bodies, such as scientific or science and innovation advisers. These advisers serve as knowledge brokers, acting as intermediaries between government and the scientific community to facilitate the exchange of knowledge and the evidence needed to address policy challenges or problems. Moreover, science advisers are encouraged to engage in state governance processes, contributing to the integration of evidence into policymaking while responding to the demands of anticipatory governance, which is linked to strategic planning and foresight. While this practice is not yet widespread across all European states, countries such as the United Kingdom have institutionalised it and have been implementing it for 60 years, incorporating scientific advice into decision-making processes (GOV.UK, 2024). Inspired by models implemented in countries such as the United Kingdom and Ireland, several states have recently established similar advisory bodies to enhance their policymaking processes. The system of science advisers in Estonia was established in 2015 as part of the RITA programme—National Programme for Addressing Socio-Economic Challenges through Research and Development—coordinated by the Estonian Research Council (Eek, 2022). To strengthen and promote governance based on scientific knowledge and evidence, the Research Council of Lithuania initiated the creation of a network of science and innovation advisers in 2023, which was completed in 2024 (Lietuvos Mokslo Taryba, 2025). The establishment and operation of the network were supported through a national project implemented from 2023 to 2026, which concluded at the end of May 2026. By the end of 2024, 22 scientific advisers had already joined the ministries of Spain, thereby reinforcing the connections between the executive government and the scientific community; this network of advisers is coordinated by the National Scientific Advisory Office (ONAC) of the Presidency of the Government (La Moncloa, 2024). Consequently, motivated by these recent developments, this study focuses on three European states—Estonia, Lithuania, and Spain—as comparative cases for identifying the strategic, legal, and institutional elements of governance frameworks that support the integration of anticipatory governance and evidence-informed policymaking. The cases were selected purposively because they had established coordinated science-advisory systems within the preceding 15 years, combined dedicated advisory roles within ministries with a central coordinating structure, and provided comparable institutional arrangements embedded in different national contexts.

Despite previous research, important knowledge gaps remain, particularly regarding the following questions: What are the key elements that enable the integration of anticipatory governance and evidence-informed policymaking? What are the specific features of integrated governance frameworks in Estonia, Lithuania, and Spain? What are the specific characteristics of these frameworks that support the embedding of a science-for-policy approach?

The aim of this research is to identify the strategic, legal, and institutional elements of governance frameworks that support the integration of anticipatory governance and evidence-informed policymaking in European states.

This research combines qualitative and quantitative analyses of the strategic, legal, and institutional elements of governance frameworks supporting the integration of anticipatory governance and evidence-informed policymaking in European states. A directed qualitative content analysis was applied to strategic documents, legal acts, and institutional policy documents using deductively derived analytical categories presented in the theoretical framework. This analysis was complemented by a quantitative keyword frequency analysis of selected studies examining national science-for-policy ecosystems. Together, these procedures enabled the identification and comparison of documented elements that may support the integration of anticipatory governance and evidence-informed policymaking, and the embedding of a science-for-policy approach.

The study is structured into several key sections: the theoretical foundations of anticipatory governance and evidence-informed policymaking, and their integration within governance frameworks; the research methodology; the results of the comparative analysis of Estonia, Lithuania, and Spain; the discussion; and the conclusions.

2. Theoretical Framework

Contemporary governance structures must support the fundamental competence of anticipating and strategically managing change within governmental systems and societies, particularly in the face of various uncertainties that necessitate a responsive policymaking approach for timely reactions and proactive anticipation of challenges (Umbach, 2024). In this context, anticipatory governance and evidence-informed policymaking emerge as complementary approaches for improving governance in European states. The following sections define these two approaches and identify the elements required for their integration within governance frameworks.

2.1. The Essence of the Concept of Anticipatory Governance

The concept of anticipatory governance has gained prominence as a crucial concept for promoting foresight and future-oriented decision-making in governance structures. Anticipatory governance is defined in various ways across the literature, reflecting its multifaceted nature. For instance, it is described as “a broad-based capacity extended through society that can act on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible”, motivating activities that build capacities in foresight, engagement, and integration among policymakers, scientists, engineers, and other stakeholders (Guston, 2014). Another definition characterises it as a system of institutions, rules, and norms that utilise foresight, networks, and feedback to reduce risk and enhance the capacity for timely responses to events (Fuerth, 2009, 2011). Additionally, anticipatory governance is viewed as “a mode of decision-making that perpetually scans the horizon” and involves a “scalable system of systems” aimed at integrating foresight into policy-making and strengthening responsiveness to changing environments (Maffei et al., 2020). Given these multifarious definitions, this article adopts a comprehensive perspective on anticipatory governance that emphasises its connection to evidence-informed policymaking. Anticipatory governance can be understood as a dynamic governance approach that integrates strategic foresight into policy development and decision-making, thereby supporting future-oriented and responsive governance under conditions of uncertainty (Umbach, 2024).

Anticipatory governance can be characterised by its five interconnected elements: guiding values, strategic intelligence, stakeholder engagement, agile regulation, and (in-)national cooperation (European Commission: Directorate-General for Research and

[Innovation et al., 2024](#)). Moreover, specific characteristics of anticipatory governance include its emphasis on future-oriented thinking, the capacity to manage emerging technologies by involving diverse societal actors, and the establishment of systems that can self-organise in response to unforeseen challenge ([Fuerth, 2009](#); [Guston, 2014](#)). It is designed to handle complex interactions among various streams of information and events, thereby providing the necessary agility to confront and respond to shifting circumstances ([Fuerth, 2011](#)). In this context, anticipatory governance relies on foresight to shape policies and strategies, enabling decision-makers to concentrate on achieving positive future outcomes through collaborative efforts among various stakeholders, including government, businesses, the public, and academics. A key component of this approach is horizon scanning, which allows for the identification of emerging trends and developments, and provides a basis for foresight initiatives, ensuring that anticipatory governance remains proactive and responsive to changes in the environment ([Heo & Seo, 2021](#)).

In the context of modern uncertainties, the importance of anticipatory governance cannot be overstated. It promotes a proactive and future-oriented approach to policymaking, allowing for the anticipation of political challenges and the expansion of planning horizons ([Umbach, 2024](#)). This proactive stance not only enhances decision-making capabilities but also aims to mitigate risks associated with systemic stress or policy emergencies, ensuring that governments are better equipped to navigate an increasingly complex world. Anticipatory governance, combined with strategic foresight, provides an approach for systematically considering possible future developments and informing present-day governance decisions ([Umbach, 2024](#); [Ramos, 2014](#)).

In summary, anticipatory governance supports future-oriented policymaking in the face of uncertainty and complexity by integrating strategic foresight into governance and decision-making processes. By involving diverse societal actors and establishing responsive and self-organising systems, anticipatory governance can support governments in anticipating emerging challenges and mitigating risks associated with uncertainty and policy emergencies.

2.2. The Essence of the Concept of Evidence-Informed Policymaking

Evidence-informed policymaking is a critical concept in governance that has evolved through various definitions in the literature, highlighting its complexity and relevance. At its core, the “evidence-policy” connection, concerns scientists’ efforts to communicate identified issues and possible solutions to policymakers and to promote the use of evidence in policymaking processes under conditions of uncertainty ([Cairney & Oliver, 2017](#)). A foundational premise of evidence-based practice is that professional decisions are more likely to yield positive outcomes when grounded in three critical pillars: the best available evidence, professional judgement, and the contextual values of customers (society) ([Spencer et al., 2012](#); [Raymaekers et al., 2026](#)).

Amidst the evolving dialogue, many practitioners prefer the term “evidence-informed” policymaking, recognising that decision-making often involves reasoned argumentation rather than being solely data-driven. This form of policymaking considers not only scientific facts but also the professional judgements of policymakers along with the interests of stakeholders ([Head, 2013](#); [Cairney, 2022](#)). Thus, for the purposes of this article, evidence-informed policymaking is defined as a policymaking approach that combines scientific evidence with professional judgement and stakeholder knowledge to inform policy decisions and strengthen the systematic consideration of available information under changing conditions.

The specifics of evidence-informed policymaking reveal several characteristics that define its operational landscape. Policymaking occurs within a multifaceted environment,

populated by various actors who influence decisions at multiple levels of government. Scientists frequently compete with other stakeholders to present their evidence effectively, navigating a complex network of institutions that shape the rules and norms of evidence acceptance (Cairney, 2022; Head, 2008). This environment is characterised by the presence of both formal regulations and informal practices, which can dictate how evidence is perceived and utilised in policymaking (Cairney, 2022; European Commission: Directorate-General for Structural Reform Support et al., 2021). Additionally, entrenched beliefs or paradigms can dominate discussions, requiring new evidence to be compellingly presented if it is to shift existing perspectives and garner attention from decision-makers (Cairney, 2022; MacKillop & Downe, 2022).

The role of science advice is integral to the process of evidence-informed policymaking. Scientific evidence is defined as knowledge grounded in scientific methods that supports policy arguments through data, information, and recognised research findings (European Commission: Directorate-General for Structural Reform Support et al., 2021). This evidence must foreground objective facts while excluding unfounded perceptions and opinions, allowing for a clearer understanding of the issues at hand (Spencer et al., 2012). Central to this is the concept of knowledge brokerage, which facilitates the translation of policymakers' needs into precise requests for evidence from the research community, ensuring that useful and relevant information is provided (European Commission: Directorate-General for Structural Reform Support et al., 2021; Head, 2008). In the face of modern uncertainties, the role and importance of science advice become even more pronounced. Governments are significant investors and users of applied social sciences, often taking an active role in shaping policy through engagement with research (Head, 2008; Gundersen, 2024). Such engagement includes determining national research priorities, funding specific initiatives, and commissioning research that directly informs policy decisions. Given the complexities inherent in today's societal challenges, a paradigm that embraces both scientific and alternative forms of knowledge is critical for maintaining institutional credibility in scientific advice (Kim & Dankel, 2025). Normative principles help to guide effective science advice in the context of uncertainties. These principles, encapsulated by the acronym "TRUST", include Transparency, Reflexivity, Uncertainty management, Sustainability, and Transdisciplinarity (König et al., 2017). Together, they ensure that scientific advice is not only credible but also capable of addressing the intricate issues facing modern governance. By fostering an environment in which uncertainties are openly communicated, and a variety of knowledge sources are engaged, the establishment of trust in science advice becomes increasingly feasible (Kim & Dankel, 2025; MacKillop & Downe, 2022). Ultimately, evidence-informed policymaking represents a holistic process that interweaves scientific evidence, policy advice, and stakeholder engagement, allowing governments to respond more systematically to contemporary uncertainties. By promoting fruitful collaborations between scientists and policymakers, this approach equips them to better navigate complex societal challenges (Gundersen, 2024; Hudec, 2023).

In summary, evidence-informed policymaking integrates scientific evidence with professional judgement and stakeholder engagement, creating a robust policymaking approach for effective governance in the face of modern uncertainties. This collaborative approach supports the responsiveness of policy processes and fosters trust in science advice, enabling policymakers to address complex societal challenges more effectively.

2.3. The Role of the Integration of Anticipatory Governance and Evidence-Informed Policymaking

The integration of anticipatory governance and evidence-informed policymaking is important for addressing the complexities and uncertainties inherent in contemporary governance. This integration leverages the strengths of both approaches, combining the

future orientation of anticipatory governance with the systematic use of evidence promoted by evidence-informed policymaking. To realise the full potential of integrating anticipatory governance and evidence-informed policymaking, both approaches must be embedded within national and regional governance frameworks that articulate a clear vision for the future of the state. These strategies should identify specific priorities in the realms of anticipation and science advising, ensuring that policy development is guided by a forward-looking perspective. Furthermore, a solid legal basis is essential, as regulations can act as either a catalyst or an impediment to the successful implementation of these approaches. Effective institutionalisation is also paramount, necessitating the establishment of dedicated bodies or roles responsible for overseeing the integration process. By assigning clear duties and responsibilities, governments can create a structured approach that enhances collaboration between different sectors, thereby facilitating the development of policies informed by both anticipatory thinking and scientific evidence. Such an integrated governance framework may support more systematic, future-oriented, and evidence-informed governance under conditions of uncertainty.

Based on the analysis of previous studies, a set of strategic, legal, and institutional categories was deductively derived to examine how anticipatory governance and evidence-informed policymaking may be integrated within national governance frameworks. These categories form the analytical coding framework applied in the subsequent qualitative content analysis of the selected documents (see Table 1).

Table 1. Deductive Analytical Coding Framework for Examining the Integration of Anticipatory Governance and Evidence-Informed Policymaking.

Group of Elements	Analytical Category	Operational Definition	Theoretical Sources	AG *	EIP *
Strategic	Strategic foresight integration	Integration of strategic foresight into policy development and decision-making.	Umbach (2024)	+	
	Proactive and future-oriented approach	Emphasises future orientation and a proactive approach to policymaking, allowing for anticipation of challenges and expansion of planning horizons.	Umbach (2024)	+	
	Evidence utilisation approach	The process of integrating scientific evidence, professional judgement, and stakeholder interests to inform policy decisions.	Spencer et al. (2012); Head (2013)		+
	Evidence-informed decision-making approach	The systematic approach that includes rational and emotional considerations, allowing policymakers to navigate complex information environments.	Cairney and Oliver (2017); Cairney (2022)		+
	Agility in managing complex interactions	Designed to manage complex interactions among various streams of information and events, providing agility to confront and respond to changes.	Fuerth (2011)	+	
	Capability to sense and act on changes	Organisational change in mindset and systems enables governments to anticipate and respond to impending events effectively.	Maffei et al. (2020)	+	
	Knowledge brokerage mechanism	The translation of policymakers' needs for evidence into clear requests to the research community for relevant and applicable information.	Head (2008)		+
	Influencing policy conditions and events	External factors (such as crises) that can alter policymaker attention and influence the prioritisation of certain policies or evidence.	Cairney (2022); Gundersen (2024)		

Table 1. Cont.

Group of Elements	Analytical Category	Operational Definition	Theoretical Sources	AG *	EIP *
Legal	System of institutions, rules, and norms	It utilises foresight, networks, and feedback to reduce risk and enhance capacity for timely responses.	Fuerth (2011)	+	
	Regulatory frameworks for evidence integration	The rules and norms that govern how evidence is gathered, evaluated, and implemented within policy (both formal and informal).	Cairney and Oliver (2017); Head (2008)		+
	Engagement of diverse societal actors	Capacity to manage uncertainties and to use foresight technologies incorporates engagement with scientists, policymakers, and other stakeholders.	Guston (2014)	+	
	Roles and responsibilities in policymaking	The distinctions between evidence providers (research community) and evidence consumers (policymakers), impacting the integration of scientific evidence into policy.	MacKillop and Downe (2022)		+
	Ethical guidelines for scientific advising	Normative principles that govern the provision of science advice, including transparency, reflexivity, and uncertainty management.	König et al. (2017); Kim and Dankel (2025)		+
Institutional	Broad-based management capacity	Anticipatory governance acts on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible.	Guston (2014)	+	
	Institutional capacity for evidence-informed policymaking	The capability of institutions to support and promote the use of evidence in decision-making processes, including investment in research and development.	Head (2008); Cairney (2022)		+
	Institutional capacity for knowledge brokering (science-for-policy)	The capability of institutions to facilitate the effective translation and application of knowledge between the research community and policymakers, ensuring that relevant evidence is accessible, understandable, and actionable in the decision-making processes.	Kim and Dankel (2025)		+
	Adaptive systems that self-organisation	Establishment of structures capable of responding to unforeseen challenges by self-organising.	Fuerth (2011)	+	
	Co-production of knowledge mechanism	The collaborative effort between governmental bodies, scientific advisors, interest groups, and scientists to develop and implement policies informed by diverse forms of knowledge.	Cairney and Oliver (2017); Gundersen (2024)		+
	Networking and relationship building in policy	The dynamics between policymakers and evidence providers, which can facilitate or hinder access to evidence and the adoption of innovative policy solutions.	Cairney (2022); Gundersen (2024)		+
	Fluid integration of knowledge and evidence	The evolving understanding and integration of diverse forms of knowledge into policy decisions, demonstrating responsiveness to changing contexts.	MacKillop and Downe (2022); Hudec (2023)		+
	Risk mitigation in uncertain environments	Aims to reduce risks linked with systemic stress and policy emergencies, preparing decision-makers for complex challenges.	Umbach (2024)	+	

* AG—anticipatory governance; EIP—evidence-informed policymaking.

These elements collectively illustrate the multifaceted nature of anticipatory governance and evidence-informed policymaking, highlighting the need to create and maintain

connections among strategic, legal, and institutional elements. Understanding these elements allows stakeholders to identify areas for potential change and improvement in the integration of foresight and scientific evidence into policymaking processes. Key elements of integrated governance frameworks include strategic foresight, effective knowledge brokerage, and collaborative engagement among diverse stakeholders, all of which are important for strengthening the responsiveness of policy and governance processes. To achieve successful integration, it is vital to cultivate an organisational culture within governmental bodies, scientific communities, and other stakeholder organisations that prioritises transparency, reflexivity, and collaboration in the co-production of knowledge. By fostering an environment conducive to scientific advising and evidence-informed decision-making, the integration of these two approaches may contribute to more systematic and effective governance in the face of emerging challenges.

3. Materials and Methods

This study employs both qualitative and quantitative research approaches, combining directed qualitative content analysis with quantitative keyword frequency analysis. The qualitative component focused on strategic documents, legal acts, and institutional policy documents relevant to the governance frameworks supporting the integration of anticipatory governance and evidence-informed policymaking. Document analysis provided the source material for the study, due to its suitability for analysing strategic, legal, and institutional arrangements. Documents constitute an important source of evidence in policy and governance research because they reflect formal priorities, institutional arrangements, rules, and policy intentions. Document analysis enables researchers to explore how various documents represent society, organise activities, and express how communities interpret their past and plan for the future (Bowen, 2009; Wood et al., 2020). As policy and governance studies primarily rely on two types of data—documents and individuals—documentary sources are particularly valuable for examining formally established governance arrangements (Owen, 2014; de Andrade et al., 2018). Documents serve specific purposes and target intended audiences; they are created by individuals or groups within socio-historic contexts and can be examined both qualitatively and quantitatively, making them useful sources for examining institutional practices, policy priorities, social values, and societal trends (Davie & Wyatt, 2021). The analysis therefore focused on what was formally documented rather than on the actual implementation or effects of the identified arrangements.

As mentioned in the Introduction, this research adopts a comparative case-study design focusing on three European states—Estonia, Lithuania, and Spain—which have recently established specific roles for scientific advising to enhance knowledge brokering and strengthen collaboration between governmental bodies and the scientific community. The cases were selected purposively according to three criteria: the timing of the establishment of the science-advisory system, its institutional structure, and the comparability of the cases across different national contexts. First, Estonia, Lithuania, and Spain had established formal networks or coordinated systems of science advisers within governmental institutions during the preceding 15 years. Second, their systems combine dedicated science-advisory roles within individual ministries with a central governmental structure responsible for coordination, reflecting key features of the distributed advisory model (STRATA, 2021). Third, the cases provide comparable examples of how a similar institutional arrangement has been embedded within different national strategic, legal, and institutional contexts.

A directed qualitative content analysis was applied because it allows theoretically derived categories to guide the systematic examination of textual material and is particularly suitable when the purpose is to apply or extend an existing conceptual framework in specific empirical contexts (Hsieh & Shannon, 2005; Elo & Kyngäs, 2008). This method

was used to examine how the strategic, legal, and institutional elements identified in the theoretical framework were reflected in the selected national documents. The analytical categories deductively derived from the theoretical framework and presented in Table 1 served as the coding framework and research instrument for the analysis. The analysis was guided by two questions: (1) How are the identified elements of integrated governance frameworks reflected in the selected national documents? (2) What country-specific features characterise these elements within the respective national science-for-policy ecosystems?

The coding unit was a meaningful textual segment, such as a sentence, paragraph, legal provision, or clearly defined section of a document, that contained information relevant to one or more analytical categories. Each segment was assigned to the category that best represented its primary meaning. Where a segment addressed more than one category, multiple coding was permitted. Ambiguous segments were interpreted in relation to the wider section and the purpose of the source document. The coded material was subsequently organised by country and by the three groups of elements—strategic, legal, and institutional—to enable systematic comparison across the cases.

The qualitative document sample comprised 12 items, including 4 national strategies, 4 national laws, 3 studies of the European Commission Joint Research Centre, and 1 planning document. These documents were selected based on specific criteria: (1) they aligned with the research focus areas, including anticipatory governance, foresight, evidence-informed policymaking, strategic governance, science-for-policy, science and research development, and national progress; (2) they were current or applicable during the period under analysis and included a long-term or future-oriented perspective; (3) they were publicly accessible; and (4) they were identified as relevant by national representatives involved in coordinating science-for-policy initiatives.

The national representatives did not participate in coding, interpretation, or the formulation of the findings. All consulted representatives were directly responsible for coordinating the science-advisory network or related science-for-policy initiatives in their respective countries. Their role was limited to identifying the principal national documents that, in their expert judgement, were necessary for understanding the relevant governance frameworks and the institutional integration of anticipatory governance and evidence-informed policymaking, as well as clarifying the institutional context in which the science-for-policy arrangements had been established. Before providing their recommendations, the representatives were informed about the purpose of the consultation, the intended use of the identified documents in the research, and the subsequent dissemination of the study findings. Final decisions on document inclusion were made by the authors according to the predefined selection criteria. The consultations therefore served to support the relevance and contextual adequacy of the document sample, while analytical responsibility remained exclusively with the authors.

The quantitative analysis concentrated on investigating keywords and their frequency within studies conducted by the European Commission Joint Research Centre that focus on the comprehensive analysis and evaluation of science-for-policy ecosystems across states. Its purpose was supplementary: it was used to identify the relative prominence of recurring terms within the selected ecosystem studies rather than to measure the effectiveness or maturity of the national systems. Google Colab was used to process the textual material and calculate term frequencies.

The Google Colab script carried out the following methodological steps on the selected files: (1) text preprocessing, including the removal of common stop words, such as “the” and “and”, words shorter than three letters, and hyperlinks; (2) calculation of the number of occurrences of individual terms; (3) compilation of frequency tables listing the most frequently occurring terms and their respective counts; and (4) generation of word clouds

as supplementary visual representations of the calculated frequencies. The interpretation was based on the frequency counts and percentages, while the word clouds were used only for illustrative purposes.

The analysis was conducted between March 2025 and April 2026. The key insights from the research are presented through comparative tables, frequency data, and figures.

The study relied exclusively on publicly accessible documentary sources and did not directly involve human participants or personal data. To enhance analytical transparency, the same deductive coding framework and document-selection criteria were applied across all three cases. Interpretations were restricted to the content of the analysed documents, and claims concerning the actual implementation, effectiveness, or outcomes of the identified governance arrangements were avoided.

4. Results

Before analysing the governance frameworks supporting the integration of anticipatory governance and evidence-informed policymaking in European states, a list of keywords was developed for each analytical category based on the analysis of guiding studies issued by the European Commission ([European Commission: Directorate-General for Research and Innovation et al., 2024](#); [European Commission: Directorate-General for Structural Reform Support et al., 2021](#)) (see Appendix A, Table A1).

The governance frameworks supporting the integration of the anticipatory governance and evidence-informed policymaking approaches encompass a multitude of elements and keywords that illustrate the complexity and interconnectivity of modern policymaking processes. The analysis of these elements reveals salient themes that are important for effective governance in an increasingly uncertain and rapidly changing environment.

The group of strategic elements emphasises the importance of forward-looking methods, such as strategic foresight integration and proactive approaches, which are important for anticipating future challenges and informing present-day policy decisions. Keywords such as “horizon scanning”, “scenario analysis”, and “long-term vision” underscore the necessity of comprehensive planning in navigating complex policy landscapes. Additionally, concepts such as “knowledge brokerage” and “evidence-informed decision-making” highlight the role of scientific evidence and collaboration among stakeholders as fundamental components in shaping informed policy choices.

The group of legal elements addresses the legal and regulatory arrangements necessary for supporting the integration of foresight and evidence into policymaking. It encompasses regulatory frameworks that underpin evidence integration, ensuring that institutional actions are supported by robust legal standards. This group also recognises the engagement of diverse societal actors and the delineation of roles and responsibilities, which are important for building trust and facilitating collaborative policymaking.

Within the group of institutional elements, a holistic perspective is advocated through broad-based management capacities that integrate emerging technologies and research capabilities. The focus on self-organising systems and co-production of knowledge mechanisms illustrates the need for dynamic and flexible structures that can respond effectively to evolving societal needs. Furthermore, risk mitigation strategies outlined in this group emphasise preparedness for systemic uncertainties and complex challenges.

Considering these findings, the identified analytical categories provide a basis for examining how the two approaches are reflected within national governance frameworks. Therefore, it is important to explore how the strategic, legal, and institutional elements identified in the theoretical framework are represented in the selected national documents.

4.1. Strategic Elements Supporting Integration

Strategic elements of governance frameworks supporting the integration of anticipatory governance and evidence-informed policymaking are tailored to the specific national contexts of Estonia, Lithuania, and Spain (see Appendix B, Table A2).

According to the analysed documents, Estonia's focus on developing a comprehensive policy analysis and impact assessment system illustrates a strong commitment to evidence-based decision-making and future-oriented governance. The integration of strategic foresight and proactive approaches is evidenced by the establishment of a specialised body—an Innovation Team within the Government Office—which acts as a conduit between policymakers and researchers. This emphasises a collaborative culture in which innovative methodologies are tested, thereby supporting the capacity of public servants to engage with academic literature. Lithuania's governance framework highlights the importance of stakeholder engagement and foresight methodologies. The State Progress Strategy and subsequent documents advocate for evidence-based decision-making grounded in public dialogue and stakeholder involvement. This reflects a national ecosystem prioritising transparency, inclusivity, and the rigorous analysis of various future scenarios, ensuring that policies are responsive to evolving public expectations and external changes. Spain's strategic orientation, particularly as illustrated by the "Spain 2050" initiative, underscores the role of transformative foresight. The strategic emphasis on empirical evidence is geared towards modernising public administration, thus supporting improvements in the policy-making process. The use of careful analysis to design convergence pathways indicates an intention to incorporate historical and projected data into policy formation, reinforcing a future-oriented approach to governance.

In summary, Estonia's focus on internal capacity and experimental culture, Lithuania's emphasis on participatory governance, and Spain's integration of empirical analysis demonstrate how these strategic elements are reflected within their national ecosystems. The common thread across these governance frameworks is a commitment to future-oriented and evidence-informed policymaking, in which the ability to foresee and respond to complexities and uncertainties is paramount. This highlights the significance of integrating foresight and evidence in shaping governance processes that respond more systematically to societal needs and challenges across these diverse national contexts.

4.2. Legal Elements Supporting Integration

The legal elements of the governance frameworks that support the integration of anticipatory governance and evidence-informed policymaking have been customised to reflect the unique national contexts of Estonia, Lithuania, and Spain (see Appendix B, Table A3).

In Estonia, the legal framework is characterised by a systematic approach to research and development, underscored by the creation of formal policies that guide governmental actions. The integration of a system of institutions, rules, and norms facilitates collaboration among ministries, reflecting a strong commitment to coordinating research efforts and aligning them with national priorities. This is complemented by a focus on citizen empowerment and participation in governance, promoting active societal engagement in policymaking processes. Lithuania's legal framework showcases a strong emphasis on ethical standards and inclusivity within its policymaking ecosystem. The State Progress Strategy highlights the importance of data transparency and equal access for all citizens, advocating for a democratic approach that respects individual rights and promotes collective well-being. The commitment to evidence-informed governance demonstrates a deliberate effort to ensure that policymaking is grounded in rigorous analysis and societal values, thus fostering trust between public authorities and citizens. Spain's national context illustrates a

significant advancement in incorporating scientific advice into legislative processes. The establishment of the Office of Science and Technology illustrates a strategic move towards creating and maintaining a parliamentary culture that values empirical evidence in political decision-making. The enactment of laws aimed at institutionalising public policy evaluation further reflects Spain's dedication to accountability and continuous improvement in governance.

Collectively, these legal frameworks indicate that all three countries are actively working to bridge the gap between scientific knowledge and policy development through formal legal and regulatory structures. Features such as institutional collaboration, ethical oversight, inclusivity, and evidence utilisation are central to their ecosystems, supporting policymaking that is responsive to and reflective of societal needs. The alignment of legal frameworks with anticipatory governance principles highlights each country's commitment to embedding future-oriented and evidence-informed practices within governance systems capable of addressing complex challenges.

4.3. Institutional Elements Supporting Integration

The institutional elements of the governance frameworks supporting the integration of anticipatory governance and evidence-informed policymaking in Estonia, Lithuania, and Spain are presented, revealing how these elements are tailored to their distinctive national contexts (see Appendix B, Table A4).

In Estonia, the elements of the framework are characterised by a strong emphasis on broad-based management capacity and the development of a digital data infrastructure. The initiatives outlined in "Estonia 2035" focus on creating a cohesive data management and cybersecurity system aimed at fostering efficient public service delivery. This reflects a national ecosystem that prioritises technological innovation and secure data access as foundational to responsive governance. The commitment to evidence-informed policymaking further reinforces institutional capacity, ensuring that research and development activities are closely aligned with societal needs. Lithuania's framework demonstrates a robust valorisation of knowledge, which is integral to its public administration. The focus on innovation and knowledge transfer underlines the importance of cross-sectoral cooperation in creating a sustainable knowledge ecosystem. The promotion of flexible strategic coordination networks showcases Lithuania's approach to facilitating collaboration across sectors, enabling the integration of diverse expertise to address complex societal challenges. This participatory ethos reflects a governance model that values inclusivity and seeks to engage multiple stakeholders in the policy process. Spain's framework embodies features of multi-level, networked governance systems, which aim to leverage territorial synergies and streamline available resources. The "Spain 2050" initiative highlights the importance of integrating digital technologies to utilise data effectively in policy monitoring and evaluation. This signals a strategic move towards creating interconnected governance structures that support cooperation between public institutions and private actors. Additionally, the establishment of dedicated bodies represents Spain's commitment to embedding scientific advice within its parliamentary culture, demonstrating the institutionalisation of evidence-based decision-making.

Across these countries, the institutional elements reveal a shared commitment to fostering systems capable of responding to changing environments. Estonia's focus on supporting innovative solutions and experiments reflects an agile approach to policymaking that encourages digital projects and co-creative processes. Lithuania's emphasis on continuous learning and engagement encapsulates the necessity for flexibility within its governance structures. In Spain, the integration of evaluation mechanisms into public policymaking signifies a cultural shift towards accountability and transparency.

Ultimately, the institutional elements of these frameworks reflect a concerted effort to integrate anticipatory governance and evidence-informed policymaking into the core of national decision-making processes. By cultivating environments that prioritise data-driven strategies, stakeholder engagement, and flexibility, Estonia, Lithuania, and Spain establish institutional conditions that may support more systematic responses to contemporary challenges within their respective science-for-policy ecosystems.

4.4. Specifics of National Science-for-Policy Ecosystems

An analysis of keywords from recent studies examining the science-for-policy ecosystems of Estonia, Lithuania, and Spain was conducted (European Commission: Joint Research Centre et al., 2023, 2024, 2025) to identify their focal areas. The keyword frequency analysis identified recurring terms and differences in thematic emphasis across the three national ecosystems. Detailed frequency data are presented in Appendix C, while the word clouds in Figure 1 provide visualisations of the results.

In Estonia, the most frequent analytically relevant terms included “research”, “ministry”, “science”, “adviser”, “need”, and “foresight” (Appendix C, Table A5; see also Figure 1, part A). Their frequency indicates a strong textual emphasis on governmental and scientific actors, science-advisory roles, and the identification of research needs. The prominence of “foresight”, “strategic”, “knowledge”, “advice”, and “network” further suggests that the analysed study places particular emphasis on future-oriented policymaking, knowledge brokerage, and institutional coordination. Keywords such as “innovation”, “funding”, “universities”, “capacity”, and “researchers” also indicate attention to the resources and organisational capacities supporting the Estonian science-for-policy ecosystem.

In Lithuania, the most frequent analytically relevant terms included “research”, “EIPM”, “ministry”, “science”, “scientific”, and “state” (Appendix C Table A5; see also Figure 1, part B). This distribution indicates that the analysed study primarily focuses on the institutionalisation of evidence-informed policymaking and the relationship between governmental and research actors. The prominence of “researchers”, “institutions”, “office”, “network”, “knowledge”, and “policymakers” suggests particular attention to the institutional architecture of the national ecosystem and the connections between evidence providers and policy actors. Terms such as “strategic”, “support”, “development”, and “implementation” also reflect an emphasis on the organisational development and practical establishment of science-for-policy functions.

In the Spanish case, the most frequent analytically relevant terms included “scientific”, “science”, “ministry”, “research”, “knowledge”, and “technical” (Appendix C Table A5; see also Figure 1, part C). The prominence of these terms indicates a focus on the scientific and technical foundations of policy advice and on the institutional actors involved in its provision. Terms such as “advice”, “advisory”, “staff”, “ecosystem”, and “evaluation” suggest attention to the professionalisation, organisation, and assessment of science-advisory functions. The frequency of “expert”, “stakeholders”, “bodies”, “functions”, and “political” further indicates that the analysed study considers the roles of different actors and organisations within the Spanish science-for-policy ecosystem.

Collectively, the keyword frequency analysis shows that the three studies share an emphasis on science, research, governmental institutions, and knowledge-related functions, while differing in the relative prominence of particular terms. The Estonian study places comparatively visible emphasis on science advisers, foresight, research needs, and institutional capacity. The Lithuanian study focuses particularly on evidence-informed policymaking, institutional networks, research actors, and the implementation of science-for-policy arrangements. The Spanish study gives greater textual prominence to scientific and technical advice, advisory functions, professional staff, and evaluation. These patterns

should be interpreted as thematic emphases within the analysed documents rather than as direct measures of the performance or maturity of the national ecosystems.



Figure 1. Word clouds of keywords, representing national science-for-policy ecosystems. Source: authors conducted based on European Commission: Joint Research Centre et al. (2023, 2024, 2025).

In summary, this comparative analysis illustrates both shared and country-specific thematic emphases within the three national science-for-policy ecosystems. It shows how similar science-for-policy functions are described through different combinations

of institutional actors, knowledge-brokerage arrangements, strategic foresight, advisory roles, and evaluation mechanisms. These findings complement the qualitative document analysis by indicating which concepts receive greater textual prominence in each national ecosystem; they do not, however, demonstrate the actual effectiveness or outcomes of the identified arrangements.

5. Discussion

The findings indicate that the integration of anticipatory governance and evidence-informed policymaking depends on the interaction of strategic, legal, and institutional elements. Across the three cases, recurring elements included strategic foresight, knowledge brokerage, stakeholder engagement, legal provisions supporting evidence use, and dedicated science-advisory roles. These findings are consistent with the understanding of anticipatory governance as a governance approach centred on foresight and future-oriented policymaking (Guston, 2014; Umbach, 2024), and with the literature on evidence-informed policymaking, which emphasises the combination of scientific evidence, professional judgement, stakeholder knowledge, and institutional context (Head, 2013; Cairney, 2022).

The analysis suggests that the two approaches may become institutionally connected when strategic priorities, legal arrangements, and organisational responsibilities reinforce one another. Strategic documents establish future-oriented priorities, legal provisions define responsibilities and procedures, and institutional structures create interfaces between governmental and scientific communities. Knowledge brokerage is particularly important in this configuration because evidence does not enter policymaking automatically and often requires translation between research and policy environments (Head, 2008; Cairney & Oliver, 2017).

The three cases reveal both common elements and different national emphases. Estonia places stronger emphasis on research needs, foresight, science advisers, digital infrastructure, and institutional capacity. Lithuania highlights evidence-informed policymaking, stakeholder engagement, knowledge valorisation, ethical principles, and institutional networking. Spain gives greater prominence to scientific and technical advice, evaluation, specialised advisory bodies, and the institutionalisation of scientific advice. The keyword frequency analysis supports these distinctions, although the frequencies reflect textual prominence within the analysed studies rather than institutional performance or system maturity.

The study contributes by clarifying the distinction between anticipatory governance as a governance approach, evidence-informed policymaking as a policymaking approach, and an integrated governance framework as the configuration of strategic, legal, and institutional elements that may connect them. It also provides a deductive analytical coding framework for examining how these elements are formally represented across national contexts.

However, the findings should be interpreted within the limits of documentary analysis. The analysed sources reveal formal priorities, institutional designs, and intended arrangements, but they do not demonstrate how consistently these arrangements are implemented or whether they produce particular policy outcomes. Therefore, the identified elements should be understood as enabling conditions and potential points of connection between the two approaches rather than evidence that their integration has been fully achieved in practice.

Future research should examine how the identified elements are implemented in practice, including the operation of science-advisory roles, the use of evidence and foresight in decision-making, and coordination between governmental and scientific communities. Interviews, organisational case studies, process tracing, and longitudinal compar-

ative research could help assess how formal arrangements function and evolve across national contexts.

6. Conclusions

This study identified the strategic, legal, and institutional elements of governance frameworks that may support the integration of anticipatory governance and evidence-informed policymaking. Across Estonia, Lithuania, and Spain, the recurring elements included strategic foresight, evidence use, knowledge brokerage, stakeholder engagement, legal provisions supporting science-informed decision-making, and dedicated science-advisory structures. The findings indicate that the integration of the two approaches depends on the alignment of strategic priorities, formal rules, and clearly defined institutional responsibilities.

The comparative analysis also revealed distinct national emphases. Estonia places greater emphasis on foresight, research needs, science advisers, digital infrastructure, and institutional capacity. Lithuania highlights evidence-informed policymaking, stakeholder engagement, knowledge valorisation, ethical principles, and institutional networking. Spain gives greater prominence to scientific and technical advice, evaluation, specialised advisory bodies, and the formal institutionalisation of science-advisory functions. These differences show how similar science-for-policy arrangements may be embedded within different national governance contexts.

The study contributes a comparative analytical framework that distinguishes anticipatory governance as a governance approach, evidence-informed policymaking as a policymaking approach, and an integrated governance framework as the configuration of strategic, legal, and institutional elements that may connect them. The identified elements provide a basis for examining and comparing formal science-for-policy arrangements in other national contexts. As the findings are based on documentary evidence, they reflect formally established priorities and institutional designs rather than their implementation or policy effects.

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Abbreviations

The following abbreviations are used in this manuscript:

EE	Estonia
LT	Lithuania
ES	Spain

Appendix A

Table A1. Elements and keywords of integrated governance frameworks.

Group	Element	Keywords
Strategic	Strategic foresight integration	Future planning; foresight; anticipation; long-term vision; strategic thinking; policy design; horizon scanning; scenario analysis; roadmaps.
	Proactive and future-oriented approach	Future orientation; proactive policymaking; proactive measures; challenge readiness; planning horizons; forward-thinking; preparedness; responsiveness; uncertainty management; sustainable development.
	Evidence utilisation approach	Scientific evidence; evidence gathering; professional judgement; informed choices; data analysis; expertise; knowledge sharing; multi-stakeholder effort; openness.
	Evidence-informed decision-making approach	Systematic approach; rational considerations; policy decisions; strategic intelligence; complex information; balanced judgement; democratic engagement; guiding values.
	Agility in managing complex interactions	Complex interactions; information streams; change management; comprehensive frameworks; coordination; collaboration; responsiveness; flexibility; multi-stakeholder.
	Capability to sense and act on changes	Organisational change; mindset shift; system responsiveness; event prediction; effective action; critical technology tracking; horizon scanning.
	Knowledge brokerage mechanism	Policymaker needs; research community; science-for-policy; evidence translation; information transfer; relevant information; applicable information; clear requests; communication; knowledge transfer; intermediaries; accessible evidence; understandable evidence; actionable evidence.
	Influencing policy conditions and events	External factors; crises; contextual awareness; uncertainty management; policy prioritisation; evidence influence; policymaker attention; event-driven policy; policy change; global competition; access to resources.
Legal	System of institutions, rules, and norms	Institutional framework; rules; norms; standards; agile governance; responsive governance; international cooperation; risk reduction; capacity enhancement; timely responses.
	Regulatory frameworks for evidence integration	Legislation; legal acts; code of conduct; formal processes; informal practices; regulatory responsiveness.
	Engagement of diverse societal actors	Stakeholders; policymakers; decision-makers; scientists; civil society; research community; public engagement; crowdsourcing; participation; inclusivity; collaboration; communication.
	Roles and responsibilities in policymaking	Evidence providers; evidence consumers; stakeholder roles; integration impact; policy influence; trust.
	Ethical guidelines for scientific advising	Ethical governance; human rights; normative principles; integrity; responsible innovation; transparency; accountability; responsibility; reflexivity; equity; values; morality.

Table A1. Cont.

Group	Element	Keywords
Institutional	Broad-based management capacity	Knowledge-based management; emerging technologies; emerging knowledge-based technologies; variety of inputs; holistic perspective; comprehensive oversight; proactive approach; environmental regeneration; sustainability; responsiveness; human capital; dynamic capabilities.
	Institutional capacity for evidence-informed policymaking	Institutional capability for evidence uses; decision-making processes; research and development; policy infrastructure; research infrastructure; human resources; investment; evidence use; cyber threats.
	Institutional capacity for knowledge brokering (science-for-policy)	Capability for knowledge brokering; scientific advisors; cross-sectorial collaboration; knowledge application; accessible evidence; effective translation; networking; intermediation.
	Adaptive systems that self-organisation	Structures; self-organising; systemic change; responsiveness; flexibility; organisational adjustment; multi-level perspective; regulatory test beds; experimentation platforms.
	Co-production of knowledge mechanism	Collaborative effort; partnership; multi-stakeholders; interest groups; knowledge sharing; diverse knowledge; policy development.
	Networking and relationship building in policy	Networks; communication; engagement; social readiness; trust building; dynamics; long-lasting collaboration.
	Fluid integration of knowledge and evidence	Evolving understanding; diverse knowledge; changing contexts; international contexts; responsive governance; comprehensive governance; flexibility; international agreements, integration.
	Risk mitigation in uncertain environments	Risk reduction; systemic stress; policy emergencies; complex challenges; preparedness; proactive planning; safety protocols; audits; compliance; responsible innovation; security; cybersecurity; international standards.

Source: authors conducted based on [European Commission: Directorate-General for Research and Innovation et al. \(2024\)](#); [European Commission: Directorate-General for Structural Reform Support et al. \(2021\)](#).

Appendix B

Table A2. Strategic elements of integrating frameworks.

State	Source	Quotes	Element
EE	European Commission: Joint Research Centre et al. (2024)	“The Innovation Team at the Government Office. The Innovation Team is unsurprisingly the key player in the innovative policymaking by aiding ministries and government departments with urgent policy concerns, testing new policy methodologies, and building internal capacity in government throughout the process. <...> The team plays a vital role in connecting the government and research, engaging scientists in teaching and consulting. It boosts public servants’ capacity to understand academic literature, fostering an experimental culture within the government”.	Strategic foresight integration

Table A2. Cont.

State	Source	Quotes	Element
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“In its activities the civil service uses foresight methods, takes decisions on the basis of dialogue with the public, evidence, and reliable data analysis, involves various stakeholders in decision-making in order to better understand and respond to public policy expectations”.	Strategic foresight integration
	Lietuvos Respublikos strateginio (2024)	“Future assessment—strategic management must be based on future insights, that is, when preparing planning documents, various future options and their impact on Lithuania in the context of European and global changes must be systematically and comprehensively analysed and assessed, and the assessment results must be submitted together with the planning documents to the participants of the strategic management system who approve them”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Spain 2050 has been conceived as an applied research device that aspires to be useful for society. Our work is part of the transformative foresight trend, which consists of studying the future in order to change decision-making in the present”.	Proactive and future-oriented approach
EE	Estonia 2035 (2021)	“Development of a policy analysis and impact assessment system, including data mining and data use (open data and data protection, data monitoring, and forecasting), assessment of the administrative burden on enterprises, ensuring regional specificities and taking into account their needs”; “Amplifying the potential of all policy areas abroad (including through state strategies) and creating open innovation nests in Estonian representations in cooperation with the private sector”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The evaluation of the future and the related development of possible scenarios are gradually integrated into the development of long-term visions for individual public policy areas”.	
	Lietuvos Respublikos strateginio (2024)	“Strategic goals must be formulated by assessing the impact of state progress scenarios on Lithuania and individual areas of state activity”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Modernising public administration to create efficiency gains, and improving the policymaking process through a greater attention to empirical evidence, experimentation, evaluation, social collaboration, and the analysis of trade-offs”.	
	National Office of Foresight and Strategy of the Government of Spain (2025)	“Equipping the public administration with the capacity to create AI software tailored to the needs of each area of the welfare state”.	

Table A2. Cont.

State	Source	Quotes	Element
EE	Estonia 2035 (2021)	“Development of a policy analysis and impact assessment system, including data mining and data use (open data and data protection, data monitoring and forecasting), assessment of the administrative burden on enterprises, ensuring regional specificities and taking into account their needs”.	Evidence utilisation approach
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Lithuania’s long-term STI policy defines the relationship with: <...> evidence-based policy-making: from state-of-the-art data analysis to innovative decision-making, taking into account the needs and strategic interests of society or the country, balancing transparency of scientific results, availability of open data and adequate protection of intellectual property rights”.	
ES	European Commission: Joint Research Centre et al. (2023)	“Ensuring a progressive consolidation and reinforcement of a culture that attaches importance to incorporating scientific evidence and evaluation in making political decisions and designing public policies”.	
	Estonia 2035 (2021)	“Implementation of evidence-based policy-making (incl. development and implementation of the organisation and coordination of national R&D and it’s budgeting and monitoring system)”.	Evidence-informed decision-making approach
EE	Rokk et al. (2022)	“The selection of topics is based on the research needs of the ministry. The research needs of ministries are mostly mapped once a year, when the next year’s activity plan and budget are planned. The content of the research topics mainly comes from the ministry’s content departments and/or subordinate institutions”; “The activities of RITA2 are aimed at achieving the following goals: (1) to increase the volume of applied research with national and socio-economic goals, the state is a smart customer of applied research and development work and a user of research results; (2) decision-making processes are science- and evidence-based”.	
	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“In its activities the civil service uses foresight methods, takes decisions on the basis of dialogue with the public, evidence and reliable data analysis, involves various stakeholders in decision-making in order to better understand and respond to public policy expectations”.	
LT	Lietuvos Respublikos strateginio (2024)	“Evidence-based management—public management decision-making must be based on monitoring data on achieved results and assessment of the financial, administrative, social and other impacts of decisions” (Article 4, 3 paragraph)	

Table A2. Cont.

State	Source	Quotes	Element
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Spain must: <...> create more effective and transparent evaluation tools for training and requalification policies to facilitate evidence-based decision-making”.	Evidence-informed decision-making approach
	Ley 27/2022 (2022)	“Regarding the principle of efficiency, the regulation, through evaluation, promotes the efficient use of public resources by formulating evidence-based public policies and does not impose additional administrative burdens on citizens”; “Public policies must be solidly formulated in their technical aspects, based on evidence, respond to the needs and challenges of society, identify their public value based on criteria, and define a metric that allows for their evaluation”.	
EE	Estonia 2035 (2021)	“Improving crisis preparedness by raising awareness of potential threats among public authorities, local authorities and vital service providers, and preventing and mitigating potential risks; <...> increasing the preparedness of state institutions, local governments, communities and the population for crises and for mitigation of consequences of the crisis or recovering from the consequences”.	Agility in managing complex interactions
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The strategic, agile and effective governance associated with a strong self-reliant society and strong state institutions capable of anticipating future changes together with the public, managing responsibility to the public and future generations, setting development priorities properly and implementing them consistently; able to innovate and adapt quickly to changing environments”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“It is also the way to achieve a solid welfare state that reduces inequality without incurring chronic public deficits, and the only way to reduce our country’s fragility when faced with episodes of economic crisis such as the current one”.	
EE	Estonia 2035 (2021)	“Crisis preparedness: improving crisis preparedness by raising awareness of potential threats among public authorities, local authorities and vital service providers, and preventing and mitigating potential risks”; “Bringing people’s knowledge, skills, and attitudes in line with the needs of the labour market and structural changes in the economy”.	Capability to sense and act on changes
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The cultural potential is being harnessed to develop democratic mindset awareness and humanity, to strengthen social cohesion and to involve various cultural groups in society, to constantly rethink identity and to build the future”.	

Table A2. Cont.

State	Source	Quotes	Element
ES	European Commission: Joint Research Centre et al. (2023)	“To move towards consolidation and anchor cultural change, it is essential to design additional governance and interface structures, which help to establish and nurture the connection between the existing expert knowledge in science and academia and the needs of public decision-makers”.	Capability to sense and act on changes
	National Office of Foresight and Strategy of the Government of Spain (2025)	“Equipping the public administration with the capacity to create AI software tailored to the needs of each area of the welfare state”; “Create a system of virtual agents to assist citizens in their interaction with the public administration”.	
EE	Estonia 2035 (2021)	“Increasing the knowledge transfer capacity of research institutions and universities (incl. training of employees, development and provision of new services)”; “Facilitating the mobility of employees between universities, enterprises, and the public sector”.	
	Rokk et al. (2022)	“The RITA2 research process begins with the opening of the program’s application round, for which the RITA program manager sends a notice to the research advisors that ministries can start proposing research topics. All ministries can participate in proposing research topics”; “The role of research advisors is highly valued, including their role in coordinating R&D work within the ministry and in increasing communication and information exchange between ministries”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“In order to achieve good networked interaction, a flexible strategic coordination network is developed by searching for common platforms across sectors and fields to address complex and long-term challenges, mobilising appropriate expert and analytical support, exploiting better linkages between state-funded scientific priorities and the future challenges of Lithuanian society, developing specialised analytical and advisory structures as intermediaries between decision-makers and science, and promoting the development of foresight independent of government”.	Knowledge brokerage mechanism
	European Commission: Joint Research Centre et al. (2025)	“Recent developments underscore a growing recognition among policymakers of the critical role of evidence—especially scientific evidence—in shaping effective policy. <...> Another notable example of this progress is the rollout of the Science and Innovation Advisers (S&IA) network, supported by stakeholders and institutions such as the Research Council of Lithuania and STRATA, which serve as both evidence providers and knowledge brokers”.	

Table A2. Cont.

State	Source	Quotes	Element
ES	European Commission: Joint Research Centre et al. (2023)	“The successful operation of additional structures would, inter alia, require specialised professionals with a knowledge of both science and policymaking. While there is high capacity in the public administration system and in science and academia, few stakeholders in the advisory ecosystem have specific competences for dialogue and knowledge exchange between science and policy, or to exercise responsibilities in science diplomacy”.	Knowledge brokerage mechanism
EE	Estonia 2035 (2021)	“Improving crisis preparedness by raising awareness of potential threats <...> and for mitigation of consequences of the crisis or recovering from the consequences”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The cultural potential is being harnessed to develop democratic mindset awareness and humanity, to strengthen social cohesion and to involve various cultural groups in society, to constantly rethink identity and to build the future”; “Promptly respond to changes occurring in international value chains, i.e., align the efforts of businesses, science, and state institutions to flexibly capitalise on the opportunities presented by these changes for breakthroughs in advanced economic sectors”.	Influencing policy conditions and events
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“The convergence pathways have been designed through a careful analysis that takes account of past trajectories, projected future trends, dozens of comparative policy cases and the interdependence between goals”.	

Table A3. Legal elements of integrating frameworks.

State	Source	Quotes	Element
EE	Teadus (2019)	“In organizing research and development activities, the Government of the Republic: (1) formulates a research and development policy that takes into account the assumptions, conditions and needs of Estonia and prepares development plans for the field that guide the country’s research and development activities; <...> (3) ensures cooperation between ministries in implementing research and development policy, taking into account the proposals of the Research and Development Council” (Chapter 3, Article 10, 1 and 3 paragraphs).	System of institutions, rules, and norms
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“To base the digitisation and opening up of data on high ethical and security standards”; “All citizens have equal opportunities to exercise the political rights and freedoms <...> to participate in the deliberations of public issues, and public policy decisions are taken on the basis of evidence and future insights, taking into account the values of society, respect for the individual and seeking common good”.	

Table A3. Cont.

State	Source	Quotes	Element
ES	Gobierno De España, Ministerio de Ciencia e Innovación (2022)	“Spain has taken important steps in this regard with the creation in March 2022 of the Office of Science and Technology of the Congress (Office C), < . . >. The objective of Office C is to incorporate the practice of scientific advice into the Spanish parliamentary culture and to contribute to decision-making and the development of public policies that are better informed by scientific knowledge, through the preparation of reports on various subjects, as well as complementary activities for the dissemination and discussion of these reports and to connect the scientific community with members of Congress and society”.	System of institutions, rules, and norms
EE	Rokk et al. (2022)	“RITA’s activities: 1. national strategic research, 2. policy-making research, 3. support for the activities of scientific advisors, and 4. RDI policy monitoring research”.	
	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The aim is to make the coordination centres and analytical institutions of the Lithuanian future ecosystem an active part of the international ecosystem of anticipatory governance”.	
LT	Lietuvos Respublikos strateginio (2024)	“Evidence-based management—public management decision-making must be based on monitoring data on achieved results and assessment of the financial, administrative, social and other impacts of decisions” (Article 4, 3 paragraph).	
	European Commission: Joint Research Centre et al. (2025)	“Lithuania possesses the essential components of an EIPM ecosystem, including key actors, institutions, and established policy frameworks”.	Regulatory frameworks for evidence integration
ES	European Commission: Joint Research Centre et al. (2023)	“Improving data governance by government in order to facilitate access and reuse by citizens and the research community. Despite the progress made since the adoption of the Law on Transparency, Access to Information and Good Governance in 2013, there are still problems such as limits on accessing key data for diagnosing problems or evaluating policy, as well as the rigidity of data structures and formats, among others”; “The Law on Science, Technology and Innovation (LSTI), which amends the previous Law of 2011, entered into force in September 2022. < . . > The LSTI also stresses the need to adapt and update the criteria for the assessment of the merits and career of research staff, taking into account actions for valorisation and transfer of scientific knowledge, including science advice”.	
	Estonia 2035 (2021)	“Empowering the Estonian people, communities and civil associations and supporting participation in governance in policymaking and the provision of services and developing opportunities for greater use of referendums and initiatives”.	
EE	Planeerimiseadus (2024)	“The planning procedure is public. The organizer of planning activities must inform the public about the planning procedure in a clear manner, sufficiently involve them in the procedure, and organize public displays and public discussions to introduce the plan during the preparation of the plan. Everyone has the right to participate in the planning procedure and to express an opinion on the plan during it” (Chapter 2, Article 9, 1–2 paragraphs).	Engagement of diverse societal actors

Table A3. Cont.

State	Source	Quotes	Element
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“All citizens have equal opportunities to exercise the political rights and freedoms <...> to participate in the deliberations of public issues, and public policy decisions are taken on the basis of evidence and future insights, taking into account the values of society, respect for the individual and seeking common good”.	Engagement of diverse societal actors
	Lietuvos Respublikos strateginio (2024)	“Openness and inclusion—planning documents must be prepared and implemented by involving all stakeholders in decision-making processes and in consultation with society, social and economic partners. Information on the progress achieved and the funds used must be clear, understandable and publicly available” (Article 4, 6 paragraph).	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Strengthen public institutions so that they can continue to develop effective, comprehensive and ambitious policies, and foster partnerships between the public sector, the private sector and civil society”; “Strengthening scientific and technological research in universities and its transfer to the productive network. <...> and the creation of consortiums between universities, research centres, the private sector and public administrations encouraged, with their own legal status”.	
EE	Estonia 2035 (2021)	“Knowledge-based and high-quality policymaking of the country as a whole: implementing co-creative policymaking (including the development and implementation of a legislative and engagement toolbox)”.	
	Rokk et al. (2022)	“The tasks of scientific advisors are to advise the ministry on R&D issues, to plan and organize international and domestic R&D cooperation, to develop R&D research plans in their area of government and to implement them in cooperation with various parties, represent Estonia in international R&D cooperation initiatives”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Lithuania fully understands the values, interests, capabilities, and needs of its partners, formulates its political positions based on the principles of solidarity, subsidiarity, mutual assistance, and collective action. Acting in unison with a broad coalition of like-minded partners, Lithuania purposefully seeks to ensure that the multilateral cooperation system reflects legitimate expectations of world states, meets the needs of the times, and contributes to addressing common challenges to the planet, humanity, and the protection of human rights”; “There is a relationship of mutual trust and openness between citizens and public authorities. <...> The principles of open governance, namely transparency, accountability, involvement of stakeholders, and, where feasible, participatory and deliberative forms of democracy, beginning at the local level, are being developed”.	Roles and responsibilities in policymaking

Table A3. Cont.

State	Source	Quotes	Element
ES	European Commission: Joint Research Centre et al. (2023)	“Spain has a well-developed R&D&I system; the newly created structures and bodies show the commitment of the government and parliament to promote scientific and expert advice and to provide the necessary resources; this is the result of the awareness and commitment of an important part of the political establishment and the scientific community; and there is an ostensible interest in society to participate in policymaking and in political decision-making processes. All this lays the foundations for enriching relations between knowledge producing and transmitting stakeholders and public administrations”; “Public administrations are key players in the Innovation System, not only as RDI funders or R&D implementers (such as OPIs), but as a key domain/context for introducing innovations that improve public management processes and policy design and implementation”.	Roles and responsibilities in policymaking
EE	European Commission: Joint Research Centre et al. (2024)	“Legal and ethical concerns limit the use of innovative methods. It would be beneficial to train and engage more legal departments to be willing to take on more risks with new methods for possible greater gain or to enable secure spaces for experimentation such as regulatory sandboxes and policy randomised-control trials, with the active co-creation with the scientific community”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Alongside the values of preserving identity, freedom and equality, respect for human dignity and justice, which people believe we should be guided by when constructing our future, community spirit has emerged as one of the key values”; “Awareness-raising therefore enables society to become aware of the impact of technology on human life and the environment, and self-reflection encourages the critical evaluation and improvement of the application of technology in the light of ethical values”; “The principles of open governance, namely transparency, accountability, involvement of stakeholders, and, where feasible, participatory and deliberative forms of democracy, beginning at the local level, are being developed”.	Ethical guidelines for scientific advising
ES	European Commission: Joint Research Centre et al. (2023)	“Also in December 2022, Law 27/2022 on the institutionalisation of evaluation of public policy in the Central State Administration was approved. The Law forms part of the commitment to modernise the public administrations to strengthen the public system for their evaluation, undertaken within the framework of the RTRP. Its aim is to ‘institutionalise evaluation as a tool for collective and organisational learning, improvement of public service and accountability and transparency, contributing to the effectiveness and efficiency of public action”.	

Table A4. Institutional elements of integrating frameworks.

State	Source	Quotes	Element
EE	Estonia 2035 (2021)	“Development of data management, secure cyberspace, a unified and high-quality data space, and digital state infrastructure: introduction of data management-friendly and people centred data management (incl. in the legal space and with technical solutions) and the promotion of secure access to data from various sources for the development of services; promoting distributed data management infrastructure (such as the population register) and data exchange architecture at the national and local government level, creating a single European data area <...>; development and implementation of a future-proof digital identity”.	Broad-based management capacity
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The valorisation of knowledge, a process based on the creation, dissemination and transfer of knowledge and carried out in all areas of public administration through policy decisions, with a view to achieving innovation abundance, sustainability, the responsible management of intellectual assets, the modernisation of work and workplaces, and the promotion of cooperation between business and academia”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Implement effective multi-level, networked anticipatory governance systems in order to take best advantage of territorial synergies, streamline available resources and create new shares responses to the economic, social and environmental challenges of the future”.	
EE	Estonia 2035 (2021)	“Implementation of evidence-based policymaking (incl. development and implementation of the organisation and coordination of national R&D and it’s budgeting and monitoring system)”; “ensuring the quality of research infrastructure and opening it up for joint use, taking into account the needs of both entrepreneurs and the public sector”.	Institutional capacity for evidence-informed policymaking
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Significant role is played by the promotion and presentation of Lithuania’s RDI potential abroad, attracting direct foreign investment into RDI activities”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Leverage digital technologies to expand and integrate the various available databases, making them a key tool for policy and programme monitoring, evaluation and design”.	

Table A4. Cont.

State	Source	Quotes	Element
EE	Estonia 2035 (2021)	“Organising the network of research institutions and state-owned foundations, taking into account balanced regional development”; “Improving the wider availability and use of research results (including the development of open science)”.	Institutional capacity for knowledge brokering (science-for-policy)
	Rokk et al. (2022)	“The tasks of scientific advisors are to advise the ministry on R&D issues, to plan and organize international and domestic R&D cooperation, to develop R&D research plans in their area of government and to implement them in cooperation with various parties, represent Estonia in international R&D cooperation initiatives”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“In order to achieve good networked interaction, a flexible strategic coordination network is developed by searching for common platforms across sectors and fields to address complex and long-term challenges, mobilising appropriate expert and analytical support, exploiting better linkages between state-funded scientific priorities and the future challenges of Lithuanian society, developing specialised analytical and advisory structures as intermediaries between decision-makers and science, and promoting the development of foresight independent of government”.	
ES	Gobierno De España, Ministerio de Ciencia e Innovación (2022)	“As part of this Plan, it is planned to continue supporting the activities of Office C and explore new avenues for scientific advice to the public sector. In this sense, there are plans to extend the Office C model to other areas of public administrations and state powers, beyond Congress, and to improve the scientific advisory systems in crisis situations contemplated in the National Security Strategy, as well as to introduce new complementary mechanisms for formal and informal scientific advice”.	Adaptive systems that self-organisation
EE	Estonia 2035 (2021)	“Knowledge-based and high-quality policymaking of the country as a whole: <...> Supporting innovative solutions, experiments and pilot projects”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“It’s a place where you can create value in different ways, engage in continuous learning, discover new ideas and experiment, feel useful at all ages of life and fulfil your potential”.	
ES	European Commission: Joint Research Centre et al. (2023)	“In the context of this report, the most relevant aspect of these data is the potential of the knowledge generated by and available to Spanish society to improve itself, to face its socio-political challenges and to play a leading role in the field of international science diplomacy”.	

Table A4. Cont.

State	Source	Quotes	Element
EE	Estonia 2035 (2021)	“Knowledge-based and high-quality policymaking of the country as a whole: implementing co-creative policymaking (including the development and implementation of a legislative and engagement toolbox)”.	Co-production of knowledge mechanism
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Co-creation involving civil society organisations and members of society, social partners and the academic community is used to create and improve the public sector”; “Citizens willingly and extensively participate in state governance, while institutions actively seek methods to engage underrepresented groups in public life”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Improving the system of multilevel governance in the field of innovation, with the primary goal of coordinating the country’s innovation initiatives from a new holistic perspective and orienting them towards strategic missions that take advantage of emerging areas of opportunity (detecting new markets), in line with the EU’s agreed aims. In this regard, the synergies between the range of R&D, innovation, entrepreneurship and digitalisation policies and bodies will need to be strengthened, taking advantage of the opportunities offered by public-private consortia”.	
EE	Estonia 2035 (2021)	“Creating incentives for research institutions and researchers to take the lead in international cooperation networks”	Networking and relationship building in policy
	Rokk et al. (2022)	As a result of RITA’s activities 3: the capacity of ministries to coordinate R&D in their area of government has increased; the ministry has an overview of the R&D competencies in the ministry’s area of government and the country’s R&D needs; testing; established forms of cooperation between ministries for additional funding and better organization of R&D in areas of government; greater awareness of international cooperation achieved”.	
	European Commission: Joint Research Centre et al. (2024)	“RITA programme (2015–2023) can certainly be considered one of the most important strategic measures for evidence-informed policymaking. <...> Rebuilding trust among key stakeholders and co-creation of solutions considering all actors and organisations seem necessary to moving forward successfully”.	
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Governance system openness, transparency, and respect for diversity, that is openness of the government and its trust in people, the necessity for stakeholders to be involved in public policy decisions from the definition of the public policy problem to the evaluation of the public policy, and the integration of human rights into the decision-making process”.	

Table A4. Cont.

State	Source	Quotes	Element
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Improve communication and collaboration between the different institutions (public and private) responsible for the design, implementation and evaluation of training and requalification in Spain, including state, regional and municipal administrations, companies, VT centres, universities, postgraduate schools, academies, and many more”.	Networking and relationship building in policy
	Estonia 2035 (2021)	“Development of talent policy programmes (including measures for international students)”.	
EE	Rokk et al. (2022)	“As a result of RITA’s activities 3: the capacity of ministries to coordinate R&D in their area of government has increased; the ministry has an overview of the R&D competencies in the ministry’s area of government and the country’s R&D needs; testing; established forms of cooperation between ministries for additional funding and better organization of R&D in areas of government; greater awareness of international cooperation achieved”.	Fluid integration of knowledge and evidence
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“Acting in unison with a broad coalition of like-minded partners, Lithuania purposefully seeks to ensure that the multilateral cooperation system reflects legitimate expectations of world states, meets the needs of the times, and contributes to addressing common challenges to the planet, humanity, and the protection of human rights”; “Each of the changes <...> will have multiple implications for the development of the Lithuanian society, <...> societal values, and the cultural identity of Lithuania”.	
ES	National Office of Foresight and Strategy of the Government of Spain (2021)	“Develop a nationwide urban policy which promotes sustainable, inclusive and resilient long-term urban development and incorporates potential health risks and benefits as the criteria for decision making”.	Risk mitigation in uncertain environments
EE	Estonia 2035 (2021)	“Ensuring the security and security of supply of communication networks; ensuring cyber security in the digital society, including the systematic and continuous assessment of cyber risks, the updating of their management measures to ensure the security and reliability of cyberspace, and the development of capabilities for the management of cyber incidents and crises (including the development of common EU procedures)”; “Improving crisis preparedness by increasing the capacity for rapid response and special operations, mass management, protection of persons and objects, and ensuring compliance with changing security threats (including in cooperation with other countries)”; “Improving crisis preparedness by raising awareness of potential threats among public authorities, local authorities and vital service providers, and preventing and mitigating potential risks”.	

Table A4. Cont.

State	Source	Quotes	Element
LT	Office of the Committee for the Future of the Seimas of the Republic of Lithuania (2023)	“The political order will continue to be a cornerstone of our future; however, its more specific forms may change depending on how Lithuania and its allies will succeed in defending and consolidating democratic values in the face of ever-growing conflicts”.	
ES	Ley 27/2022 (2022)	“At the strategic level of public policymaking, the public value of evaluation lies in improving the decision-making process and accountability to citizens, and in strengthening trust in public institutions and the quality of democracy. At the managerial level of public action, evaluation and its institutionalization represent a cultural shift in the administration that, for the first time, proactively integrates a tool for improvement and transparency into planning on a permanent basis”.	Risk mitigation in uncertain environments

Appendix C

Table A5. Most frequent analytically relevant keywords * in the Estonian, Lithuanian and Spanish science-for-policy ecosystem study.

Country	Rank	Keyword	Frequency
Estonia	1	research	602
	2	ministry	535
	3	science	522
	4	adviser	325
	5	need	306
	6	foresight	233
	7	EIPM	213
	8	knowledge	207
	9	strategic	198
	10	scientific	170
	11	advice	162
	12	role	157
	13	network	147
	14	innovation	147
	15	funding	142
	16	universities	141
	17	development	128
	18	impact	127
	19	capacity	124
	20	researchers	123
Lithuania	1	research	765
	2	EIPM	397
	3	ministry	380
	4	science	346
	5	scientific	305
	6	state	272

Table A5. Cont.

Country	Rank	Keyword	Frequency
Lithuania	7	researchers	270
	8	institutions	242
	9	office	237
	10	activities	219
	11	need	218
	12	impact	217
	13	strategic	213
	14	development	191
	15	network	190
	16	knowledge	187
	17	support	175
	18	policymakers	173
Spain	19	system	165
	20	implementation	155
	1	scientific	223
	2	science	156
	3	ministry	146
	4	research	141
	5	knowledge	130
	6	technical	90
	7	advice	89
	8	advisory	83
	9	staff	74
	10	ecosystem	73
	11	evaluation	72
	12	information	69
	13	organisation	69
	14	political	69
	15	expert	67
	16	stakeholders	64
	17	bodies	64
	18	functions	63
	19	national	62
	20	state	59

* Frequencies are absolute counts within the analysed national ecosystem study. Country names, institutional acronyms, technical artefacts, document-navigation terms, and contextually uninformative generic terms were excluded using consistent criteria. Simple grammatical variants were combined (e.g., ministry/ministries; adviser/advisers; need/needs). Because the source documents differ in length, frequencies should be interpreted within each document and not as direct measures of cross-country prominence.

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