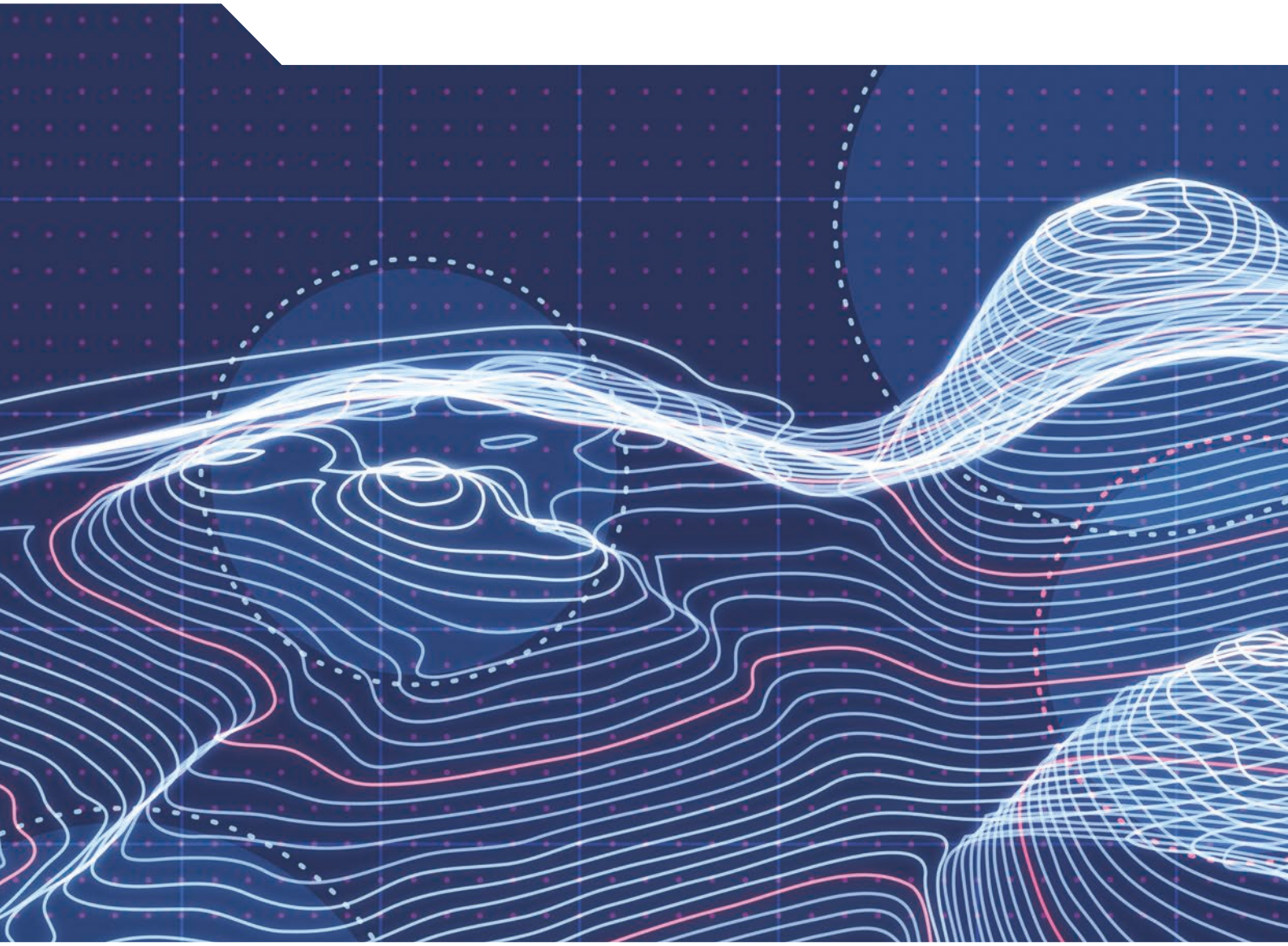
OECD Public Governance Reviews

The Public Governance of Anticipatory Innovation Ecosystems in Latvia

EXPLORING APPLICATIONS IN KEY SECTORS



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OECD
BETTER POLICIES FOR BETTER LIVES

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Foreword

Organisations around the world are faced with a series of complex and interconnected developments, ranging from environmental tipping points to security threats and accelerated technological shifts. Governments are struggling to make sense of this reality and respond in an adequate way, not just to tackle crises, but also to identify future opportunities. Anticipating change and harnessing it for innovation is a promising approach to successfully navigate an uncertain world and survive in global competition. But no single institution can do this alone. A range of perspectives and expertise are needed to tackle the kinds of challenges societies face today and will confront in the future.

Governments need to build capacity for effective collaboration across sectors, bridging organisations and expertise to harness collective intelligence. This means being able to put in place and effectively manage partnerships today that can respond to change tomorrow. These partnerships among governments, research organisations, private sector organisations and civil society can help develop collective solutions before windows of opportunity are lost or crises hit. With a dedicated focus on anticipation, this diversity of actors can develop a collective understanding of the possible futures ahead, navigate uncertainty and help governments make better decisions in the present.

This report offers an approach for governments to systematically design and develop anticipatory innovation ecosystems. Governments need a dedicated governance capacity to manage these ecosystems and harness bottom-up anticipatory insights for the benefit of policy making. The OECD has been working with Latvia to examine how the country's governance processes and mechanisms need to be transformed to enable ecosystem innovation across key sectors in a systematic manner. The work has identified processes to improve and integrate governance at the policy (meso) and ecosystem (micro) levels, so that insights generated by ecosystems can be fed upstream into policy decisions and ecosystem development can be steered in a strategic way. This fosters an environment suitable for innovation which draws on local and network-dependent strengths while keeping abreast of potential future developments.

The insights contained in this report were gathered through on- and offline workshops and interviews with over 80 ecosystem stakeholders in Latvia, as well as desk research and interviews to identify good practice for anticipation and innovation ecosystem governance globally. The report can be used to enhance innovation in key sectors for Latvia including: knowledge-intensive bioeconomy; biomedicine, medical technologies, bio-pharmacy and biotechnologies; smart materials, technologies and engineering systems, smart energetics; and information and communication technologies (ICT).

Investing in the governance of anticipatory innovation ecosystems is important for tackling the great missions of our time, ranging from sustainability to societal challenges such as demographic change. It is a model that can be applied across sectors to create capacity and improve strategic thinking through collaboration. Latvia is in a privileged position to spearhead this work: the country is faced with innovation challenges that affect small economies and needs to pre-empt and adjust to external developments in a way that makes the best use of its agile economic landscape. With the help of anticipatory innovation ecosystems, Latvia can identify future opportunities in a systematic manner and connect them to existing capacity across organisations. This work can be an example for governments around the world looking for more effective ways to thrive in an uncertain environment.

Acknowledgements

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A wide range of individuals have contributed to the success of the project. The OECD thanks the LIAA team Anda Paegle, Elīna Peiseniece and Inta Raiena for their close partnership on the project and coordination of research in Latvia, and Kaspars Rožkalns, Laura Štrovalde and Ņikita Kazakevičs for their guidance and insights. Special thanks also go to earlier contributors to the project including Natālija Pavļuha, Jānis Nīgals, Lauma Muižniece, Andrejs Berdņikovs (LIAA), Chiara Bleckenwegner (former OECD consultant). The OECD would like to give special thanks to all those who contributed their knowledge through research interviews to better understand innovation ecosystem case studies and the context in Latvia, and who participated in online and in-person workshops and interventions. Special support in the form of workshop facilitation and analytical input was provided by design researcher and ecosystem expert Cristian Matti from the European Commission's Joint Research Centre Competence Centre on Foresight and Bruno Monteiro of the OECD.

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Abbreviations and acronyms

AIG	Anticipatory Innovation Governance
ALTUM	Latvian Development Finance Institution
CFCA	Latvian Central Finance and Contracting Agency
EC	European Commission
EDP	Entrepreneurial Discovery Process
EIT	European Institute of Innovation and Technology
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
EU	European Union
EV	Electric Vehicle
FAIR data principles	Findable, Accessible, Interoperable, and Reusable
IP	Intellectual Property
JRC	European Commission's Joint Research Centre
KIC	Knowledge and Innovation Communities
LCS	Latvian Council of Science
LIAA	Investment and Development Agency of Latvia
MoE	Latvian Ministry of Economics
MoES	Latvian Ministry of Education and Science
OPSI	OECD Observatory of Public Sector Innovation
PESTLE	Political, Economic, Social, Technological, Legislative, Environmental
PRI	Partnerships for Regional Innovation
R&I	Research and Innovation
RIS3	Research and Innovation Strategy for Smart Specialisation
RRI	Responsible Research and Innovation
RTU	Riga Technical University
S3	Smart Specialisation Strategy
STEM	Science, Technology, Engineering, Mathematics
STI	Science, Technology and Innovation
SWOT	Strengths, Weaknesses, Opportunities, Challenges
ToC	Theory of Change

Executive summary

The fast-paced change occurring in domains as different as artificial intelligence, biotechnology and environmental protection presents governments with both opportunities and challenges. While innovations resulting from the rapid development of new technologies have the potential to contribute to prosperity and address grand challenges such as climate change and inequality, their impacts on society, individuals and the environment are uncertain. In this context, the ability of the public sector to proactively govern innovation is increasingly important so that it can be directed towards pathways that are likely to deliver collective benefits, and away from negative consequences.

This proactive shift can be supported by anticipation, a process through which actors use foresight approaches such as futures scenarios to systematically ask questions about plausible futures to inform public action in the present. The leap from asking questions about the future to using the answers they generate can be challenging. The OECD anticipatory innovation governance (AIG) framework sets out mechanisms that governments can use to create the conditions for effective anticipation and proactively steward change though experimentation and innovation.

Informed by research undertaken as part of a two-year partnership between the OECD and the Investment and Development Agency of Latvia (LIAA), this report is a case study of the potential application of the AIG framework to develop and manage *anticipatory innovation ecosystems* as vehicles for knowledge generation, innovation governance and co-ordinated action to bring about preferred futures. The focus is on the role of government in building the right structures, mechanisms and capabilities to design and develop effective anticipatory innovation ecosystems. In an anticipatory innovation ecosystem, actionable knowledge about the future is created through activities that enable a collective consideration of future needs, opportunities and challenges by ecosystem partners from research, industry, government and civil society. This knowledge can help ecosystem partners innovate and governments become more proactive in their policy design. The relationships established through the ecosystem development process also lay the foundations for co-ordinated action by ecosystem partners to achieve outcomes that would not be possible for them individually, thereby building innovation capacity.

Anticipatory innovation ecosystems can be helpful in a range of policy areas which require transversal coordination, including addressing skills gaps and development and the challenges of aging populations. Given Latvia's interest in developing innovation ecosystems for 'Smart Specialisation' in technological domains where the country has current and potential advantages, the report focuses on the application of anticipatory approaches to inform technological innovation.

Key findings

The report consists of two parts. Part I establishes the case for anticipatory innovation ecosystems and sets out how they can be governed through a multi-level approach. In Part II, opportunities and challenges for applying this approach in the Latvian context are identified, and recommendations are made for next steps.

Part I outlines two nested levels of governance for the development of effective anticipatory innovation ecosystems. The first, 'micro-governance' concerns the engagement of relevant stakeholders and the ongoing facilitation of collaboration within the ecosystem. The micro-governance of ecosystems is sustained by four processes: the engagement of diverse stakeholders; an orientation around shared innovation goals; collaboration; anticipation, learning and adaptation. Government can play an important role in initiating and monitoring these processes; guidance on this is provided in Chapter 2. The second, 'higher', level, 'meso-governance', concerns the functions, practices and structures that facilitate the relationship between government policy and the innovation ecosystem. Seven functions for government in enhancing meso-governance are identified: orchestrating, framing, championing, market building, funding and regulating. Government actors can explore how best to exercise these functions to provide co-ordinated support to ecosystems.

Part II begins with an exploration of the Latvian context before proposing a three-phase process for developing anticipatory innovation ecosystems in Latvia. The initiation phase sets out an overarching purpose and roles for the government support of ecosystems. During the development and maintenance phase, activities to establish micro-governance processes among ecosystem partners are initiated. The exit phase focuses on the approaches that government can use to determine the ongoing value of their support of an ecosystem and identify opportunities to withdraw.

The report concludes with findings and recommendations to help Latvia improve its governance of anticipatory innovation ecosystems and ensure that its government can benefit from the futures-oriented knowledge they generate to become more proactive in a fast-changing and uncertain world. These are summarised below:

- Understanding and expectations of anticipatory innovation ecosystems are not well aligned or communicated. Educating key stakeholders, communication and developing a coherent programme theory of change can help drive engagement and a shared understanding.
- The level and type of support provided to anticipatory innovation ecosystems in Latvia is not adequate for their needs: Regular assessment of ecosystem needs through meso-governance functions can help government actors in the Innovation and Research Governance Council identify and co-ordinate support.
- The connections among existing resources, initiatives and funding and the anticipatory innovation ecosystem programme are underdeveloped: LIAA and the Innovation and Research Governance Council could consistently work to identify relevant resources and funding opportunities.
- Structures and processes for feeding insights generated by anticipatory innovation ecosystems into public sector decision processes are not sufficient: LIAA could analyse ecosystem insights and produce regular reports on future opportunities and threats. The Innovation Research and Governance Council could feed this knowledge back into policy.
- The knowledge and capacity of ecosystem partners to facilitate anticipatory innovation ecosystem methods is limited: Latvia could develop LIAA's capacity to design and facilitate relevant activities that enable the development of micro-governance processes and the generation of anticipatory knowledge.
- Ecosystem partners require clarity about the purpose of ecosystem activities: Each ecosystem could collaboratively develop a theory of change so that the orientation of activities around shared goals can be established and success can be monitored.
- Resources need to be targeted to support the development of innovation ecosystems: LIAA could prioritise a limited number of ecosystems based on its capacity to support them and engage external and ecosystem stakeholders to provide additional resources.
- Key ecosystem stakeholders are not consistently engaged: Latvia could communicate high-level commitment to ecosystem support by assigning an ecosystem leadership function to a senior executive in LIAA, and ensure that engagement plans for stakeholders are developed.

Part I Developing a governance approach for anticipatory innovation ecosystems

1 Enhancing innovation ecosystems in Latvia through anticipatory governance

Applying anticipatory innovation governance (AIG) approaches to innovation ecosystems allows governments to harness the collective intelligence of diverse stakeholders and lead change. Incorporating strategic foresight and other futures approaches directly in innovation ecosystem management enables governments to stimulate transformative innovation and build up new value chains. This chapter outlines the promise of anticipatory innovation ecosystems and describes how the OECD has worked with the Investment and Development Agency of Latvia (LIAA) to explore how they might be fostered through appropriate public governance.

Introduction

The fast-paced change occurring in domains as different as artificial intelligence, biotechnology and environmental protection presents governments with both opportunities and challenges. On the one hand, innovations resulting from the rapid development of new technologies have the potential to contribute to national prosperity and address grand challenges such as climate change and inequality. On the other, not all innovations are successful and the impacts of new innovations on society, individuals and the environment are uncertain (OECD, 2018[1]). The consequences of innovation may run counter to established policy objectives and create social and environmental disruption. In this context, the ability of public sector to proactively govern innovation is increasingly important so that it can be directed towards pathways that are likely to deliver collective benefits, and away from negative consequences.

This capacity for proactivity is particularly important for small states, which can lack the critical mass in their research and development (R&D) and markets to test upscaling processes, but which can leverage close networks of stakeholders and less complex administrations to experiment in areas of promising early innovation (Tõnurist, 2017[2]). For small states entering early into emerging value chains, finding critical technology niches is essential for long-term value-added productivity growth. Industry and markets in general spot these opportunities, but for smaller economies this is often not a reliable strategy. Governments often need to provide "patient capital" and direction to overcome uncertainty in early investments to build up new economic sectors (Mazzucato, 2015[3]). In smaller countries, where resources are limited, this relies on the capacity of government to detect viable investments and opportunities in its economy and partner regionally to develop place-based advantages (proximity helps to facilitate trust between partners, lower transaction costs, and make use of system externalities) (Tõnurist and Kattel, 2016[4]). Furthermore, as innovation increasingly depends on global value chains, creating local innovation hubs becomes even more important as embeddedness and existing synergies in local networks predetermines the ease in which companies are able to move from country to country and also the ability of the country to attract more investments (Bergek et al., 2015[5]). In its Guidelines for National Industrial Policy 2021-2027, the government of Latvia has recognised these challenges, opportunities, and strengths small states face. The Guidelines detail Latvia's ambitions to promote the identification and development of pathways for innovation through a combination of bottom-up business and innovation discovery and more responsive policymaking (Government of Latvia, 2021[6]).

Anticipatory innovation governance (AIG) is a future oriented and opportunity focused approach that can be applied in Latvia to help achieve these aims. AIG sets out mechanisms that allow governments to develop and act on knowledge about the future in order to identify potential opportunities proactively and steward change through 'anticipatory' innovation (Box 1.3 describes different facets of innovation). Effective AIG is dependent on the ability of government to leverage the knowledge and experiences of diverse stakeholders through networks and partnerships and public participation. Unlocking the collective intelligence of actors across government, industry, research and civil society can allow a wide range of signals about the future to be collected and interpreted, providing all parties with valuable insights for strategic decision-making. This knowledge can be used to direct innovation towards more inclusive, high-potential outcomes (OECD, 2018[1]). It may also be applied by governments to inform policy in other areas affected by rapid change and uncertainty, such as the labour market (Box 1.1) or policy areas which face complex challenges and are dependent on society-wide solutions (such as aging) (Box 1.2).

Box 1.1. Finland: An anticipatory ecosystem approach to the governance of continuous learning

The world of work is continuously transformed by the complex interaction of trends such as automation, climate change and an aging population. The changes they precipitate affect the demand for skills: jobs and tasks in one sector may disappear while others emerge which require new combinations of competencies. In addition, these trends alter demands for the provision of learning: new forms of self-employment such as 'gig-work' may create opportunities for individuals to learn at times that suit them, but they also challenge expectations about employers' role in skill development.

Against this backdrop, Finland has recognised the need for a reform of continuous learning to create a system that is able to anticipate and respond to changes in the demand for skills and learning across the labour market and broader society. The OECD worked closely with representatives of the Finnish government to explore how the anticipatory innovation governance (AIG) framework could inform the governance such a system.

Enhancing anticipatory innovation governance through the collective intelligence of diverse stakeholders

The challenge of developing an anticipatory system for continuous learning in Finland was characterised by two key features.

First, the breadth of stakeholders int the continuous learning system (including businesses and trade unions) and the autonomy of municipalities and education providers in Finland was likely to mean that hierarchically imposed changes would experience resistance. Furthermore, central government was unlikely to have sufficient capacity for processing information about the actions and effects of sub-agencies, making centralised management difficult to achieve.

Second, information about future changes to jobs and skills is often contested and subject to different ideological interpretations, for instance about the causes of low levels of engagement in adult learning. This means that deliberation is likely to be required in to create an evidence base for decision making that is perceived as legitimate by a wide range of stakeholders.

The OECD proposed that Finland build on these features by developing a governance system that fosters **networks and partnerships** between governmental and non-governmental stakeholders and facilitates **collective sense-making** so that information about the changing context of continuous learning is gathered from a wide range of sources, and that policy decisions are based on consistently understood evidence and perceived as legitimate and realistic.

In this way, an ecosystem-like approach to generating and acting on knowledge about the future is applicable to policy contexts outside of innovation.

Source: OECD (2022[7]), *Anticipatory Innovation Governance Model in Finland: Towards a New Way of Governing*, https://doi.org/10.1787/a31e7a9a-en.

Box 1.2. Korea: Seoul 50+ Policy

Seoul50Plus ("50+") is an innovative mix of social welfare, employment, and lifelong learning policies geared towards supporting people 50 and older in a rapidly aging society. With an ecosystem of

stakeholders from the target group and supporting NGOs, the aim is to explore and anticipate new life models, life transitions and social participation in a centennial society.

The work is coordinated by the Seoul 50+ Foundation that carries out needs assessments and coordinates policy responses aimed to address social security blind spots in a new type of a society. Coordination has been necessary to ensure that gaps and overlaps with existing welfare services are minimised, and to ensure that a full range of services can be provided through partnership with private and civil society organisations. A comprehensive infrastructure comprising '50+ campuses' and '50+ centres' built on multi-sectoral collaboration provide services to members of the 50+ generation, including counselling, education and networking opportunities, but also new types of employment.

Source: OECD (2019[8]), *Public Value in Public Service Transformation: Working with Change*, https://doi.org/10.1787/47c17892-en; CPI (2018[9]), *The Seoul 50+ Initiative in South Korea*, https://www.centreforpublicimpact.org/case-study/seoul-50plus (accessed on 1 November 2022).

Informed by action research undertaken as part of a two-year partnership between OECD OPSI and the Investment and Development Agency of Latvia (LIAA), this report explores how governments might employ *anticipatory innovation ecosystems* as vehicles through which they can prepare for the future by consistently leveraging the collective intelligence of diverse stakeholders, and by orienting their actions towards delivering different types of value through innovation. OECD work on bioeconomy and biotechnology has emphasised the importance of innovation ecosystems in fostering value chains and industrial clusters, focusing on the inter-relation of state-sponsored technology development and firms (Philp and Winickoff, 2019[10]). The current report adopts a broader definition of an innovation ecosystem as an evolving, complex network of diverse organisations who collaborate to achieve shared innovation goals (Granstrand and Holgersson, 2020[11]; Klimas and Czakon, 2021[12]; Russell and Smorodinskaya, 2018[13]). Anticipation describes the act of "asking questions about plausible futures so that we may act in the present to help bring about the kind of futures we decide we want" (David Guston, in (OECD, 2018[1])). In an anticipatory innovation ecosystem therefore, actionable knowledge about the future is consistently generated through ongoing collective consideration of future needs, opportunities and challenges by ecosystem partners. This approach is therefore aligned closely with the ambitions set out in Latvia's Guidelines for the National Industrial Policy 2021-2027 (Government of Latvia, 2021[6]).

While a review of international cases conducted for this report has found that actors in many innovation ecosystems employ anticipatory techniques such as strategic foresight to explore possible futures and describe compelling visions, none have applied anticipation in systematic way. Similarly, while theoretical and practical work on future-oriented technology assessment (Cagnin, Havas and Saritas, 2013[14]) and the co-creation of policy initiatives (Matti et al., 2022[15]) have recognised how innovation-focused participatory foresight approaches can help governments anticipate and respond to change, little work has been done to leverage innovation ecosystems as a source of anticipatory intelligence for government. The anticipatory innovation ecosystem approach is therefore novel in its aim to apply anticipation as a consistent driver of innovation, and its use of innovation ecosystems to continuously generate strategic futures knowledge to inform government decision-making.

Who this report is for

The intended audiences for this report are individuals from government agencies with a mandate to stimulate innovation (such as LIAA), public officials who in their policy fields rely on cross-sectoral input for innovation (for example, to fulfil a mission) or wish to learn more about innovation ecosystem approaches and the impact of employing anticipatory methods. Non-governmental actors working with innovation

ecosystems will also benefit from reading this report, though some concepts and viewpoints will require translation to their contexts and needs.

Readers of this report will develop a clearer idea of the benefits and trade-offs of working through an anticipatory innovation ecosystem approach. They will understand governance functions that the public sector can play in initiating, supporting, monitoring and exiting anticipatory innovation ecosystems, based around an empirically-grounded model for ecosystem governance. Importantly, they will also have vocabulary and concepts to hand that they can use to gain buy-in for anticipatory innovation ecosystems from stakeholders in government, industry, academia and civil society.

How this work was undertaken

This project set out to explore how the application of anticipatory approaches by innovation ecosystems might stimulate anticipatory innovation and enhance the capacity of the Government of Latvia to proactively deal with transformative change.

Working in partnership with the Investment and Development Agency of Latvia (LIAA), OECD OPSI undertook practical, evidence informed interventions that engaged government actors and stakeholders in four existing technology networks in Latvia (Table 1.1). Combined with research interviews and a dedicated formative evaluation, this collaborative action-oriented approach served both to reveal insights about the effective public governance of anticipatory innovation ecosystems (with a particular focus on the Latvian context) and developed the capacity of LIAA to develop anticipatory innovation ecosystems. It was informed by extensive literature reviews, interviews with Latvian stakeholders and original case-study research covering 10 innovation ecosystems across Europe. For a detailed methodology, please see Annex A.

Table 1.1. Participatory workshops undertaken with stakeholders in Latvia

Date	Focus	Participants	Location
7 April 2021	Introduction to anticipatory approaches	Representatives of organisations working with photonics and smart materials	Online
28 April 2021	Map and assess potential ecosystems	LIAA team members	Online
27 October 2021	Identify opportunities for engaging ecosystem partners	LIAA team members	Online
14 December 2021	Explore and identify functions to be played by government representatives	LIAA team members, Ministry of Education and Science, Ministry of Economics	Online
22 January 2022	Develop a programme-level theory of change and ecosystem engagement plan	LIAA team members	Online
23 February 2022	Identify shared issues and objectives for the future of biomedicine in Latvia	Representatives of organisations working with biomedicine	Online
5 April 2022	Identify shared issues and objectives for the future of Photonics and Smart Materials in Latvia	Representatives of organisations working with photonics and smart materials	Online
12 April 2022	Stress-test the 2018 'LIBRA' strategy for the Latvian Bioeconomy against potential future changes	Representatives of organisations working in the bioeconomy	Online
21-22 April 2022	Co-develop agenda and activities for ecosystem engagement workshop in Riga	LIAA team	In-person (Paris)
17-18 May 2022	Identify a shared ecosystem vison and explore actions to achieve it	Representatives of organisations working with biomedicine	In-person (Riga)
14 June 2022	Identify shared issues and objectives for the future of Smart Mobility	Representatives of organisations working on smart mobility	Online
16 June 2022	Propose and prioritise ecosystem activities to achieve shared ambitions	Representatives of organisations working with photonics and smart materials	Online

The case for anticipatory innovation ecosystems

The role of innovation in a complex and rapidly changing world

To build the case for the public governance of anticipatory innovation ecosystems, it is necessary to establish why governments wish to stimulate innovation. Innovation is a process through which actors develop, implement and, in the private sector, commercialise new or improved products and processes (known as 'innovations') (OECD/Eurostat, 2018[16]). In the public sector context, a core aim of innovation is to create "impact" through public value (OECD, 2022[17]; 2019[8]). In general, public value represents a normative consensus of prerogatives, principles, benefits and rights that can be attributed to both governments and citizens (Jørgensen and Bozeman, 2007[18]), and linked to a variety of values like effectiveness, transparency, participation, integrity and lawfulness. The public sector may be interested in supporting innovation in the private sector to increase a country's competitiveness for more value-added jobs, sustainable tax revenue, sustainability, health and a host of other public aims.

Innovation, therefore, can be seen not only as a key catalyst of economic growth, productivity and well-being (OECD, 2018[1]) but as a driver for a variety of values. In recent years, a growing awareness of the need to find solutions in an increasingly complex and uncertain world has meant that the hopes for what can be achieved through innovation have expanded and diversified, further prioritising public value. Funding initiatives from the European Union, such as Horizon 2020, show how innovation is expected to "address a number of well-chosen societal challenges and for example contribute to a transition to low carbon and inclusive economy" (Schot and Steinmueller, 2018[19]). As has been seen in the COVID-19 crisis and the rapid development of vaccines, innovation is not only necessary to catalyse social and economic development, but also to ensure that societies are able to adapt and flourish in adversarial environments (McGuire and Paunov, 2022[20]).

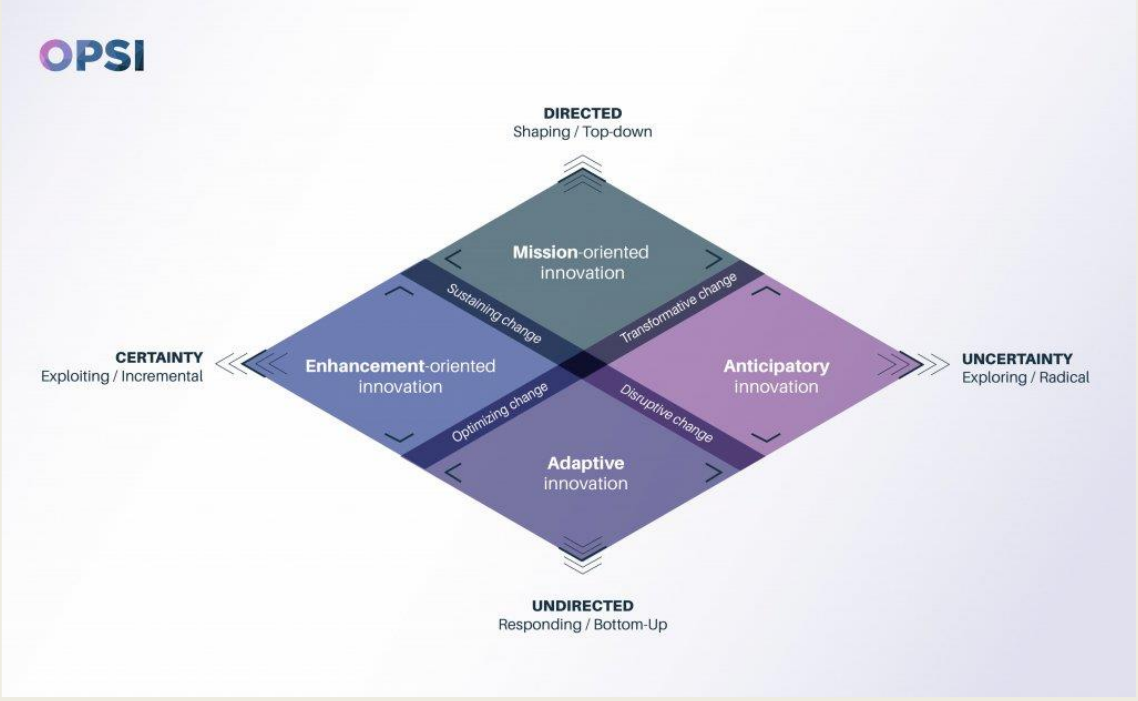
At the same time, it has long been understood that the benefits of innovation are not realised without risk or negative consequences, nor are they equally experienced. Past innovation is the cause of many of the 'grand challenges' of today, as the development of new processes and products created and sustained the damaging resource-intensive, fossil-fuel based paradigm of production and consumption that has persisted since the industrial revolution (Schot and Steinmueller, 2018[19]). The dominance of certain groups among both innovators and consumers of innovation has exacerbated inequalities (Criado-Perez, 2019[21]). The speed of implementation of an innovation can, intentionally or unintentionally, create shocks in the systems they affect which result in negative second-order consequences. Guarding against and addressing these issues is a priority for the development of more resilient and equal societies.

In short, innovation is increasingly expected to deliver multiple types of value and address complex challenges in an equitable manner. Governments have therefore begun to explore how a range of approaches to shape and intervene in systems for innovation can promote the development of new technologies and other solutions with wide-ranging social and environmental benefits, but limited negative consequences. The OECD's innovation facets model (see Box 1.3 below) maps out these approaches and their relevance to different contexts. Enhancement oriented approaches are appropriate for more certain environments in which efficiency and effectiveness are prioritised. Adaptive approaches enable government to steward innovation to address the evolving needs of citizens and emerging environmental shifts. Mission-oriented approaches place government in the position of directing innovation to address complex societal challenges. Finally, anticipatory approaches aim to enable governments to address and benefit from change in conditions of uncertainty by promoting an active exploration of the future. In these more uncertain environments, innovation ecosystems have emerged as a vehicle through which governments can leverage the knowledge and resources of diverse actors while stewarding innovation towards delivering greater public value.

Box 1.3. Innovation facets model

The Observatory of Public Sector Innovation has developed an innovation model along two central characteristics – uncertainty and directionality. Based on these characteristics, four different facets of innovation emerge, each of which is suited to a particular type of environment. While the model is focused on public sector innovation, the model can be applied to innovation more generally.

Figure 1.1. Innovation Facets Model



Source: OECD (2019[22]), "Innovation facets and core values: How different forms of innovation can cause different reactions", https://oecd-opsi.org/blog/innovation-facets-and-core-values-how-different-forms-of-innovation-can-cause-different-reactions/.

- Enhancement-oriented innovation is suited to more certain environments in which greater efficiency and efficacy are required. It is focused on upgrading practices, and building on existing structures (e.g. through digitalising services and better process management). An example of this type of innovation is the use of behavioural insights to improve the compliance rate with one-time payments.
- Adaptive innovation tests new approaches in order to respond to a changing operating environment and address emerging needs (e.g. co-designing new community responses to emerging challenges such as the COVID-19 pandemic). Governments adopting social media as a channel for citizen interaction is an instance of adaptive innovation.
- Mission-oriented innovation establishes a clear outcome and an overarching objective for achieving a specific mission (e.g. setting clear goals and roadmaps towards carbon neutrality). As an example, setting an objective to dramatically reduce greenhouse emissions within a decade is a mission-oriented approach to innovation.

- Anticipatory innovation explores and engages with possible future changes that might shape priorities (e.g. conducting experiments to explore the future of work). An example of anticipatory innovation is the use of a sandbox to explore the impact of Artificial Intelligence on service delivery in health.

Source: OECD (2022[17]), *Tackling Policy Challenges Through Public Sector Innovation: A Strategic Portfolio Approach*, https://doi.org/10.1787/052b06b7-en.

The promise of innovation ecosystems

According to the Oslo Manual of the OECD, "innovation is not a linear, sequential process, but involves many interactions and feedbacks in knowledge creation and use. In addition, innovation is based on a learning process that draws on multiple inputs and requires ongoing problem solving" (OECD/Eurostat, 2018[16]). While innovation can and does occur within individual organisations, the dispersal of knowledge and resources across business and institutions means that its emergence is stimulated by interactions between stakeholders within regional, technological, sectoral and national innovation systems.

Research and practice in policy and business have therefore long sought to better understand how knowledge and resource flows across organisational boundaries can be orchestrated in order to enable opportunities for innovation to be identified and seized (Bogers et al., 2019[23]). This interest has deepened in recent years with the development of systems innovation approaches, which aim shift entire systems towards government priorities through innovation by examining and shaping the interdependencies of a wide range of actors (OECD, 2016[24]). Within this milieu, the 'innovation ecosystem' has emerged as a popular way to frame coordinated approaches to stimulating innovation by leveraging the knowledge and resources of a wide range of actors (see Box 1.4 on the role of innovation ecosystems for the circular bioeconomy). It is a more operational concept than national, technological or regional innovation systems as it denotes and concentrates on the act of collaborating for shared innovation goals.

Box 1.4. Accelerating technology through innovation ecosystems: the case of the circular bioeconomy

In a report titled 'Innovation Ecosystems in the Bioeconomy', the OECD (2019) has previously investigated the potential of innovation ecosystems as policy instruments to catalyse the "transition to new economy that uses less energy, makes less waste, and inspires a more circular approach".

The bioeconomy is defined as "the set of economic activities in which biotechnology and the life sciences (also chemistry and in particular their smart integration) contributes centrally to primary production and industry through the conversion of biomass into food, materials, chemicals and fuels." In a circular bioeconomy, biomass is recovered from other processes which would normally result in their waste. Developing circular bioeconomies, therefore, is dependent on the coordination of stakeholders in ways that enable waste to be converted into resources. The focus of ecosystem approaches on stimulating coordination and collaboration makes them of relevance to the circular bioeconomy. Following Kanter (1994) innovation ecosystems are defined as "groupings of companies in different industries with different but complementary skills which link their capabilities to create value for ultimate users."

Through analysis of bioeconomy ecosystems in Belgium, Canada, China, Finland, France, Italy, Japan, Norway, Sweden and the United States of America, the study sought to understand the types of policies applied to "help to spur technological development and the formation of formation of new types of

cross-sectoral value chains, industrial and innovation ecosystems and commercial partnerships to enable the transition to a more sustainable and circular bioeconomy", and explore how these might differ across bioeconomies.

The report outlines the necessity of a systemic approach to developing viable value chains as the success of individual elements is dependent on other parts of the system. Ecosystem approaches, by promoting the interlinking of actors, can ensure that individual elements do not become 'stranded', but are able to build on and contribute to the success of others. Strengthening the system additionally requires policy alignment to ensure that technology push and market-pull are aligned, and that competition for biomass does not hamper innovation.

Four common policy instruments are identified as valuable to stimulate the development of the circular bioeconomy through innovation ecosystems:

- **Clusters:** Publicly funded organisations to support the coordination and connection of organisations from different industry sectors.
- **Pilot and demonstration phase funding:** Demonstration of new technologies is considered essential to promote technology development but high-risk. Government funding can help to de-risk the process.
- **Joining policy up**: Identifying and promoting synergies in policy and regulation are valuable for breaking down the barriers to innovation. The report used the example of poor synergy in which "supply-side policy instruments to encourage using wastes as feedstocks" are blocked by regulatory barriers to prevent this.
- **Carbon price and taxation:** These instruments are identified as opportunities to promote and fund the circular bioeconomy.

Source: Philp, J. and D. Winickoff (2019[10]), "Innovation ecosystems in the bioeconomy", https://doi.org/10.1787/e2e3d8a1-en.

For this report, the OECD defines the innovation ecosystem as an evolving, complex network of diverse organisations who collaborate to achieve shared innovation goals (Granstrand and Holgersson, 2020[11]; Klimas and Czakon, 2021[12]; Russell and Smorodinskaya, 2018[13]).This broad definition intentionally encompasses a range of multi-stakeholder innovation programmes and initiatives, such as clusters, while extending the types of organisation involved beyond private sector companies cited in a previous OECD definition (Philp and Winickoff, 2019[10]). While innovation ecosystems are often conceived as emerging naturally from relations between stakeholders (used academically or in policy analysis as descriptive tools for pre-existing relationships), a growing body of evidence shows that they can also be consciously promoted and coordinated.

Innovation ecosystems are *structures* that facilitate the "flow of innovation-relevant knowledge across the boundaries of individual organisations" (OECD/Eurostat, 2018[16]). An innovation ecosystem can also be characterised as an ongoing *process* to generate innovation "characterized by changing multi-faceted motivations of networked actors, high receptivity to feedback, and persistent structural transformations, induced both endogenously and exogenously" (Russell and Smorodinskaya, 2018[13]), and resulting in continuous evolution of the ecosystem's boundaries, goals, and the roles participating of stakeholders (Ritala and Almpanopoulou, 2017[25]).

By engaging diverse stakeholders from industry, academia, government and civil society (the 'Quadruple Helix') in a participatory, co-creative process, innovation ecosystems are expected to stimulate innovation through a wide range of mechanisms. They build trust and reduce transaction costs by fostering connections between actors who do not normally work together (Guzzo and Gianelle, 2021[26]; Philp and Winickoff, 2019[10]), enable the sharing of knowledge, information and resources that are beneficial for

ecosystem actors (Guzzo and Gianelle, 2021[26]; Philp and Winickoff, 2019[10]), facilitate the identification of areas in which the network of ecosystem partners has a comparative advantage (JRC, 2021[27]), enable the selection of priorities and discovery of opportunities for innovation that deliver better collective outcomes (Foray, Morgan and Radosevic, 2018[28]), facilitate coordinated action to bring about transformative change that can address grand challenges (Schot and Steinmueller, 2018[19]) and enable innovation ecosystem partners to achieve outcomes that would be unattainable if they were working alone (Hasche, Höglund and Linton, 2019[29]; Pontikakis et al., 2022[30]).

The high hopes for innovation ecosystems are evident in the European Union's investment in Smart Specialisation, a policy approach that aims to develop and leverage regional innovation ecosystems to stimulate innovation and catalyse sustainable and inclusive regional growth (Guzzo and Gianelle, 2021[31]) (Box 1.5). While the theoretical basis for Smart Specialisation builds on a firm understanding of the systemic nature of the emergence of innovation, its implementation across Europe has been beset by governance challenges and a lack of capacity to facilitate the bottom-up identification of opportunities for innovation through the 'entrepreneurial discovery process' (Guzzo and Gianelle, 2021[31]). To address some of these issues, the anticipatory innovation ecosystem approach outlined in this report places a strong focus on governance.

Box 1.5. Smart specialisation

Smart specialisation is a policy approach for regional development that aims to orient resources towards building innovative capabilities in a limited number of fields. Within smart specialisation, priorities are based on regional strengths and defined through a bottom-process that engages local stakeholders. The concept was first defined in 2009 and introduced by the European Commission in the EU Cohesion Policy 2014-2020. Each region was required to develop a research and innovation strategy for smart specialisation (RIS3) in order to access funding for research and innovation from the European Regional Development Fund (ERDF).

At the core of smart specialisation is the Entrepreneurial Discovery Process (EDP). The EDP is an interactive process through which actors from across the quadruple helix collaborate to prioritise innovation fields based on the identification of key regional strengths and opportunities. The approach leverages the specialised knowledge of these actors to facilitate the co-creation of policies and identification of relevant actions to stimulate the innovation. This process of ongoing, coordinated action by quadruple helix actors to identify shared goals and collaboratively work towards them can benefit from the effective governance of place-based innovation ecosystems which provide a framework for ongoing collaboration.

The role of government in this process centres on helping other actors sustain coordinated participation in order to generate actionable knowledge. More recently, the policy concept of smart specialisation strategies for sustainable and inclusive growth (S4+) has sought to connect S3 to the more directed mission-oriented policy approach in order to better address societal challenges. Additionally, Partnerships for Regional Innovation (PRI) aim to build on S3 to promote transformative innovation and system level change through multi-stakeholder partnerships focused on achieving agreed impacts.

Source: Foray, D., P. David and B. Hall (2009[32]), *Smart Specialisation – The Concept*, Knowledge Economists Policy Briefs, "Knowledge for Growth" Expert Group; Foray, D. (2014[33]), "From smart specialisation to smart specialisation policy", https://doi.org/10.1108/ejim-09-2014-0096; OECD (2013[34]), *Innovation-driven Growth in Regions: The Role of Smart Specialisation*, OECD, Paris; Pontikakis, D. et al. (2022[30]), *Partnerships for Regional Innovation: Playbook*, https://data.europa.eu/doi/10.2760/775610; McCann, P. and L. Soete (2020[35]), *Place-based Innovation for Sustainability*, https://data.europa.eu/doi/10.2760/250023; Morisson, A. and M. Pattinson (2020[36]), *Policy Brief: Smart Specialisation Strategy (S3)*, https://www.interregeurope.eu/sites/default/files/inline/Smart_Specialisation_Strategy__S3__-_Policy_Brief.pdf.

Mechanisms for discovery in innovation ecosystems

Drawing on the research of the economic sociologist David Stark (2009[37]) and others (Winickoff et al., 2021[38]; Schot and Steinmueller, 2018[19]),ecosystems can be understood as instruments to generate breakthrough innovations by facilitating a constructive tension between two counteracting mechanisms for discovery: convergence and dissonance.

Convergence describes the integration of diverse types of expertise, technologies and resources to create novel assets, or innovations. It is achieved by bringing together heterogenous stakeholders in an environment that facilitates collaboration and co-creation. Following the adoption of Rocco et al.'s definition of convergence by Winickoff et al. (2021[38]), 'Convergence [...pertains to ...] the escalating and transformative interaction among seemingly distinct scientific disciplines, technologies, communities, and domains of human activity to achieve mutual compatibility, synergism, and integration, and through this process to create added value and branch out into emerging areas to meet shared goals.' (Rocco et al. 2013 in (Winickoff et al., 2021[38])).

In this description, convergence sounds like a harmonious process. However, existing system dynamics, path dependence and vested interests often conspire to create friction and constrain the imaginations of innovation ecosystem partners. Yet far from being a drawback of innovation ecosystems, friction is a key mechanism for generating breakthroughs (Stark, 2009[37]). Friction occurs as distinct frameworks of value, such as economic, social and environmental, are brought into relationship with one another through the interaction of heterogeneous ecosystem partners. These values determine objectives that compete with and may contradict one another, creating 'perplexing situations' and a 'sense of dissonance' that "disrupts organizational taken-for-granteds, generates new knowledge, and makes possible the redefinition, redeployment, and recombination of resources" (Stark, 2009[37]).

In practical terms, dissonance forces stakeholders to recognise trade-offs inherent in choices related to innovation and find new ways to reconcile them. Through conflict and deliberation, they are able to identify potential negative and beneficial outcomes of innovation pathways. It is through the maintenance of dissonance and the continuous negotiation of different frameworks of value that previously invisible opportunities are uncovered, leading to truly novel innovations.

Consequently, convergence and dissonance are core concepts in coordinating innovation ecosystems in an anticipatory manner. Dissonance is needed to consider variety of futures, both risks and opportunities and avoid lock-in; while convergence is required to take action based on future signals avoiding dominance of status quo and incumbents.

The importance of appropriate governance for innovation ecosystems

As the terms 'friction' and 'dissonance' suggest, the process of collaborative innovation can be uncomfortable for those engaged in it. Friction can become destructive if actors are unprepared to listen to one another or see their objectives as entirely incompatible. Project leaders and participants in co-innovation programmes may wish to reduce friction by rapidly settling on an agreed direction which prioritises one set of values or principles of evaluation, or by imposing a particular understanding of an issue to be resolved. Yet while such approaches may avoid conflict in the short term (and fit with the timescales and expectations of political leaders), they can weaken the attachment of stakeholders to the ecosystem who feel that their values are not understood or represented. Forcing stakeholders to settle on the an expedient objective, risks missing the identification and capture of opportunities for ground-breaking and transformative innovation (Stark, 2009[37]; Schot and Steinmueller, 2018[19]).

Innovation ecosystems can provide a structure in which friction can be *organised* and made productive through effective governance. The governance structure proposed to achieve this is termed 'heterarchy' (Stark, 2009[37]; Russell and Smorodinskaya, 2018[13]). Unlike hierarchy, which supposes the management of interacting stakeholders through top-down leadership, heterarchy describes an organising model in

which different principles of evaluation and worth are held in equal relationship to one another. As a result, heterarchies enable stakeholders engaged to make sense of challenges, opportunities and innovations by drawing on the multiple perspectives of others. Heterarchies facilitate convergence by ensuring that a single type of expertise does not dominate, and a single view of the application of a new technology does not occlude the identification of others.

The challenge of 'organising dissonance' through heterachy demands much of stakeholders engaged in innovation ecosystems. For government, it necessitates a shift from governmental leadership to collaborative or distributed leadership (Foray, Morgan and Radosevic, 2018[28]). Ecosystem partners must trust that they are all committed to finding solutions that result in shared benefits, in spite of regular disagreement. It necessitates faith in the process of innovation ecosystem development, in spite of friction that may slow down the identification of opportunities (JRC, 2021[27]). Participants in a heterarchy must be prepared to question their assumptions and revise their mental models based on different ways of understanding the world. This shift in mindset can be time consuming to achieve.

The roles of government in innovation ecosystems

Government and agencies, as independent convenors with the power to shape regulation, have important roles to play in order to create contexts in which innovation ecosystems can flourish. This report centres on the role of government stakeholders to initiate and support the development of four processes that sustain a productive tension between convergence and dissonance. At the level of individual innovation ecosystems, the 'micro-governance' processes (Wegner and Verschoore, 2021[39]) can be co-designed by government stakeholders and ecosystem partners in order to facilitate collaboration.

Government must also learn to listen to the insights generated by innovation ecosystems and coordinate to act on them. Through their continual search for opportunities, innovation ecosystems can identify gaps and barriers in the systems that prevent or inhibit the discovery and development of innovations (Philp and Winickoff, 2019[40]). By attending to these, governments can design better policy and accelerate innovative processes. Chapter 2 of this report offers a framework of seven government functions to enable this to be done in a systematic manner.

Table 1.2. Benefits and challenges of innovation ecosystems

Benefits of innovation ecosystems	Limitations and challenges of innovation ecosystems
Generation of novel innovations through convergence	Friction between stakeholders can slow or halt innovation if not managed
Representation of diverse viewpoints enables the identification of better collective outcomes	Challenging and time-consuming to develop appropriate governance structures
Reduction in transaction costs	Demands a new mindset for policymakers and participants
Improved access to necessary resources for innovation	Existing relationships between stakeholders may block new partners and lead to group think or domination by powerful incumbents
Stronger ownership of collectively developed strategies	

Towards anticipatory innovation ecosystems

While innovation ecosystems enable the identification of new opportunities by leveraging the collective intelligence of their members, a bias towards present concerns and a lack of strategic thinking can mean that even the most diverse set of organisations can generate narrow and short-sighted ideas.

Anticipatory approaches aim to address this challenge. They allow actors to build on information in the present to create knowledge about the future, enabling them to make choices that take into account future trends, opportunities, threats and values. These approaches include the 31 selected qualitative and

quantitative 'traditional foresight methods', listed by Tõnurist and Hanson, including horizon scanning ('Systematic monitoring and examination of a broad range of data sources about the phenomenon about which one aims to gain foresight, in order to identify perspectives and trends, premature signs of potential upcoming developments, as well as how they may affect the future.'), scenarios ('Scenarios are 'stories' illustrating visions of possible futures or aspects of possible future. Scenarios are constructed by starting with the present and past and projecting into the future and usually presented in a range of possible futures.'), backcasting ('Backcasting is a normative scenario method that analyses how events could develop from the present into an imagined future.') and participatory foresight ('…a method usually used in normative foresight analysis, in which citizens state their visions and preferences for particular futures and provide comments on scenarios and solutions presented by experts.') (Tõnurist and Hanson, 2020[41]).

Anticipation, as distinct from strategic foresight, describes the way in which the knowledge generated by these methods is used *in practice* to make choices about innovation pathways to pursue and actions to undertake. It can allow actors operating together as part of innovation ecosystems to not only prepare for the future, but to shape it, "creating and implementing new, potentially value-shifting innovations in environments of deep uncertainty" (Tõnurist and Hanson, 2020[41]). This is known as anticipatory innovation. In small states such as Latvia, anticipatory innovation has particular value as a way of leveraging limited resources to identify opportunities to enter into and develop emerging value chains (Tõnurist and Kattel, 2016[4]).

Key benefits of anticipatory innovation ecosystems

There are four key benefits of anticipation to innovation ecosystems: the identification of future technological opportunities, the exploration of consequences of technological development, the facilitation of convergence, and the organisation of dissonance (see Box 1.6 for the case study of the Baltic Sea Ro-Ro Shipping Ecosystem).

First, by exploring the future through anticipatory approaches, innovation ecosystem members can develop a better understanding of the types of innovations that are likely to deliver positive outcomes across a range of possible futures. The goal here is not to predict winners: this is not possible. Instead, anticipation stimulates the identification of a wide range of options that may be beneficial for the innovation ecosystem to explore. The objective of this is to prevent the pursuit of innovation goals that risk becoming irrelevant, and to allow the ecosystem to develop more robust strategies for the development of anticipatory innovations. In this way, anticipatory approaches turn uncertainty into an asset for entrepreneurial discovery as opposed to a risk to be guarded against.

Second, anticipatory approaches enable the exploration of the consequences of (technological) development. Their value for this purpose has been recognised in the U.S Nanotechnology initiative and through the Responsible Research and Innovation (RRI) pillar of the EU's Horizon 2020 programme (OECD, 2018[1]). The engagement of diverse ecosystem partners in the Quadruple Helix enables impacts to be mapped across multiple domains, from the environment to the labour market. This approach allows innovation ecosystem partners to negotiate the benefits and drawbacks of options for technological development and choose to pursue those which generate preferred types of value and are likely to have limited or manageable negative consequences. In this way, an anticipatory innovation ecosystem becomes a vehicle for anticipatory governance, providing the government with an opportunity to promote the selection of beneficial options and generating information that can inform the development of policy and regulation.

These first two benefits of anticipation concern the generation of knowledge which enables innovation ecosystems and governments to act with a better understanding of possible futures. The second two relate to the functioning of innovation ecosystems and reveal anticipation as a key tool for innovation ecosystem governance by organising dissonance.

Third, anticipation opens up the future as a space for convergence. Where organisations may struggle to see how their competing interests or frames of value can be integrated in the present, the future can offer an imaginary backdrop in which reconciliation can occur. As anticipation reveals a variety of options for exploration, ecosystem participants can begin to see how greater collaboration can enable them to access opportunities and overcome challenges. Lithuania's development of smart specialisation roadmaps (Box 1.7) shows how cross-sectoral priorities were identified through anticipatory approaches.

Finally, anticipation has the power to create the 'perplexing situations' that characterise dissonance by confronting innovators with the challenges and opportunities the future may contain, and the values of those who will live in it. This provokes those engaging in anticipatory approaches to think creatively about how innovations can align with or shape potential future priorities. For Schot and Steinmuller, this opens up the possibility of transformative change by "stimulating the ability to look from a distance (this could be an imagined future; or a set of social and environmental challenges) at one's own deeply embedded routines" (Schot and Steinmueller, 2018[19]) .

Through the application of anticipatory approaches, therefore, innovation ecosystems can vary the tension between convergence and dissonance, enabling the creation of 'productive friction' that results in ground-breaking innovation. Furthermore, by promoting innovation ecosystems as a vehicle for the exploration of possible futures and collective action, governments are presented with an opportunity to leverage the collective intelligence of diverse stakeholders to generate futures knowledge that can inform policy decisions across a variety of domains.

Box 1.6. Applying anticipatory approaches to the Baltic Sea Ro-Ro Shipping Ecosystem

The anticipatory approaches of roadmapping and scenario planning were employed as part of an innovation ecosystem programme, ECOPRODIGI, led by Interreg VG Baltic Sea that aims to advance the EU's strategy for a Sustainable Blue Economy through innovation in Roll-on/Roll-off (Ro-Ro) shipping.

Through an iterative and participatory process comprising preparatory research and analysis, interactive workshops, 'post processing' of insights generated by the workshops and digital engagement, the organisers of the foresight process sought to develop and stress-test innovation three innovation 'roadmaps' for the future of Ro-Ro shipping. In their paper outlining the case study, Spaniol and Rowland (2022) describe the process for the development of a roadmap for integrated logistics-operations.

Three day-long workshops took place, in November 2019 in Lithuania, in January 2020 in Denmark, and in February 2020 in Norway, which each convened 30-40 local actors in addition to a core team of actors from across the project consortium. Over 100 stakeholders associated with the Sustainable Blue Economy from a wide range of businesses and organisations from across the Baltic Sea Region were therefore engaged in the process of constructing.

The workshops sought to unlock the collective intelligence of participants to build knowledge about possible futures for Ro-Ro shipping and explore how a range of changes might influence these. In each workshop, participants were asked to assess and build on knowledge generated in the previous workshop in order to develop increasingly robust roadmaps and refine futures scenarios against which the roadmaps could be tested. A combination of foresight methods, including backcasting and horizon scanning were used.

The workshop in Lithuania generated content for the roadmap through a broad exploration of the future and resulted in an 'extensive list' of potential events and trends that could affect the innovation ecosystem. In Denmark, participants used this information to begin plotting a roadmap of innovation

and possible influential events against a timeline. The content generated by this process was subsequently digitised in order to engage a wider range of stakeholders. In the third workshop in Norway, participants refined the online roadmap 'to further articulate and distinguish events and tasks-to-be-done from generic trends and technologies.' The resulting roadmap was subject to validation by other ecosystem members and Ro-Ro stakeholders and stress-testing against eight futures scenarios.

Benefits of anticipatory approaches

Spaniol and Rowland find that the application of anticipatory approach enabled ecosystem partners to build consensus and orient around a shared vision of the future. The iterative, participatory and deliberative process of developing and stress-testing roadmaps not only leveraged dissonance among stakeholders to produce a robust anticipatory strategy. It also promoted the development of connections between previously disparate stakeholders and resulted in a 'shared language' to talk about the ecosystem, promoting convergence.

Importantly, Spaniol and Rowland find that the participatory approach resulted in distributed ownership of the roadmap that enables the ecosystem to remain coherent in the absence of a 'focal firm'. This enhances the strength and sustainability of the ecosystem by promoting a more heterarchical and distributed governance.

Source: Spaniol, M. and N. Rowland (2022[42]), "Business ecosystems and the view from the future: The use of corporate foresight by stakeholders of the Ro-Ro shipping ecosystem in the Baltic Sea Region", https://doi.org/10.1016/j.techfore.2022.121966.

Box 1.7. Developing Smart Specialisation Roadmaps in Lithuania through anticipatory approaches

In 2013, anticipatory approaches were used in the process of defining priorities and implementation roadmaps for Lithuania's Smart Specialisation Strategy 2014-2020. The approach sought to address prior issues relating to innovation in Lithuania by engaging a wide range of stakeholders in the identification of ecosystem priorities.

These challenges included a low level of cooperation between industry and research, fragmentation of research and development (R&D) and research and innovation (R&I) policy priorities, programmes, funds and institutions, and failure to leverage different funds to create synergies between measures. Efforts to concentrate funds and create connections, such as the 'science valleys' or clusters, had so far been able to deliver only limited impact.

Process

The process was undertaken beginning in 2013 under the supervision of the Ministry of Education and Science and Higher Education Monitoring and Analysis Centre (MOSTA), with the help of an International Independent Expert Group. It engaged six expert groups, consisting of about 150 experts in total, to analyse trends and identify priorities. As such, it was "a bottom-up process with top-down methodological support" (Paliokaitė, Martinaitis and Sarpong, 2016[43])

The process consisted of three stages, modelled as independent projects. They could only proceed upon the satisfactory completion of the previous stage (*stage-gate process*). Feedback loops were introduced to adjust the process in response to previous outcomes.

- "**Stage 0** was devoted to **scoping** — developing and discussing the methodology, awareness-raising, building consensus on the methodological choices, including the definition of 'priorities' and 'priority areas', securing the funding and constructing a management system consisting of the coordinating committee (public officials from the key ministries), administrative body (MOSTA), and the implementing bodies (the International Independent Experts Group as well as two separate consortiums of analysts and expert groups' facilitators contracted through a public procurement procedure)." [emphasis added] (Paliokaitė, Martinaitis and Reimeris, 2015[44]).
- "**Stage one** (1) focused on the **identification and mapping of the broader priority areas based on a qualitative analyses** [sic] of the long-term national challenges, the current research and economy potential [sic]. Further discussions with seven expert panels made up of key stakeholders and representatives from the research and business communities resulted in an all-inclusive six broad priority fields." [emphasis added] (Paliokaitė, Martinaitis and Reimeris, 2015[44]). **Stage Two** (2) was aimed at mapping out specific specialisations within six broad priority fields. This involved a more detailed analysis of trends and challenges in each of the priority areas, followed by discussions of six expert groups that comprised business and research representatives in each of the priority areas (about 150 experts and 24 discussions in total). Each of the six expert groups was chaired by two group leaders – one acknowledged scientist and one industry captain. Included in these expert groups were Policy makers from the ministries of interest (e.g. Transport, Health, and Education)." (Paliokaitė, Martinaitis and Reimeris, 2015[44]).

Following a process of consensus-building around key priorities, the potential of collaborative action by public and private actors to address these and the identification of barriers to progress in these areas, policy roadmaps were proposed. These aimed to function as a tool for the coordination of public and private stakeholders to achieve policy priorities.

Benefits and challenges of the anticipatory approach

Paliokaitė, Martinaitis and Sarpong (2016[43]) identify three key benefits of the participatory and anticipatory approach for the identification of priorities and the development of implementation roadmaps. Firstly, it challenged the previous sector-based approach which had dominated innovation policymaking in Lithuania and provided an arena and a purpose for cross-sectoral discussions. Secondly, the collective identification of outcomes by expert groups helped to orient objectives towards broader social needs, provided a framework for better management of the implementation, and created ownership of the priorities. Thirdly, the recommendations of the foresight process were largely transposed into policy when it comes to the priority areas. In addition, the process created a large knowledge base for policy makers.

Nonetheless, the process and outcomes did experience challenges. The expert panels reported receiving interference from interest groups; representatives from the ministries did not readily accept the policy proposals associated with the selected priorities, and there was a mismatch between the experimental and uncertain nature of the proposals resulting from the process and the existing administrative culture, which is "prone to low risk-tolerance" (Paliokaitė, Martinaitis and Sarpong, 2016[43]). These challenges highlight the need for effective anticipatory innovation governance (AIG) to facilitate the translation of futures knowledge into action.

Source: Paliokaitė, A., Ž. Martinaitis and R. Reimeris (2015[44]), "Foresight methods for smart specialisation strategy development in Lithuania", https://doi.org/10.1016/j.techfore.2015.04.008; Paliokaitė, A., Ž. Martinaitis and D. Sarpong (2016[43]), "Implementing smart specialisation roadmaps in Lithuania: Lost in translation?", https://doi.org/10.1016/j.techfore.2016.01.005; Reimeris, R. (2016[45]), "New rules, same game: The case of Lithuanian Smart specialization", https://doi.org/10.1080/09654313.2016.1179722.

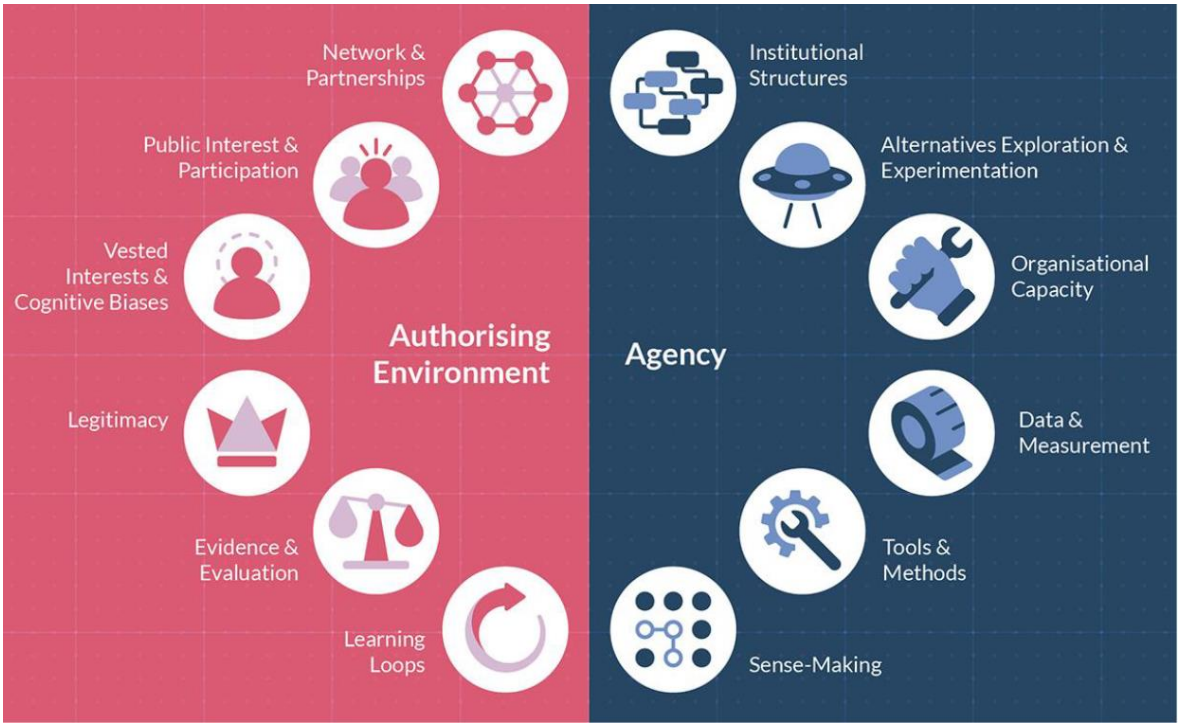
Anticipatory governance for innovation ecosystems

It is clear that the coupling of anticipation and innovation ecosystems offers a promising path to impactful innovation and the generation of futures knowledge that is useful for governments. Yet the systematic application of anticipatory approaches within innovation ecosystems requires more than simply knowledge of foresight approaches; it needs effective governance. Anticipatory innovation ecosystems are therefore subject to many of the same governance challenges and limitations as innovation ecosystems (Table 1.2).

Anticipatory governance in general can be considered a type of 'process governance', which "shifts the locus from managing the risks of technological products to managing the innovation process itself: who, when, what and how. It aims to anticipate concerns early on, address them through open and inclusive processes, and steer the innovation trajectory in a desirable direction" (OECD, 2018[1]). For governments, this can provide an opportunity to promote public value through innovation as well as generating intelligence for the design of more resilient policies.

With a particular focus on deriving the full benefits of anticipation, anticipatory innovation governance (AIG) describes the structures, practices and mechanisms that enable especially public sector with other stakeholders to explore and act on future opportunities, risks and challenges (Figure 1.2). It involves both creating an environment in which anticipatory knowledge can be generated and applied in practice (the authorising environment) and building capacity of individuals and teams for the selection and application of appropriate anticipatory approaches (agency) (Tõnurist and Hanson, 2020[41]). The AIG framework could provide a structured approach to turn futures knowledge into innovation in a more operational manner by concentrating on the role of government in both establishing relationships and creating new roles to coordinate ecosystems. Chapter 2 details how the mechanisms of AIG can inform the effective multi-level governance of anticipatory innovation ecosystems.

Figure 1.2. Mechanisms of anticipatory innovation governance



Source: Tõnurist, P. and A. Hanson (2020[41]), "Anticipatory innovation governance: Shaping the future through proactive policy making", https://doi.org/10.1787/cce14d80-en.

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2 A governance approach for anticipatory innovation ecosystems

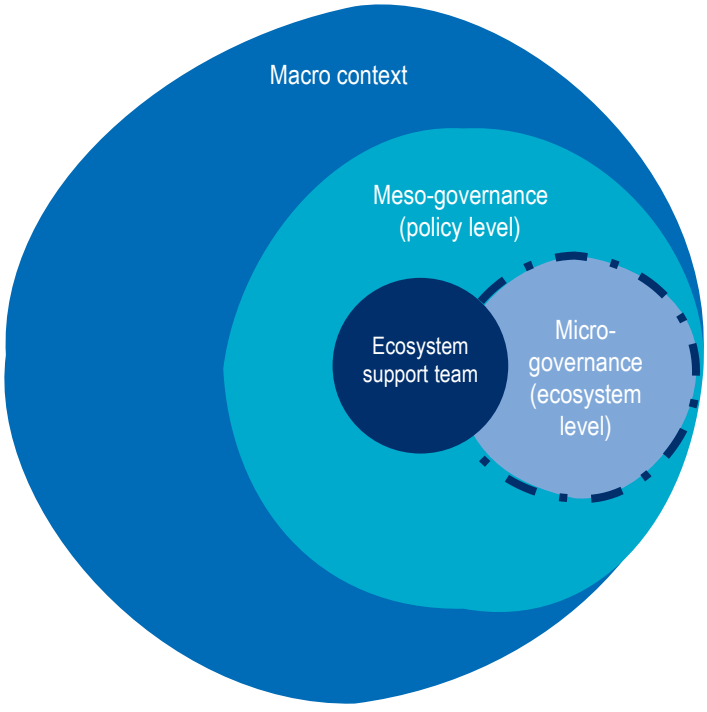
The implementation of anticipatory approaches by innovation ecosystems promises to facilitate creative collaboration, stimulate the development of future-ready innovations, and inform government policy. This chapter explores how an anticipatory innovation governance (AIG) approach can enable innovation ecosystems to leverage anticipation and unlock their potential.

As the previous chapter outlines, the key goal of an anticipatory innovation ecosystem is to create the conditions in which diverse stakeholders are stimulated to explore the future together, uncover opportunities to shape and derive value from it, and coordinate their activities to generate innovations through the convergence of knowledge, technologies and values. However, achieving convergence is not a smooth process. The different values and ways of understanding the world that enable partners in innovation ecosystems to collaboratively uncover and grasp previously hidden opportunities carry with them inherent incompatibilities that create dissonance and friction.

Anticipatory approaches present a set of tools which enable stakeholders working with innovation ecosystems to manage convergence and dissonance. On one hand, they create new spaces for convergence by opening up future territories for innovation in which differences and competition are less obstructive to collaboration. On the other, they generate dissonance by forcing innovation ecosystem partners to confront and collectively make sense of possible future situations in which the drivers and demands of innovation are disrupted or transformed. By working together to explore these future territories and situations, innovation ecosystem partners can begin to anticipate the types of innovations that will be valuable and develop futures-oriented strategies that help them to remain on viable innovation pathways in the face of uncertainty.

The effective application of anticipatory approaches is dependent on a supportive authorising environment, and the agency of individuals to select and use of appropriate methods for generating actionable knowledge about possible futures. The mechanisms of the authorising environment and agency are detailed in depth through the anticipatory innovation governance (AIG) model (Figure 1.2) (Tõnurist and Hanson, 2020[1]).

Figure 2.1. Micro- and meso-governance of anticipatory innovation ecosystems



This chapter proposes an approach for the governance of anticipatory innovation ecosystems that incorporates mechanisms identified in the AIG framework and provides guidance on how they and others can be leveraged to foster productive relationships between ecosystem partners. The approach has been developed through literature review and empirical research (comprising interviews with representatives of

ten ecosystems across Europe, testing of insights with public servants, and practical workshops with ecosystem partners in Latvia).

Experimentation is necessary to identify appropriate governance arrangements

Two nested levels of governance warrant focus for the development anticipatory innovation ecosystems. The first concerns the engagement of relevant stakeholders and the ongoing facilitation of collaboration within the ecosystem. Following Wegner and Verschoore, we term this micro-governance (Wegner and Verschoore, 2021[2]). As outlined in the Chapter 1, the nature of innovation ecosystems as networks of voluntary participation and the necessity of creating a space where contested values can be deliberated means that micro-governance must be collaborative and heterarchical (Russell and Smorodinskaya, 2018[3]).

The second 'higher' level concerns the functions, practices and structures that facilitate the relationship between government policy and the innovation ecosystem. This is termed 'meso-governance' for the purposes of this report. In order to realise the potential benefits of anticipatory innovation ecosystems, this relationship should be bilateral. Government policy and horizontal inter-ministerial coordination shape the environment for the anticipatory innovation ecosystem, while insights generated through the interaction of ecosystem partners can have a beneficial influence on government policy, improving coordination and providing information that can enable government to be more proactive. In this way, innovation ecosystems initiate a "continuous process of policy learning and adaptation", improving the quality of vertical and horizontal governance in the public sector and establishing more efficient coordination to support innovation (Guzzo and Gianelle, 2021[4]).

The 'macro' level concerns the trends and changes that cannot be governed, but which ecosystems and governments aim to anticipate, respond to and shape. The precise functioning of the micro- and meso-levels of governance is contingent on a range of contextual factors, including historical relationships between stakeholders, the focal technology of an ecosystem, and power structures. Reflecting on innovation ecosystems developed as part of Smart Specialisation initiatives, Guzzo and Gianelle find that "territories should discover what governance arrangements work best in their context, preferring the experimentation of new governance structures and processes…instead of adopting ideal models and best practices, which are often formally introduced without promoting real changes" (Guzzo and Gianelle, 2021[4]).

This bias towards experimentation is particularly applicable for determining governance processes and structures for anticipatory innovation ecosystems. These aim to uncover opportunities for innovation by convening disparate stakeholders into new configurations for co-innovation and demand novel arrangements for cross-sector collaboration. The complex, developing and contextual nature of each anticipatory innovation ecosystem requires that governance arrangements are dynamic and continually revised through experimentation and interaction between ecosystem partners. Any attempt to describe an 'ideal type' of governance is therefore not worthwhile. To overcome this challenge, the OECD has developed a governance approach based on the AIG model that centres on *processes* for micro-governance, and the *functions* to be played by government for meso-governance.

Government teams and public sector agencies can play a key role to foster the development of appropriate governance arrangements at the micro- and meso-levels, operating as an 'ecosystem support team' (Guzzo and Gianelle, 2021[4]) (Dedehayir, Mäkinen and Ortt, 2018[5]). In addition to facilitating coordination and experimentation in governance, the responsibilities of this team are likely to include supporting the two-way flow of information between government and the innovation ecosystem and leading the application of anticipatory approaches at both micro- and meso-levels. When initiating anticipatory innovation ecosystems, it is likely that the team will be required to lead the development of the key micro-governance processes detailed later in this chapter. However, management of these processes can be outsourced or

taken up by other interested parties, enabling the team to focus resources elsewhere. Box 2.1 shows how a dedicated ecosystem support team was set up in Helsinki.

Box 2.1. Finland: Smart & Clean Helsinki Foundation

The Smart & Clean Helsinki Foundation was a 5 year (2016-2021) "step-change" social innovation initiative with the purpose of catalysing investment and innovation around Finland's capital region and surrounding cities to fight climate change, become a hub for sustainable economy and drive investment and economic growth in the region at the same.

The Foundation's mission statement was "accelerate change in the Helsinki Region so that in 2021, the Helsinki Metropolitan Area and Lahti will be the world's best testbed for smart and clean solutions.", with secondary visions of having "The world's most resource-wise citizens", "The world's smartest urban energy".

The Foundation's financiers and members included 29 institutions, amongst them municipalities, universities, companies, Public Research and technology transfer institutes (VTT) and the Finnish innovation agency Sitra. Its governance was set up to represent its diverse membership and funding (a third of the funds came from municipalities, a third from Sitra, a third from businesses and universities)

The Foundation employed five full-time personnel to support the development of ecosystem projects. To better illustrate how they envisioned their role as an ecosystem support team, the Foundation used the analogy of an orchestra conductor: "…a conductor is leading a group of experts in different instruments to play a musical piece together. The conductor doesn't play the instruments better than any of the participants, but they have a unique role in finding a way to make all the players contribute to the outcome in the best way. And in an orchestra the different players are mutually dependent on each other's contribution to the outcome." (Smart & Clean Foundation, 2021[6])

To support ecosystems as an 'orchestrator', the Foundation team identified nine key functions:

> *"- Collects data and calculates the impacts.*
>
> *- Creates a holistic picture of the actions needed to make the change wanted.*
>
> *- Identifies all the actors needed to make the change.*
>
> *- Identifies and connects the actors.*
>
> *- Identifies the right actions with the most impact (utilising data).*
>
> *- Creates leadership models that enable the individual actors to see that their actions are dependent on each other and that sometimes individual organisations need to compromise for the good of the common goal.*
>
> *- Communicates and markets the ecosystem and the solution(s).*
>
> *- Fosters trust as a neutral actor.*
>
> *- Builds capacity and knowledge" (Smart & Clean Foundation, 2021[6]).*

Source: Smart & Clean Foundation (2021[6]), *Smart & Clean - Key Learnings*; Smart & Clean Foundation (2017[7]), *Smart & Clean Helsinki Metropolitan Annual Report 2016/17*.

The approach detailed in this chapter aims to provide practical guidance to stakeholders who aim to foster and maintain anticipatory innovation ecosystems through effective governance at either the micro- or meso- level. Each micro-governance process is accompanied by a list of activities that ecosystem stakeholders can undertake to develop it. These are categorised as either 'backstage', or 'frontstage':

- Backstage: Activities and methods which are conducted 'out of sight' of ecosystem partners, or though one-to-one engagement. For example, commissioning or undertaking research, briefing policy makers, interviewing ecosystem partners.
- Frontstage: Activities and methods which engage multiple stakeholders in a public or semi-public setting. For example, workshops and webinars.

To support meso-governance, the report presents a tool for government stakeholders to review how they can support and influence the development of anticipatory innovation ecosystems through seven government functions. Chapter 4 outlines how micro-governance processes can be practically combined with meso-governance functions based on the case of Latvia.

Micro-governance: A process-oriented approach

The OECD identifies four key processes for the micro-governance of anticipatory innovation ecosystems: the engagement of diverse stakeholders, an orientation around shared goals, collaboration, and anticipation, learning and adaptation. In a dynamic environment shaped by both the evolving relationships of ecosystem partners and the changing external context, these processes are never summarily 'perfected', but must be regularly reviewed in order to sustain the productive relationships that drive anticipatory innovation ecosystems.

Figure 2.2. Micro-governance processes

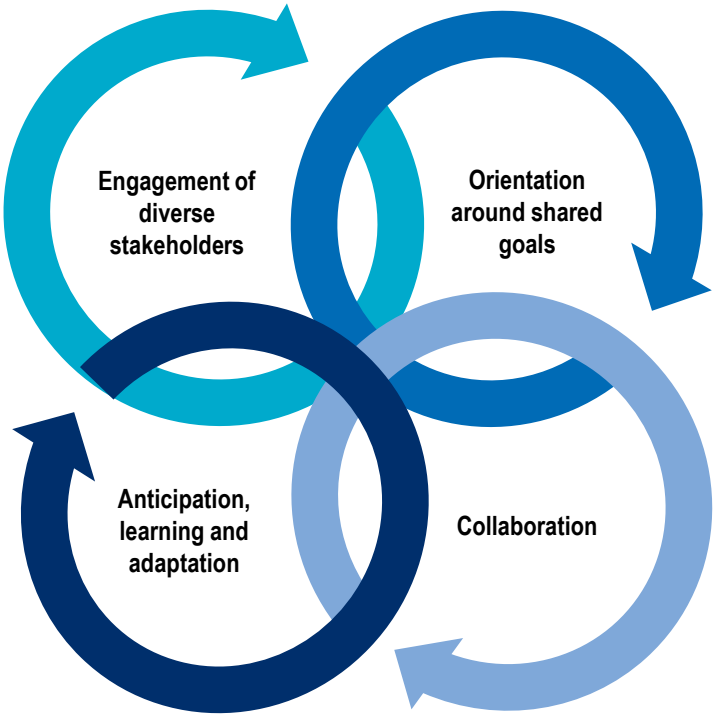


Table 2.1. Overview of micro-governance processes

Process	Why it is important	Main impact to be achieved	Key considerations
Engagement of diverse stakeholders	Diversity increases the collective intelligence of the ecosystem	• Ensure heterogeneity of experience and expertise • Create conditions for productive 'dissonance' of stakeholders that can lead to more ground-breaking innovations	• How to identify relevant stakeholders based on an exploration of the future? • When and how to engage stakeholders with divergent interests? • How many stakeholders to engage? • How to monitor and review stakeholder engagement?
Orientation around shared goals	Goal orientation ensures dedication and commitment of stakeholders	• Ensure there is a shared understanding of the direction of the ecosystem • Create concrete objectives to guide coordinated ecosystem activities	• How to collectively define a futures-oriented vision and goals? • How to facilitate coordination around desired outcomes? • How to monitor and renew the vision and shared goals?
Collaboration	Effective collaboration between organisations relies on suitable conditions and incentives	• Identify mutually beneficial activities for the ecosystem partners • Build productive and trusted relationships between ecosystem partners • Address issues surrounding the sharing of IP, data and resources	• How to establish trusted relationships? • How to establish agreed rules for engagement? • How to set out roles? • How to leverage resources for collaboration?
Anticipation, learning and adaptation	Innovation in uncertain environments is knowledge intensive and requires robust processes for the effective use of insights that are generated through anticipation and experimentation	• Establish anticipation and experimentation as valuable approaches to generate knowledge • Ensure that knowledge generated by the ecosystem is actionable • Set up processes to monitor and adapt the logic of ecosystem activities	• How to identify relevant information for anticipation? • How to make sense of the changing internal context and external environment? • How to identify ecosystem limitations and needs? • How to adapt ecosystem goals and activities?

Engagement of diverse stakeholders

The engagement of diverse stakeholders is the foundation for delivering the benefits of anticipatory innovation ecosystems. Diverse stakeholders are necessary to provide the range of knowledge, expertise and resources that are the raw materials for innovation through convergence. The heterogeneity of their viewpoints, values and ways of understanding the world create the dissonance that allows the ecosystem to identify new opportunities for anticipatory innovation (illustrated in the example of the Dutch Top Sector Life Science and Health in Box 2.2).

The mechanisms of the AIG framework articulate key reasons that diverse stakeholders should be engaged to facilitate anticipatory innovation.

- **Detecting and making sense of change to identify opportunities**: Diversity within the innovation ecosystem enables participants to detect a wide range of weak signals of change and make sense of them collaboratively. By creating an environment in which they can explore the present situation and potential changes from a wide range of viewpoints, the anticipatory innovation ecosystem allows actors to identify opportunities and challenges that would be undetectable to each individually. For example, entrepreneurs might identify applications for new technologies developed in academia through their understanding of the market; civil society actors may provide an insight into social trends and norms that create new niches for innovation.

- **Exploration of alternatives and overcoming vested interests:** A breadth of viewpoints and expertise enables participants in the ecosystem to imagine and explore a wider range of alternative futures and potential solutions. Ecosystem members can leverage their dissonant values to assess and deliberate trade-offs between these alternatives, enabling the ecosystem to move towards innovations that deliver better collective outcomes now and in the future. Conflict allows vested interests and biases to be revealed and questioned, providing a path for innovation ecosystem members to collectively conceive of innovations that are not constrained by current power structures or ways of working.
- **Public participation to explore consequences and benefits of innovation:** The inclusion of stakeholders who typically have little involvement of the innovation process, such as civil society groups, can help to overcome the myopia of incumbent players when it comes to assessing the consequences of technology development. This provides government and other parties with the opportunity to steer the innovation process towards better social and environmental outcomes and become more conscious of potential risks (including social backlash). Furthermore, engaging potential beneficiaries of innovation "can help orient innovation efforts in directions that are most pertinent and fit-for-purpose. This in turn would support future take-up from users" (Kreiling and Paunov, 2021[8]) .
- **Knowledge exchange and learning loops:** Bringing together a range of actors provides ecosystem members with the opportunity to learn from others working in the same or connected fields (Könnölä et al., 2021[9]). They can identify shared issues and challenges relating to innovation and explore ways to resolve them together. The capacity of the group to detect a wider range of signals can allow ecosystem members to quickly identify and make sense of consequences of their actions and make regular adjustments to their ways of working in order to improve outcomes.

Box 2.2. The Netherlands: Dutch Top Sector Life Science and Health

Designated by the Ministry of Economic Affairs and Climate Policy, the **Dutch Top Sector Life Science and Health** is a mission-driven initiative that supports economic opportunities through public-private partnerships (PPPs) surrounding the societal theme of health and care in the Netherlands.

This Dutch Top Sector seeks to ensure the good health of Dutch citizens and decrease health inequalities among socioeconomic groups. Additionally, the sector aims to contribute to the Dutch living environment and lifestyle and offer precise care for people with chronic diseases, lifelong disabilities and dementia.

In an interview with the OECD, the Executive Director of Dutch Top Sector Life Science and Health pointed that ecosystem approach to mission-driven R&I supported the resolution of the long-standing confrontation between public and private investments and interests, demonstrating that new types of solutions can be found if partners are forced to address the perceived controversies. One promising avenue is the use of modern technologies and FAIR data principles (Findable, Accessible, Interoperable, Reusable), that, for example, allow access to conclusions from data without giving direct access to or transfer of data. As it was summed up:

> *"If we want to stick to the old landscape we will stick to these old regimes, laws and regulations. Yet we must find out what are new future-savvy technologies, methodologies, and rules and regulations. This can also be seen in the context of Covid-19 – the urgency made formerly close to impossible collaborations possible."*

Source: OECD interview; Health-Holland (n.d.[10]), *Homepage*, https://www.health-holland.com/ (accessed 15 November 2022).

Key considerations

Identification of relevant stakeholders

The Quadruple Helix has been observed and promoted as a way of structuring diversity in order to stimulate innovation through novel interactions between different types of actors. The 'helices' refer to types of actors: industry, academia, government and civil society. Civil society in the context of Quadruple Helix can mean anything from NGOs and lobby groups, mass-media to the over-arching societal and cultural milieu in which the other actors are embedded (Hasche, Höglund and Linton, 2019[11]).

Within each helix, the participation of different types of organisation and individuals is valuable. For example, large companies can provide access to global business networks and value chains, medium-sized companies are identified as "small enough to be able to innovate quickly, yet large enough to contribute to manufacturing" (Philp and Winickoff, 2019[12]) , while start-ups are nimble at identifying and address new niches for innovation. In civil society, the engagement of potential users of innovation can provide valuable information to enable ecosystem partners to respond to and shape demand, while the involvement of minorities and marginalised groups is important to explore and understand the potential risks of innovations.

The identification and engagement of relevant stakeholders for anticipatory innovation ecosystems is an ongoing process that is dependent on the goals and needs identified by ecosystem participants. This can seem like a 'chicken-and-egg' problem, in which it is unclear which stakeholders to engage until some have been engaged. In practice, no ecosystem is constructed entirely from scratch. For a government to identify an area in which the development of an anticipatory innovation ecosystem would be beneficial, it must have first established that there is a critical mass of potential ecosystem partners (see Box 2.3 for an overview of methods to establish ecosystem potential).

Public servants may be concerned about showing a preference for particular organisations by engaging them first. This can be avoided by communicating that ecosystem development is an iterative process and by being clear and open about the methods for stakeholder selection.

Assuming that broad priority areas for ecosystem development have already been identified by government or existing ecosystem partners, there are a range of methods that can be applied to map relevant stakeholders. Systems mapping approaches provide a broad overview of the actors who may be affected by or have a role to play in the anticipatory innovation ecosystem. These methods document connections between actors around a particular problem or objective and the role they play in the system (Matti et al., 2020[13]). Participatory approaches to systems mapping can enable stakeholders engaged in the ecosystem to identify which organisations might be missing and recognise how they are already interdependent. This is a benefit to building capacity for *collaboration.*

Quantitative approaches to stakeholder mapping can also help and ecosystem partners and support teams to identify who should be engaged in the ecosystem. Nesta, the UK innovation foundation, has developed approaches to identify innovative organisations and explore networks of innovation by using novel and open data sources such as business websites and social media platforms. These methods help to identify existing innovation networks whose collaborations can act as a foundation for anticipatory innovation ecosystems, and also identify gaps between communities that the ecosystem can help to address (Nesta, n.d.[14]).

Relevant stakeholders can also be identified by employing anticipatory approaches. By exploring possible futures in which innovation plays a role, it may become clear that an unexpected group of actors will be affected by the development of a new technology or become key links in the value chain.

Box 2.3. Approaches for selecting and prioritising innovation ecosystems for government support

As part of this project, the OECD conducted a literature review to document methods observed in national governments for selecting local, regional, and national innovation ecosystems. It revealed common five types of approach: foresight-based, quantitative, mixed-methods, industry-led and grand challenge based 'missions'.

In practice, these methods can overlap, and it is often beneficial if they are used to complement each other. Instruments used in one method can be used in another, or the output of one method can be used to inform decisions in another one. These methods demonstrate the importance of **engaging diverse stakeholders** and **setting shared goals** in the early stages of ecosystem development.

- **Foresight-based selection methods** engage diverse stakeholders come to envision different potential futures. The stakeholders can decide on collective actions to direct towards more desirable futures. Foresight can collect diverging viewpoints from the relevant stakeholders in the ecosystem and help build consensus. This is useful in selecting ecosystems because policy makers do not typically have access to the "tacit knowledge" that exists in the ecosystem. The disadvantages of a foresight-based selection approach are that it may over-represent the views and biases of particular stakeholders, and that participatory foresight processes can take a long time (more than one year) to undertake. Foresight approaches have been used to identify priorities for innovation ecosystems in Lithuania (Box 1.7) and Romania.
- **Quantitative methods** rely on statistical analysis of the current state of the economic and innovation performance of a geographical region of any size in order to select innovation ecosystems. Quantitative methods have the deficit that they may not provide a complete picture of a given region's potential, as they are based on a limited range of past data. A purely quantitative method of selecting smart specialisations and thus innovation ecosystems for Finland's regions was suggested in 2017 in order to provide a clear data-driven picture of the most dominating sectors in each region.
- **Mixed-methods** use both qualitative approaches like foresight and quantitative methods to select an innovation ecosystem. Mixing these methods can provide a more comprehensive picture of an ecosystem's potential, but diverse sources of data can tell competing stories. This misalignment requires strong analytical skills to incorporate and synthesise the collected information. Mixed-methods have been used in several regions to develop R&I strategies and select innovation ecosystems. The Balearic Islands adopted a mixed-methods approach to develop their smart specialisation strategy for 2013-2017. It combined methods such as statistical analysis, interviews and SWOT analysis.
- Innovation ecosystems can be selected by calling on **industry-led consortia** to organise and apply for government support to innovate in certain pre-defined areas. This method allows bottom-up self-selection and self-organisation and galvanises the creation of new linkages between ecosystem partners. This method risks favouring already entrenched sectors and ecosystems. The selection of Canada's Superclusters invited consortia to demonstrate how they could deliver the greatest value to Canada.
- Innovation ecosystems can be selected with the specific goal of solving **grand challenges**. Grand challenges are complex societal problems with multiple linked causes and multiple solutions. For each grand challenge, one or more time-bound missions can be set out and ecosystems convened to solve these missions. These ecosystems typically involve actors from diverse sectors. The emphasis is put not only on stimulating research and development, but also on creating demand for "necessary" innovations through demand-side policies.

The disadvantage is that mission ecosystems pose governance and performance evaluation challenges due to their cross-sectoral and systemic nature. The UK Government published the final version of the Industrial Strategy in November 2017, which included four grand challenges, chosen through feedback from a public consultation process and input from scientific leaders. Sweden's innovation agency Vinnova has also experimented with various ways of establishing and governing mission-driven ecosystems, resulting in projects such as Vision Zero Cancer.

Source: OECD research based on Paliokaitė, A., Ž. Martinaitis and R. Reimeris (2015[15]), "Foresight methods for smart specialisation strategy development in Lithuania", https://doi.org/10.1016/j.techfore.2015.04.008; Paliokaitė, A., Ž. Martinaitis and D. Sarpong (2016[16]), "Implementing smart specialisation roadmaps in Lithuania: Lost in translation?", https://doi.org/10.1016/j.techfore.2016.01.005; Kaivo-oja, J. et al. (2017[17]), "Smart specialization strategy and its operationalization in the regional policy: Case Finland", https://doi.org/10.3846/bme.2017.362; Government of Canada (2019[18]), *Building a Nation of Innovators - Innovation for a Better Canada*, https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00105.html; Beaudry, C. and L. Solar-Pelletier (2020[19]), "The Superclusters Initiative: An opportunity to reinforce innovation ecosystems"; Government of Canada (2016[20]), *Technology Demonstration Program - Program Guide*, http://epe.lac-bac.gc.ca/100/201/301/weekly_acquisitions_list-ef/2016/16-31/publications.gc.ca/collections/collection_2016/isde-ised/Iu37-3-2015-eng.pdf; Fagerberg, J. and G. Hutschenreiter (2020[21]), "Coping with societal challenges: Lessons for innovation policy governance", https://doi.org/10.1007/s10842-019-00332-1; UK Government (2017[22]), "Industrial strategy: Building a Britain fit for the future", https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future; Hill, D. (2020[23]), "Realizing mission-oriented innovations in a fast-moving world", https://council.science/current/blog/realizing-mission-oriented-innovations-in-a-fast-moving-world/; Mazzucato, M. (2017[24]), "Mission-oriented innovation policy: Challenges and opportunities", https://www.ucl.ac.uk/bartlett/public-purpose/publications/2017/sep/mission-oriented-innovation-policy-challenges-and-opportunities; Govern de les Illes Balears (2013[25]), *Illes Balear - Towards a RIS3 Strategy*, https://kipdf.com/illes-balears-towards-a-ris3-strategy_5ab8529b1723dd339c818b56.html.

Level and type of engagement

The level and type of engagement of different stakeholders does not need to remain consistent across groups or over time. The ecosystem can derive the benefits of engaging diverse stakeholders by facilitating the participation of select groups in specific activities at points in its development. For example, participatory agenda-setting involving a wide range of stakeholders from civil society can help to define the objectives and normative boundaries for innovation early on in ecosystem development (OECD, 2018[26]). Subsequently, closer collaboration between academia and industry can enable the development of innovations within this frame for development.

It is perhaps for this reason that the number of innovation ecosystem partners is so varied across ecosystems. In a survey of 247 innovation ecosystems in Europe, Komorowski found that "innovation ecosystems can include a very small number of actors (six ecosystems identified and analysed via the survey report to include less than ten actors) or a very large number (five are reported to involve more than 10.000 actors)." (Komorowski, 2019[27]).

Valkokari et al. (Valkokari, Hyytinen and Kutinlahti, 2021[28]) note that most successful ecosystems have multiple degrees of engagement. A 'core group' of highly engaged ecosystem actors is beneficial to determine an overall vision and strategic direction for ecosystem activities. Individuals within this group should participate consistently over time, and have the knowledge and authority to align the strategic objectives of their organisations to that of the developing ecosystem. At lower levels of engagement, 'theme-specific development groups' of organisations may participate in projects which contribute to the ecosystem goals without playing a role in the overall governance of the ecosystem, while 'ecosystem interest groups' of organisations which provide services to ecosystem actors may simply use the ecosystem as a networking opportunity (Valkokari, Hyytinen and Kutinlahti, 2021[28])). This type of structure is illustrated in the example of Finland's 6G Flagship in Box 2.4.

Box 2.4. Finland: 6G Flagship

Coordinated by the University of Oulu (Finland), 6G Flagship is funded by the Academy of Finland, a government agency within the administrative branch of the Ministry of Education, Science and Culture.

With over 500 academic partners and more than 400 industrial partners, e.g., ICT enterprises, the ecosystem facilitates collaboration with a variety of stakeholders to continue the deployment of 5G technologies and services and also develop research for the future of a 6G world. This visionary approach of the ecosystem enables partners to connect and identify opportunities with upcoming technologies in a 6G Network and to prepare partners for new business models that align digitalisation with the United Nations Sustainable Development Goals.

Mix of formal and informal governance approaches across core partners and wider network

6G Flagship ecosystem is an example of applying adjusted ecosystem governance models for the core members of the ecosystem and a wider network. The core network of partners is engaged in strategic day-to-day collaboration and face-to-face meetings. The ecosystem is also very active internationally. Collaboration with the international partners is organised through specific collaboration projects using different types of funding models and funding sources compared to the mechanisms used with the strategic core partners. To summarise, for the core partners the ecosystem has formal structures – 6G advisory steering board and annual meetings. With other partners it is less formal and guided by the individual research projects and their requirements.

Source: OECD interview; 6G Flagship (n.d.[29]), *Innovation & Co-creation in 6G Flagship Ecosystem*, https://www.6gflagship.com/get-involved/ecosystem/ (accessed on 15 November 2022).

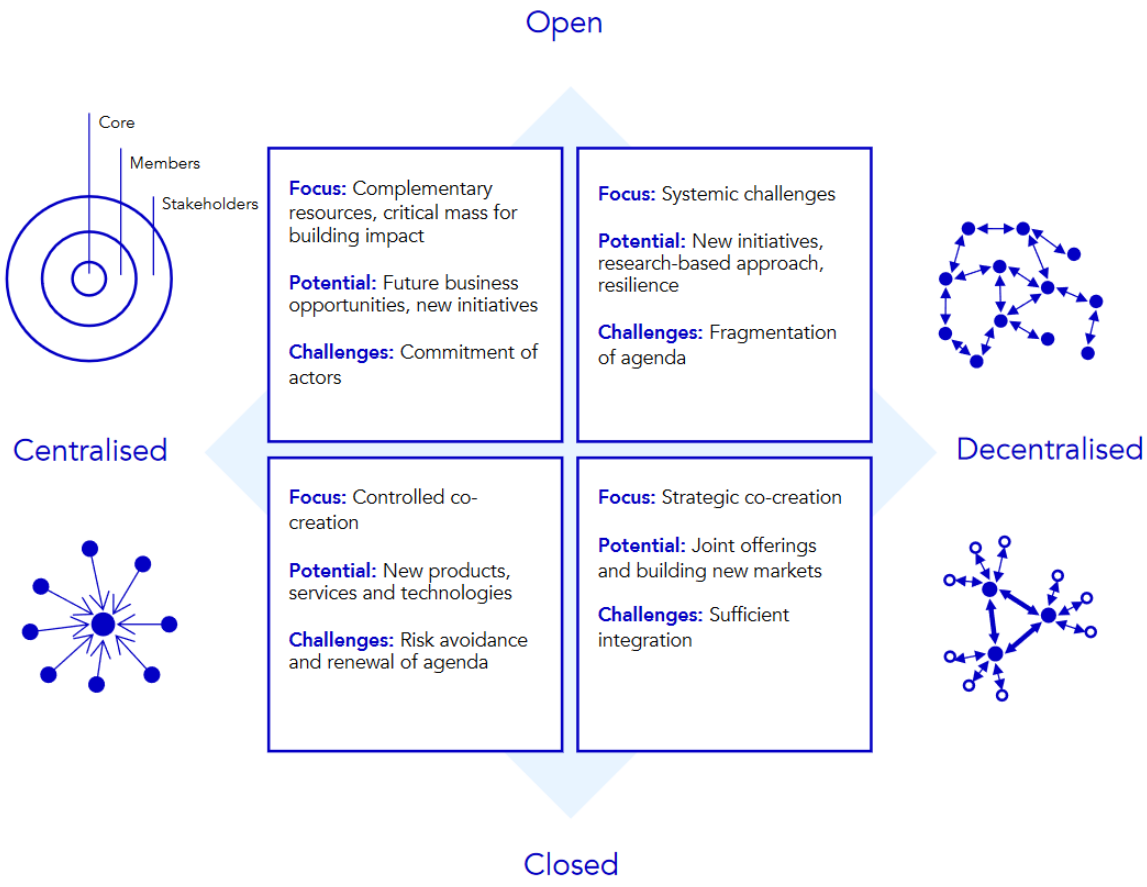
Monitoring and renewing the engagement of diverse stakeholders

According to Valkokari et al. this three-degree model of engagement is centralised but open and is suited to the identification of business opportunities and the generation of new initiatives. Figure 2.3 presents three alternative structures and outlines their benefits and drawbacks. Ecosystem partners and support teams can benefit from understanding and experimenting with different structures to find and revise the one that is appropriate to the goals they are working towards.

Anticipatory innovation ecosystems will always be a coalition of the willing: “their materialisation depends on the voluntary actions of hierarchically independent others – who need to anticipate some benefit for themselves before committing to making their contributions” (Autio, 2021[30]) . A key challenge in the early stages of ecosystem development is the creation of a sense of momentum. If this is not achieved, potential ecosystem partners may lose interest and the early efforts of ecosystem support teams will be wasted (Autio, 2021[30]).

To attract participants, actors involved in the development of ecosystems, such as the ecosystem support team, can benefit from the creation of a clear engagement plan that describes the benefits and outcomes of participation that are tailored to the organisations they wish to engage. Valkokari et al. (Valkokari, Hyytinen and Kutinlahti, 2021[28]) have synthesised different benefits which actors participating in an innovation ecosystem can expect to see and what other participants in the ecosystem or the ecosystem as a whole can expect as benefits (Table 2.2). This can ecosystem initiators and partners to understand what types of actors to engage, and incentives and benefits of participation that should be communicated.

Figure 2.3. Ecosystem structures



Source: Valkokari, K., K. Hyytinen and P. Kutinlahti (2021[28]), *Collaborating for a Sustainable Future - Ecosystem Guide*, https://doi.org/10.32040/2020.Ecosystemguide.

Table 2.2. Benefits for innovation ecosystem participants

Actors	Benefits generated by ecosystems	Value to ecosystems and other actors
Large companies	• New ideas, perspectives, and innovations from outside • Building partnerships or doing acquisition to scale or to expand business • Using complementary expertise of other actors • Sharing technology and business risks	• Business ecosystem drivers with established business networks in the ecosystem focus or related areas • Connections with customers and ability to scale and commercialise solutions on a wider range of topics • Possibility to invest time and resources into ecosystem activities • Setting shorter-term business objectives and development challenges
Small companies	• New ideas, perspectives, and innovations from outside • Expanding business through new partnerships without taking big risks • Contacts with customers and the ability to scale and commercialise solutions	• Established businesses with deep know-how on specific topics • Ability to scale and commercialise solutions on specific topics

Actors	Benefits generated by ecosystems	Value to ecosystems and other actors
Start-ups	• New ideas, perspectives, and innovations from outside • Fast-track testing of new ideas and solutions in an ecosystem • Opportunities to scale business through new partnerships	• Ability to introduce new thinking, solutions and • Opportunity to take risks and try out new solutions and approaches • Reaching out to (new) customers through new channels and technologies
Test beds and living labs	• Competitive, efficient, and compelling business, working and living environment • Monetary or other type of value for providing data and insight • Functioning as a cost-effective platform for co-creation	• Providing test platforms, infrastructure, and users for the ecosystem actors • Provide data and insight for research and development purposes • Feedback on the solutions and services being developed
Research organisations	• Expanding research portfolio through new partnerships • Building new networks and collaboration in the specific R&D area of interest • Attaining new skills, capabilities, and know-how through the ecosystem • Accessing new technologies, tools, and data through the ecosystem • Accessing new test environments, infrastructures, and users through the ecosystem	• Providing skills, capabilities & know-how for the ecosystem • Providing technologies, tools, and data for the ecosystem
Third sector (Civil Society)	• Creating skills, capabilities, and know-how • Opening up new funding sources	• Understanding customer relationships and citizens' needs • Ecosystem test beds and users
Cities	• Support and expertise (centres of expertise) strengthening the capabilities of urban communities • Creates the prerequisites for the innovative development of services in urban communities • Making cities more attractive • Using new RDI funding sources	• Enables cooperation within an ecosystem permits processes, engaging urban dwellers, opening up one's own activities & being a customer • Understanding customer relationships and citizens' needs (including customer data for developing innovations) • Active co-creation which functions as a neutral ecosystem orchestrator and coordinator • Brings together different parties and provides development environments to support cooperation
Funders and other stakeholder actors	• Private funders: short or long-term return of investment through R&D activities • Competitive, efficient, and compelling business and development platform • Advancing local competitive position at the national level, as well as position on the international level • Opportunities to explore new regulation and policy frameworks in test environments	• Investing in ecosystem R&D activities • Provide favourable ground for R&D&I activities • Public funders: Co-develop and co-create test platforms; Expertise in business scaling and effective commercialisation • Policymakers and regulators: Contributing to innovation policy making at the national and European levels

Source: Adapted from Valkokari, K., K. Hyytinen and P. Kutinlahti (2021[28]), *Collaborating for a Sustainable Future - Ecosystem Guide*, https://doi.org/10.32040/2020.Ecosystemguide.

In addition to tailored benefits and incentives, a clear vision and goals are important to galvanise and sustain participation. In early stages of development when overarching goals for the ecosystem are still unclear, shorter-term milestones such as the creation of an ecosystem strategy can create a sense of urgency and provide impetus for stakeholders to engage (Kreiling and Paunov, 2021[8]).

As described above, the roles and needs of stakeholders within an ecosystem change over time. "An ecosystem is not a closed network as it must constantly renew itself. In order to keep on the jointly chosen path, the ecosystem's actors need orchestration to support the self-organisation process" (Valkokari,

Hyytinen and Kutinlahti, 2021[28]). Stakeholders working with ecosystems must be attentive to gaps in the ecosystem and missing voices, as well as the presence of actors whose contributions to the ecosystem risk diverting it from its goals. After each engagement of ecosystem participants, the following questions can help the ecosystem support team to consider what other stakeholders may need to be engaged in order to enable progress:

- Who was present, and what might they offer the ecosystem (e.g. resources and knowledge)?
- Are any stakeholders emerging as potential leaders within the ecosystem?
- Which stakeholders might be missing from the ecosystem, based on the issues raised by those who were present?

Table 2.3. Tools and approaches for the engagement of diverse stakeholders

Backstage	Frontstage
Systems mapping	Participatory systems mapping
Value-chain mapping	Participatory foresight
Stakeholder interviews	Co-design workshops with clear objectives
Persona development	Information sharing workshops
Engagement plan development	Delphi surveys to develop ideas about potential future developments around an issue
Preparation of short-term goals	Expert interviews to gather input on a specific topic/question/challenge
Preparation of a prototype vision	Open-source brainstorming activities (e.g. hackathons)
Identification of resources that ecosystem members can access	

Orientation around shared goals

For innovation ecosystems to successfully leverage diverse knowledge and capabilities required to generate anticipatory innovation, they must facilitate the coordination of different stakeholders around shared goals. These goals should be informed by a compelling core vision for the impact that the ecosystem aims to bring about through its activities.

Vision creation and goal setting within anticipatory innovation ecosystems is an iterative, participatory process that enables ecosystem participants to explore and understand areas of friction and synergy in order to identify opportunities for innovation. To create a vision that compels a wide range of stakeholders to collaborate, ecosystem partners must work to understand each other's values and goals. For a vision to be credible, it must be based on a shared understanding of the needs it addresses and the capabilities of ecosystem partners to achieve it. For it to be robust and remain relevant in the face of ongoing change, it must be developed through an active engagement with the future that reveals areas of uncertainty.

The process of developing a vision and goals is inherently anticipatory as it involves imagining a desired future state of the world that ecosystem partners aim contribute to through collaboration. The mechanisms of the AIG framework present some key criteria to consider as part of the development of a vision and goals.

- **Legitimacy:** For a vision to function as a post around which ecosystem activities can be coordinated, ecosystem participants must see it as legitimate. There are three important elements of legitimacy. The first concerns the desirability of the impact envisioned. Ecosystem partners must share the view that the vision represents a future that they wish to contribute to. The second concerns the political legitimacy, and the alignment of the vision to policy goals. The third element concerns the credibility of the vision. If a vision is perceived as unachievable, it will not work to galvanise participation.

- **Public interest and participation:** Participatory approaches to developing a vision can help to ensure broad public and political support for the activities of the anticipatory innovation ecosystem. In addition to orienting the innovation ecosystem towards better social and environmental outcomes (and away from problematic areas), engaging a wide range of participants to set the vision for an ecosystem can help to identify potential users and beneficiaries of innovation.
- **Alternatives exploration:** Anticipatory approaches enable the creation of multiple possible visions, providing ecosystem participants with the opportunity to explore what may result if they move in a number of different directions. This allows the ecosystem to avoid the pitfalls of vested-interests and biases and identify opportunities for innovation that are otherwise out of reach.
- **Sense-making:** Participatory sense-making allows ecosystem participants to develop a more comprehensive understanding of current and future needs that can be used to set the foundation for a shared vision.

Key considerations

Types of goal

Visons and goals come in many shapes and sizes. They may be richly imagined, impressionistic, or narrowly defined. They may be immediately attainable, or they may require a grand restructuring of a present system. Each type has its place and function, and it is important for ecosystem support teams and partners to recognise which is valuable for what purpose.

GIZ outlines three types of change that ecosystems can consider when determining visions and goals. These are categorised as incremental (more of the same), reform (adaptation of the system), or transformative change, which leads to the creation of a new system, or to a change so substantial that it is largely unrecognisable from the initial system (GIZ, 2020[31]). This framework can help ecosystem partners to think beyond present constraints and envision future goals that are appropriate to the ecosystem.

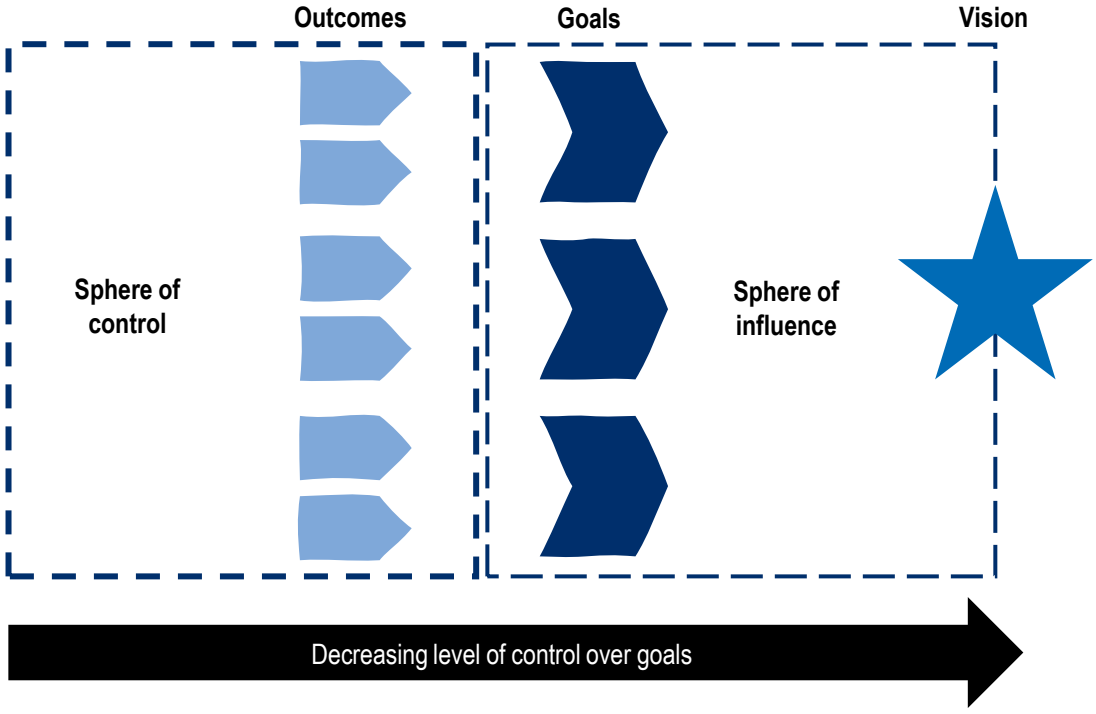
Table 2.4. Types of change

Examples	Incremental	Reform	Transformation
Energy	Increasing energy efficiency (lower carbon regime)	Promoting renewable energies (lower carbon regime)	Abandoning fossil energy, using 100% renewables (carbon neutral regime)
Waste	Less waste (waste regime)	Waste re(down)cycling (waste regime)	Circular economy/cradle to cradle (no waste regime)
Transport	E.g. more energy and resource efficient cars with less emissions (recent transport regime)	E.g. reforming speed limit, fuel tax, tolls... (recent transport regime)	Restructuring traffic towards carbon neutrality, circular economy, multiple shared modes of transport... (new transport regime)

Source: GIZ (2020[31]), *Transformative Project Design*, https://www.giz.de/expertise/downloads/GIZ-BMU_2020_Transformative%20Project%20Design_EN.pdf.

It is helpful to define visions and goals with reference to an ecosystem's sphere of influence (Figure 2.4). A vision presents a plausible and preferable vision of the future which the activities of the innovation ecosystem have played a key role to bring about. Goals comprise key components of the vision that the ecosystem aims to achieve. While the realisation of the goals and vision can be *influenced* by the activities of the ecosystem, they are not under the direct control of ecosystem partners.

Figure 2.4. Goals categorised according to an ecosystem's sphere of influence



Once ecosystem partners have determined a vision, it is possible to work backwards to explore and identify intermediary outcomes that must be achieved. This approach draws on the anticipatory method of 'backcasting', and can be applied to develop and innovation roadmap or 'theory of change' that ecosystem partners can use as a tool to coordinate their activities, revise their assumptions, and adapt their strategy (Boni et al., 2021[32]).

Outcomes should describe goals that can be achieved through the activities of the ecosystem. A collective approach to determining outcomes can allow ecosystem partners to identify areas in which collaboration between specific actors may be beneficial, prioritise outcomes and identify contingencies, and explore multiple pathways to achieving the same impact. Smaller working groups can be formed around specific outcomes. The development of micro-governance processes should also be considered as an outcome to ensure that the ecosystem continues to function effectively.

The identification of outcomes makes it possible to specify indicators and milestones that allow ecosystem partners and support teams to track the progress of the ecosystem.

Legitimacy and credibility for goals

A compelling and legitimate vision for anticipatory innovation ecosystems must take into account the interests and capabilities of ecosystem partners, the policy priorities and ambitions of government, and the broader global context that influences the need for innovation. Grand challenges, such as those articulated by the United Nations' SDGs, and government priorities provide useful framing devices for the development of a shared vision at the level of micro-governance, encouraging ecosystem participants to see how their work might contribute to broader societal goals.

Developing a legitimate and credible vision requires strong analytical capabilities to identify and collate relevant information and bring together appropriate stakeholders, skilled facilitation and the ability to create a "credible 'big picture'" (Valkokari, Hyytinen and Kutinlahti, 2021[28]). While a vision needs to be credible,

interviews with ecosystem support organisations conducted by the OECD revealed that setting objectives that are too rigid in the early stages of ecosystem development can risk committing it to failure (Box 2.5).

Box 2.5. Belgium: Spearhead cluster flanders.healthTech

Created in 2004, Spearhead cluster flanders.healthTech is a Flanders (Belgium) based not-for-profit cluster dedicated to life sciences and biotechnology.

This industry driven cluster has more than 340 members across the life sciences network and works closely with companies, universities and professional service providers.

In a research interview, a representative from flanders.healthTech explained that developing a shared goals for an ecosystem requires a carefully facilitated transition from a loose vision to more concrete outcomes:

> *"You need 'artistic fuzziness' in the beginning of the ecosystem building to focus on the vision and emerging processes. By the end of the process, you need to make a project proposal. Then it needs to be quite crisp and robust. It is important at the beginning to not to put too many people around the table, but also not to focus on smart goals in the beginning because then you are killing it."*

Source: OECD interview.

Anticipatory approaches to setting and orienting around shared goals

Anticipatory approaches provide a toolkit to build consensus around shared visions and identify intermediary outcomes and goals. They can be used to develop theories of change, roadmaps for innovation, and stress-test these against possible futures scenarios. The cases of the Ro-Ro shipping ecosystem (Box 1.6) and the identification of smart specialisation priorities in Lithuania (Box 1.7) demonstrate how legitimate and credible visions and goals can be arrived at engaging a wide range of stakeholders in a multi-stage programme which combines anticipatory approaches.

Participatory foresight, which involves citizens in the exploration of future pathways for innovation, can enhance the relevance and democratic legitimacy of goals. Integrating citizens' visions and embedding their narratives into the identification of shared goals allows for a broader understanding of the impact of innovation pathways and how the demand-side innovation policies (see OECD (2011[33])) need to be adapted in order to realise a viable and desirable vision (Rosa et al., 2021[34]). Concerns about how future generations might be impacted by the programme can also be explored.

Foresight methodologies are very broad (for an overview see Tõnurist and Hanson (2020[1]), Popper (2008[35])) and their applicability is dependent on the scope of the project, the resources of the facilitators and the amount of time available. Three possible methods are presented below:

- **Citizen visioning:** In this method, citizens are asked to envision day-to-day activities in the future in a scenario which they would consider optimal as a community.
- **Futures Dialogue:** A flexible method through which different stakeholder groups (citizens and experts) discuss and eventually reach an agreement on what various desirable futures could look like.
- **Narrative Generation:** This method implies citizens participating in story-telling workshops in which they create (either collaboratively or individually) coherent short stories which describe aspects of future scenarios through the eyes of a representative persona (Rosa et al., 2021[34]).

Alongside the normative approach to setting a vision through participatory foresight outlined above, explorative approaches can allow stakeholders to assess whether the goals they are working towards remain relevant across multiple possible futures. Horizon scanning, which engages stakeholders to identify changes that might affect the ecosystem in the future, enables the development of futures scenarios against which ecosystem strategies can be stress-tested.

Monitoring and renewing the vision and shared goals

By exploring and documenting shared visions and outcomes, participants in an anticipatory innovation ecosystem become conscious of how their interactions can begin to bring about preferred futures. This process builds the ecosystem's *capacity for collaboration*, and lays the foundations for it to *anticipate, learn and adapt*. In the complex, changing environment which ecosystem partners are trying to influence, the desired impact and outcomes should be regularly reviewed.

Explorative approaches to foresight can allow ecosystem partners to check the relevance of the outcomes and impacts they aim to achieve. Regular discussion of progress towards the outcomes can allow ecosystem partners to identify challenges that need to be addressed as a group and inform government policy and regulation. Where an outcome is identified as unachievable or no longer relevant, it can be a prompt for the ecosystem partners to work together to find a new approach to move towards the ecosystem impact, or re-evaluate the desired impact entirely.

Table 2.5. Tools and activities to orient around shared goals

Backstage	Frontstage
Analyse and synthesise government policy objectives	Foresight approaches (visioning, horizon scanning, backcasting, etc.)
Collect and analyse goals set by ecosystems in similar fields	Theory of Change workshops
Prepare briefings on international trends	Deliberative processes to identify areas of consensus
Interviews and surveys to understand goals of individual organisations	Stress-testing of long-term objectives with a range of possible futures
Development of draft goals and visions for feedback	Strategic communication activities around a defined vision, e.g. development of vision & mission statement
Analysis and synthesis of workshop outputs	Collective identification of fora to promote the vision such as conferences, associations, policy discussions
Drafting of strategy documents	
Communication efforts to sharpen key messages, develop a uniform design and language	

Collaboration

The Oslo Manual defines collaboration in the context of innovation as follows: "Collaboration requires co-ordinated activity across different parties to address a jointly defined problem, with all partners contributing. Collaboration requires the explicit definition of common objectives and it may include agreement over the distribution of inputs, risks and potential benefits" (OECD/Eurostat, 2018[36]). Effective collaboration between stakeholders is what distinguishes an ecosystem from a loosely grouped network of actors. According to Russell and Smorodinskaya, "innovation ecosystems are essentially the result and derivative of collaboration-type interactions, i.e., they emerge at the moment when cooperating actors have achieved a certain level of integration concerned with a joint identity, joint strategy and joint goals" (Russell and Smorodinskaya, 2018[3]). This cooperation can improve stakeholders' access to resources, shorten time of products to market, and enable joint learning which improves innovation capability (Pellikka et al., 2021[37]).

As actors have distinct and parallel values and objectives, and may be in competition, building collaborative capacity is dependent on finding ways for stakeholders to manage their differences and de-risk sharing of information and resources. The goal is to develop a heterarchy in which ecosystem partners feel that their contributions are secure and equally valued, and are prepared to listen to others. “This trusted relationship…” according to Tõnurist and Hanson (2020[1])“can open up situations for exploring uncertainty” and shaping an authorizing environment for the development of anticipatory innovations. The ecosystem support team, as an independent party in the ecosystem, plays a vital role in establishing this.

Key considerations

The elements of collaborative capacity can be categorised under four areas for governance: relationships, rules, responsibilities and resources.

Development of relationships

Successful innovation ecosystems enable trusted, collaborative relationships to develop between diverse actors who in other contexts may see their interests as contradictory or incompatible. This thickening of networks and development of social capital through informal mechanisms is a catalyst for anticipatory innovation, allowing knowledge to be developed and uncertainty to be explored (Tõnurist and Hanson, 2020[1]). “Trust among members has the potential to reduce transaction costs, increase the likelihood of inner network stability, promote knowledge sharing, and stimulate innovation (Klijn et al., 2010). It is especially relevant in collaborative networks because the uncertainties of collaboration cannot all be managed through hierarchical power, surveillance, and contracts (Edelenbos & Klijn, 2007)” (Wegner and Verschoore, 2021[2]).

To explore uncertainty together, participants must feel comfortable to speak openly and agree to disagree constructively. To solve problems together, they are likely to have to share knowledge and resources (Valkokari, Hyytinen and Kutinlahti, 2021[28]). Creating the conditions in which these types of exchanges can occur is an important challenge for ecosystem partners and support teams.

Regular interaction itself, through activities such as field-visits, meetings and workshops, facilitates the development of trust and strengthens relationships (Wegner and Verschoore, 2021[2]). However, to create a heterarchical environment in all partners are able to contribute, differences in power between ecosystem partners must be explored and understood. An assessment of power by the ecosystem support team can help to reveal vested interests and act as a guard against capture of the ecosystem by a narrow range of actors to ensure that relationships are maintained with less powerful actors whose knowledge and experience are important to direct the ecosystem.

Setting rules

Rules describe the formal and informal governance mechanisms that facilitate engagement between ecosystem members. They create a space in which ecosystem members feel comfortable to share knowledge, expertise and resources, and understand how value generated through interactions within the ecosystem will be captured and owned. “Action in an ecosystem is strongly based on a situation where individual actors understand the rules of the ecosystem, their chances of benefiting from the value created by others and their own ability to create value for others” (Valkokari, Hyytinen and Kutinlahti, 2021[28]).

Ecosystem support teams can play a key role in setting out initial rules for participation, and can catalyse collaboration by preparing prototype agreements that specify the expectations for and rights of participants (Autio, 2021[30]). These should be reviewed by ecosystem partners to ensure that they are suitable for the objectives of the innovation ecosystem. Rules are likely to be necessary in the following areas:

- **Openness and membership:** The ecosystem must determine conditions for participation in the ecosystem; whether partners must be invited or can join themselves. “The rules around openness

should be defined such that they support the objectives of the ecosystem; sometimes a more restrictive operating model gives better and quicker results." (Valkokari, Hyytinen and Kutinlahti, 2021[28]).

- **Intellectual Property:** Ecosystem partners should create written agreements about the rights of ownership in order to ensure that barriers to the sharing of data and intellectual property which may inhibit collaborative innovation are assessed and addressed. The initial design and provision of 'model contracts' by IP offices can simplify and accelerate this process (Winickoff et al., 2021[38]) (Kreiling and Paunov, 2021[8]).
- **Data ownership and use:** "The rules around the ownership of data used or resulting from the activities of the initiative and the resulting innovations need to be clear to all actors before engaging in a co-creation initiative. Good practice is the use of framework agreements that secure the interests of all partners involved." (Kreiling and Paunov, 2021[8]).
- **Standards:** Setting standards enables stakeholders to exert power over the future and steer the process of innovation. "A technical standard is an established norm or a legal requirement that provides a technical specification for a repeatable technical task, process or product… Standards also deliver competitive advantage and are at the core of network effects (Katz and Shapiro, 1985[27]) – as they create compatible technical system that are widely used by others, provide minimum quality and safety (Akerlof, 1970[28]) and enhance consume and investor confidence." (Winickoff et al., 2021[38]).
- **Behavioural norms:** Behavioural norms are an important factor in the creation of an environment for collaboration and "operate as an important informal coordination mechanism in the absence of formal 1-to-1 contracts." (Autio, 2021[30]).
- **Decision-making:** Different approaches to decision-making, such as consensus (in which all parties must agree), consent (in which no party objects), majority rule, or delegation (in which select parties are chosen to make a decision on behalf of the group) are appropriate for different types of decision (Berditchevskaia and Bertoncin, 2021[39]).
- **Ethical principles**: Ethical principles can be developed to establish both shared values and mutually agreed boundaries for the anticipatory innovation ecosystem. An exploration of future changes and pathways for innovation can help ecosystem partners to consider how ethical principles may be breached in possible futures.

These rules, which should be determined based on the objectives of the ecosystem, go on to determine the structure of the ecosystem.

Determining roles

As outlined in the earlier section on the engagement of diverse stakeholders, the roles of actors can change over time, and are "determined by the ecosystem vision and the joint roadmap" (Valkokari, Hyytinen and Kutinlahti, 2021[28]). Setting and achieving ecosystem objectives is likely to require the presence of a 'core' group of consistently engaged stakeholders. A team or organization with responsibility for coordinating ecosystem activities is also necessary, and this role is likely to be undertaken by government or university actors in the early stages of ecosystem development (Dedehayir, Mäkinen and Ortt, 2018[5]). As objectives become clearer and initiatives emerge, additional stakeholders may be engaged to participate in working groups to achieve specific goals (Valkokari, Hyytinen and Kutinlahti, 2021[28]). Given the voluntary nature of participation in anticipatory innovation ecosystems, defining the roles and responsibilities of participating stakeholders important to build in a sense of accountability that maintains the trust and momentum it requires.

Identifying and managing resources

A key benefit of innovation ecosystems is that they improve access to resources and knowledge that are distributed among ecosystem partners (see Table 2.2 for the types of resources that organisations commonly bring into ecosystems).Through discussion and a developing understanding of the strengths, resources and capabilities of participating actors, stakeholders can identify how they can contribute to achieving the desired ecosystem outcomes, and what resources they can access through interaction with other ecosystem partners. They can additionally identify gaps in resources that cannot be provided by ecosystem partners. In this case, the ability of ecosystem partners and support teams to fill these gaps by identifying and convening new stakeholders is important (Pellikka et al., 2021[37]). The identification and management of resources therefore requires developed capacities for knowledge management and stakeholder coordination to identify and document those held by ecosystem partners, and those external to the ecosystem.

In the case of shared resources being accrued by and ecosystem through contributions by ecosystem members or external funding, clear decision-making rules should be defined.

Monitoring and renewing capacity for collaboration

An anticipatory innovation ecosystem is a complex system that changes in response to internal and external forces and relationships. Considering the future through anticipatory approaches can enable ecosystem partners to establish rules and practices for collaboration that are more robust. Nonetheless, frictions and impasses can emerge, stakeholder roles may change, and established rules may become an impediment to progress. Ecosystem partners and support teams must therefore regularly review the elements of this micro-governance process so that challenges can be addressed. The following questions can help the ecosystem partners and support teams to evaluate the capacity for collaboration:

- Are any areas of friction emerging that might inhibit collaboration?
- Are any stakeholders or groups of stakeholders dominating?
- Are any stakeholders of groups of stakeholders in the ecosystem being excluded?

Table 2.6. Tools and activities to develop capacity for collaboration

Backstage	Frontstage
Prepare prototype agreements	Fieldtrips
Assess the power dynamic between ecosystem partners	In-person and online workshops
Document resources available to the ecosystem	Virtual or in-person peer-learning activities to share case studies and best practices
Survey ecosystem partners to identify drivers and barriers to collaboration	Exchange on pitfalls and failures to avoid (e.g. “Fail Friday”)
Build collaborative platforms for collective knowledge management	Peer-review of key documents / strategies / research proposals etc.
Compile toolboxes or a selection of case studies to feed into a given process	Regular collective brainstorming on emerging issues / new ideas / learnings within the community

Anticipation, learning and adaptation

Knowledge development and exchange are key drivers for innovation (OECD/Eurostat, 2018[36]; Philp and Winickoff, 2019[12]), such that innovation can be described as the result of “the practical application of existing or newly developed information and knowledge” (OECD/Eurostat, 2018[36]). The innovation ecosystem approach aims to leverage the fact that “knowledge is generated, distributed and used by multiple actors of an innovation system, such as firms, universities, public research institutions (PRIs),

customers as users of product innovations, and individuals" (OECD/Eurostat, 2018[36]) by fostering an environment in which heterogenous stakeholders can share and co-create knowledge.

The way in which an *anticipatory* innovation ecosystem facilitates the generation and use of knowledge about the future sets it apart from other approaches. The process of anticipatory innovation is driven by ongoing collective learning about the future and how it might be shaped through the collaboration of ecosystem partners. It is sustained by the capacity of ecosystem partners as a group to adjust their assumptions and coordinate their activities in response to new knowledge generated through ecosystem activities and external sources of information. As a result, the success of an anticipatory innovation ecosystem is dependent on its capacity for anticipation, learning and adaptation.

The AIG framework outlines key mechanisms to build the ecosystem's capacity for anticipation, learning and adaptation. Ecosystem partners and support teams can use this to better understand what activities are necessary to support the ecosystem.

- **Alternatives exploration and experimentation:** In conditions of uncertainty, the consequences of innovation cannot be known prior to its creation. However, by drawing on a wide range of information and types of expertise, it is possible for ecosystem partners to explore and consider alternative futures that may plausibly shape and be shaped by different innovation pathways. A number of anticipatory techniques exist that allow innovators to generate new knowledge to guide their decisions and activities, ranging from scenario-based thought experiments to sandboxes or living labs which allow them to practically test innovations.
- **Sense-making:** The breadth of expertise and ways of interpreting their environment among partners in anticipatory innovation ecosystems enables them to detect, understand and shape emerging patters of change. Sense-making describes this process of ongoing collaborative interpretation and action which generates unique and valuable knowledge.
- **Tools and methods:** A wide range of tools and methods can be applied within anticipatory innovation ecosystems to surface and leverage the knowledge of ecosystem partners. Tõnurist and Hanson identify over 30 'traditional foresight methods', such as horizon scanning, STEEP analysis and quantitative modeling, each of which can be applied to generate new knowledge to inform the decisions of ecosystem partners (Tõnurist and Hanson, 2020[1]). Given their diversity, it is important for and ecosystem partners and support teams to understand in which situation they are relevant.
- **Data and measurement:** Effective anticipatory decision-making requires that ecosystem partners have access to relevant, timely and granular information that enables them to spot trends and monitor changes and progress within the ecosystem. While identifying what information is relevant in an uncertain future-oriented environment is a challenge, the process of collective sense-making can allow ecosystem partners to identify appropriate indicators to track and phenomena to keep under observation, for example news articles on technological development in a specific domain or polling data on social trends. Ensuring that the mix of ecosystem partners includes a range of types of expertise allows the ecosystem to detect and interpret a wider range of qualitative and quantitative signals of change.
- **Evidence and evaluation:** Continuous experimentation and monitoring are central to identifying fruitful pathways for anticipatory innovation. However, the monitoring and evaluation of anticipatory innovation ecosystems can risk interpreting superficial achievements, such as the number of stakeholders engaged, as indicators of success, while important changes that are more difficult to measure, such as the trust between stakeholders, may be overlooked. Evidence and evaluation should therefore focus on allowing ecosystem partners and support teams to continually assess the success of the ecosystem against the four governance processes: engagement of diverse stakeholders, orientation around shared goals, collaboration and anticipation, learning and adaption (see ***formative evaluation*** below).

- **Learning loops:** The knowledge generated through the activities of ecosystem partners must be managed in a way that enables the ecosystem to adjust its activities and types and roles of stakeholders involved in order to maintain a path towards relevant shared goals. Single loop learning describes the process by which an organisation (or an ecosystem) evaluates its effectiveness and adjusts its activities to improve it. Double loop learning describes how an organisation uses new knowledge to re-evaluate its underlying assumptions about what change is necessary, and how it is brought about. A third level, *deutero learning*, describes the process for re-evaluating an organisations effectiveness at identifying what change is required in a system (Tõnurist and Hanson, 2020[1]).
- **Organisational capacity:** Tõnurist and Hanson (2020[1]) use the term 'organisational capacity' to describe the way in which an organisation balances activities aimed at exploring new opportunities against those aimed at exploiting knowledge and information that has already been uncovered. Anticipatory innovation ecosystems have the potential to enhance this 'ambidexterity' by bringing organisations focused on exploration into contact with those with capacity to exploit knowledge.

Key considerations

Knowledge management

Capacities and capabilities for knowledge management are vital to ensuring that an innovation ecosystem builds on the knowledge it generates to identify and seize opportunities for anticipatory innovation. Knowledge that is created through ecosystem activities can all to easily be misinterpreted or lost. Matti et al. (2022[40])identify three processes that constitute a cycle of 'continuous learning and adaptation' which enable diverse organisations to work together to solve problems:

- Sense-making is the process by which ecosystem participants collectively interpret emerging patterns of change, developing a shared understanding of the system that they hope to impact through innovation.
- Knowledge co-creation comprises the development of novel ideas and narratives through the combination of the various types of knowledge that are held by ecosystem partners.
- Decision-making draws on evidence collected and legitimised through the knowledge co-creation and sense-making processes to determine ways forward for ecosystem partners.

These processes are supported by two key sets of practices. First, 'harvesting and documentation' practices, through which insights are collated and recorded, are necessary to stimulate knowledge generation through ecosystem activities. Factsheets, posters, webinars and reports can combine insights that arise through ecosystem activities with information gathered more broadly to provide a continually updated evidence base for decision-making by ecosystem partners. Second, 'developing actionable knowledge' through the analysis of insights generated by ecosystem activities (Matti et al., 2022[40]).While these practices can be undertaken by ecosystem partners, the presence of a dedicated ecosystem report unit can ensure that knowledge is recorded, analysed and communicated in a timely and neutral manner. Given that information and knowledge that can contribute to ecosystem development and be used for innovation is often sensitive, it may also be important to ensure that effective systems are in place for it to be securely shared. The Unlocking Industrial 5G ecosystem in Finland developed a digital platform to enable knowledge sharing and collaboration (Box 2.6).

Box 2.6. Finland: Unlocking Industrial 5G

Initiated in 2020, **Unlocking Industrial 5G** is a project led by Nokia which works towards developing innovation ecosystems surrounding 5G-based technologies and services. The project is part of a Veturi

(Finnish word for locomotives) programme and is funded by Business Finland, a government organisation which is run by the Finnish Ministry of Employment and Economy.

A digital platform for knowledge sharing and collaboration

Unlocking Industrial 5G ecosystem has created and uses a digital platform to organise the partners and sub-ecosystems. It was created by NOKIA and continuously improved together with ecosystem partners. It helps to utilise ecosystem connections and enhances sub-ecosystem cooperation. It works like a social network for the ecosystem partners and provides different functionalities.

For example, partners can share soft assets like technical specifications around some certain topic, white papers, etc. The platform and its contents are open for everyone with access but there are options to create close spaces for limited number of specific collaborators. NOKIA decided to create the network because they noticed the ecosystem needs specific tools to manage the ecosystem and encourage collaboration. There was also a significant demand from the ecosystem members. Ecosystem collected the functionality requirements from ecosystem members to best meet their needs.

Source: OECD interview; Nokia (n.d.[41]), *Nokia Veturi Program*, https://www.nokia.com/innovation/veturi-program/; Pellikka, J. (2020[42]), "Nokia Veturi Program - Unlock Industrial 5G".

Developing a theory of change to monitor and assess activities and progress

The creation of a shared theory of change (ToC) or strategic roadmap early on in the development of an anticipatory innovation ecosystem provides ecosystem partners and support teams with a framework against which progress towards desired outcomes can be measured, and objectives can be reassessed. The example of PhotonDelta in the Netherlands (Box 2.7) shows how the development of this type of shared resource can enhance ecosystem agility and legitimacy.

The Theory of Change is a framework for programme and policy design and evaluation which explains how activities (or interventions) in a system are supposed to contribute towards the stated goal of the programme. Both practitioners and academics have advocated using ToC for policy and programme design because of the flexible nature of the framework and its ability to explicitly link interventions to their expected outcomes (COP RBM, 2012[43]; Hivos, 2012[44]; Molas-Gallart et al., 2021[45])

A ToC is developed by first identifying the goals of an ecosystem (the 'change' that it is hoped will be achieved), and then working backwards to identify the activities that are expected to achieve these goals and the resources or inputs that are required to undertake the activities (Molas-Gallart et al., 2021[45]). The process of developing a theory of change can create alignment between stakeholders. It acts as a sense-making exercise, by forcing participants to identify all the hidden assumptions they are making and the rationales they are using while developing it, uncovering unexpected causal pathways and linkages between the inputs available to different groups which could lead to joint activities. Commonly applied as an evaluation tool (Barbrook-Johnson and Penn, 2022[46]), a ToC allows anticipatory innovation ecosystems to identify and select appropriate performance indicators, which may also be adopted by government.

As the programme progresses, the original ToC serves as a guide to check on progress. If the circumstances of the programme and the environment in which the ecosystem acts have modified, or if the programme is not developing according to the initial plan, the ToC can be changed, and the original assumptions are put to the test. The assumptions that do not hold can be dropped or updated. This is especially relevant for programmes interested in transformative change, where adaptive learning is one a fundamental basis of change (Rogers, 2014[47]).

Box 2.7. The Netherlands: PhotonDelta

In 2013, the current CEO of PhotonDelta (an organisation dedicated to ecosystem support) received a request from an investment bank to lead a project on photonic integration in the region of BrainPort (Eindhoven, Netherlands). This was a European funded project to create demonstrators for photonic integration technology. Initially few companies and universities were involved. For example, one of the main initiators of the ecosystem was Eindhoven University of Technology.

At its early stages, PhotonDelta understood that the broad impact of photonics required the involvement of more stakeholders from the private sector, such as technology partners and suppliers, and from the scientific arena with research and development partners e.g., Delft University of Technology.

The evolution of an ecosystem within this complex field of photonics urged for research excellence and PhotonDelta achieved this by attracting companies interested in innovation and startups that were concerned in the societal impact of photonics.

In 2017, PhotonDelta had their programme included in regional government policy and in a four-year annual programme of Dutch cabinets. This was a turning point for the ecosystem as it was assigned to government support and facilitate the industrial development of photonics in the Netherlands. This leadership buy-in also pushed PhotonDelta to define a strategy and roadmap for the ecosystem which further built trust and mechanisms of collaboration with universities, regional authorities and industry.

A representative of PhotonDelta explained to the OECD how the roadmapping process supported the legitimacy and agility of the ecosystem:

> *"People want to achieve, they want to excel, they want to be the best in what they are doing. That is still one of the most important internal driving factors of PhotonDelta. You have to have a very good strategy and you have to be very agile. […] Roadmapping is a very strong way to engage different parties in the ecosystem."*

Source: OECD interview.

Formative evaluation

While concrete goals and objectives provide direction and urgency for the collaboration of ecosystem partners, it must be remembered that the ecosystem itself is a continuously developing process, driven by the four micro-governance processes. Furthermore, the collaboration of multiple stakeholders undertaking many activities in a changing environment creates high levels of uncertainty about the end-results of the programmes.

Assessing the result or progress of an ecosystem in terms of rigid outcomes, or 'impact evaluation', can therefore be a challenging and misleading approach to determining its success. For this reason, assessing and establishing how each micro-governance process can be improved is an important function of evaluation.

This focus of evaluation as a tool to identify enhancements to processes is known as process or formative evaluation. In the multi-stakeholder context of an innovation ecosystem, formative evaluation benefits from drawing on the experiences and insights of a range of ecosystem partners. Molas-Gallart et al. (2021[45]) recommend that formative 'evaluation practice needs to be adaptable and flexible, selecting different methods and techniques' to develop a fuller understanding of the ways in which the functioning of the ecosystem can be improved. This approach was identified by the BioWin ecosystem support organisation as important to support the development of the ecosystem (Box 2.8). As part of this project, the OECD

conducted a formative evaluation which combined survey and interview methods to better understand how LIAA's engagement with ecosystems could be improved (Box 2.9) and prompted LIAA to regularly consider the micro-governance processes of each ecosystem.

Box 2.8. Belgium: BioWin Health Cluster

With support from the Minister of Economy in Wallonia, Belgium, **BioWin health cluster** was created in 2006 with the role to select and monitor collaborative Research and Innovation (R&I) as well as work in initiatives to develop industrial policies in the health field, namely, biopharma, medtech and digital health sectors.

With a diverse ecosystem, BioWin has 250 members. The majority of the members and stakeholders are industrial members, followed by industrial Walloon companies and service providers. These also include the participation of universities, private research centres and hospitals that support projects that focus on the cluster's strategic priorities to further develop the region's biomanufacturing industry and health innovation.

Collaboration through informal and formal processes

In an interview with the OECD, a representative highlighted the **co-existence of formal and informal processes** for collaboration depending on the specific tasks. The strategic decisions are taken in the Advisory Board which involves in total 16 representatives covering all types of actors including large companies, small companies, universities and research centres. The Advisory Board also has two observers – one from the government and one from administration. Every three years companies organise elections to select their representatives. The selection of the president and vice-president involves a fierce competition as this post entails reputational aspects and requires international visibility. The day-to-day running of the cluster is ensured by a small and agile management team.

An important aspect for a successful governance is the **trust that is developed between the management team and the Advisory Board**. The Managing Director has an easy and informal access to the board members in case smaller strategic decisions need to be addressed. All Board meets annually for a formal discussion, while meetings with the president and vice-president are scheduled on a monthly basis. While it is recognised that the Advisory Board of 16 members is too complex for the cluster governance and in the ideal scenario should be restricted to 7-8 people, the BioWin team finds the developed orchestration mechanisms quite successful. As the Managing Director of BioWin explained it:

> *"Today we succeed in finding a good balance between formal and informal ways of doing things. The strategic decision are formal and it is normal to have them this way. If relationship is too formal, you lose the efficacy."*

Formative evaluation

In an interview with the OECD, a representative of the BioWin ecosystem support organisation explained that defined KPIs are used by the government of Wallonia to review if defined objectives are reached. A lack of formative evaluation was identified as a limitation:

> *"Recently [the government] asked to fix our quantitative objectives. We have some 35 objectives which is [very extensive]. Each year we review if we have reached these objectives, but this is new. We are not properly evaluated at the moment, but this is very important for our improvement."*

Source: OECD interview; BioWin (n.d.[48]), *Le Pôle Santé de Wallonie*, https://biowin.org/ (accessed on 15 November 2022); BioWin (2021[49]), *BioWin Annual Report 2021*, https://biowin.org/wp-content/uploads/2022/06/2021_BioWin_annual_report_FINAL.pdf.

Box 2.9. Formative evaluation for Latvia's Anticipatory Innovation Ecosystems

The OECD conducted a formative evaluation on the tools and methods developed by the OECD Observatory of Public Sector Innovation (OPSI) that were applied to support anticipatory innovation ecosystems in Latvia. The OECD OPSI approach was tested through a series of on- and offline workshops co-organised in partnership with the Investment and Development Agency of Latvia (LIAA) in the period from February to June 2022. The overarching objective of the workshops was to build collective capacity of ecosystem participants to embed anticipation and futures-orientation into their innovation efforts.

The evaluation had two objectives. First, it aimed to analyse ecosystem partners' perceptions on the relevance and usefulness of the workshops. Second, the evaluation sought to establish a method through which LIAA and ecosystem actors can periodically reflect on the applicability of the tools and activities for further ecosystem building.

Overview of the method

The evaluation covered six workshops for the following four ecosystems:

- Bioeconomy ecosystem (one online workshop).
- Biomedicine ecosystem (one online workshop and one in-person workshop).
- Smart materials and photonics ecosystem (two online workshops).
- Smart mobility ecosystem (one online workshop).

Eighty-two participants took part in the six workshops representing government, industry (incl. state-owned companies), research and academia, as well as other types of organisations. Most participants (54) took part in online workshops, while 28 members from the Biomedicine ecosystem met also in an offline workshop convened in Riga, Latvia.

The evaluation relied on two core methods: 1) online survey of all workshop participants; and 2) interviews with a representative sample of participants. The short online survey was designed to gather a more aggregate and quantitative feedback from a large pool of workshop participants. The survey was sent to all participants (n=82) with a response rate of 46% (38 completed replies).

Among other questions survey asked participants to consider how each workshop affected their perception of the micro-governance processes (see Table 2.7).

Table 2.7. Micro-governance questions

Questions/answer options	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have an improved understanding of the skills, knowledge and resources of other ecosystem partners and how we can complement each other					
I have an improved understanding of goals and objectives for the ecosystem					
I am more aware of the benefits of collective learning through engagement with the ecosystem					
I feel more confident that ecosystem partners will be able to work together to innovate					
I have an improved understanding of the trends and drivers that may affect the ecosystem in the future					

Outcomes of the formative evaluation

The data collection tools applied for this formative evaluation – the survey questionnaire and the interview guide – worked well to achieve the objectives of this evaluation. The survey was short and had a good response rate (41%). Survey respondents did not provide any comments or other feedback signalling problems with the survey. Therefore, it was determined that LIAA can re-use the survey framework and adjust the questions to collect feedback after future ecosystem workshops focusing on the innovation ecosystem development.

Combining interview and survey methods enabled the simple collection of input from many participants to be complemented by more nuanced insights. The evaluation revealed an overall positive assessment of the ecosystem workshops but identified micro- and meso-governance issues that could be used to inform policy design.

Source: OECD research.

Monitoring and renewing capacity for anticipation, learning and adaptation

The following questions can help the ecosystem partners and support teams to evaluate the capacity for anticipation, learning and adaptation:

- What information and knowledge gaps have ecosystem partners identified? How can these be addressed?
- What systems are in place for ecosystem partners to share information with each other? Are they effective?
- How is information and knowledge generated by the ecosystem being harvested, documented and analysed?
- What processes are there for shared decisions to be made to adjust or re-orient ecosystem activities and goals?

Table 2.8. Tools and activities to develop capacity for anticipation, learning and adaptation

Backstage	Frontstage
Knowledge management	Theory of Change workshops
Evaluation interviews and surveys	Webinars
Creation of information resources	Foresight approaches (horizon scanning, scenario building etc.)

Meso-governance: A function-based approach

While micro-governance describes the practices and structures necessary to facilitate anticipatory innovation within an ecosystem, meso-governance encompasses the way in which government stakeholders coordinate their actions to create and maintain the conditions for anticipatory ecosystem development. Government has a key role to play in creating the authorising environment for anticipatory innovation ecosystems, with a particular value in de-risking and creating legitimacy for participation within ecosystems.

In addition to stimulating the development of anticipatory innovation ecosystems, effective meso-governance enables government to anticipate change and become more proactive. Anticipatory innovation ecosystems generate valuable information by leveraging the collective intelligence of their members to detect signals of change, explore and make sense of uncertainty. To benefit from this, government actors are likely to need to promote and facilitate anticipatory activities and make sense of the needs, challenges and objectives for ecosystems that result from them. Effective knowledge management is therefore vital. To support policy learning and ecosystem development, meso-governance should also facilitate coordination across ecosystems and government silos to respond to emergent signals of change and address barriers to ecosystem development. It is important that meso-governance is not hierarchical but facilitates the emergent and collaborative leadership that constitutes micro-governance, and enables the transmission of information both upstream and downstream between policymakers and ecosystems.

To support ongoing coordination, the OECD has developed a framework for that government actors can use to assess the needs of ecosystems and consider the roles that they can play to support them. This approach, which outlines seven key functions for government to perform in order to support anticipatory innovation ecosystems, draws on the identification of roles undertaken during ecosystem genesis by Dedehayir et al. (2018[5]) and the 'styles of government action' framework developed by the UK government's Policy Lab (Siodmok, 2020[50]).

Following Policy Lab, the functions are not presented as an exhaustive list of the types of intervention that government can undertake, nor can they only be performed by government. Instead, they are tools for thinking through how government might leverage existing capacities and policies to catalyse the success of anticipatory innovation ecosystems, and for spotting gaps or inconsistencies in the current provision of support and related policies.

The functions are:

1. Orchestrating: Identifying and leveraging expertise and resources from relevant stakeholders to address ecosystem needs; fostering the conditions for effective coordination and collaboration within the ecosystem.
2. Framing: Clearly articulating policy decisions and priorities, ensuring that ecosystems incorporate anticipation into their activities, setting standards.
3. Championing: Promoting ecosystem activities and products nationally and internationally.
4. Market building: Directly procuring new innovations or creating consumer level incentive schemes to promote uptake.
5. Providing: Providing non-financial resources (such as information, data, foresight support and training) and infrastructure to support ecosystem activities.
6. Funding: Providing direct funding or guidance to access funding to support ecosystem activities.
7. Regulating: Experimenting with regulation approaches that are favourable to innovation, such as sandboxes.

Seven meso-governance functions

The following outline presents example activities and interventions drawn from the OECD STIP compass (https://stip.oecd.org/stip/) and research conducted as part of this project.

Orchestrating

Government can play a powerful role as a convenor of stakeholders and knowledge to support ecosystem development. Effective orchestration requires capabilities for stakeholder and knowledge management, and regular interactions with current and potential ecosystem partners. Activities and interventions to related to orchestration include:

- Establishment of dedicated ecosystem support organisations (see Box 2.1 on Smart and Clean Helsinki).
- Establishment of horizontal STI coordination bodies.
- Hosting ecosystem workshops and actor meetings.
- Holding information seminars on available facilities for ecosystem partners.
- Establishing links with complementary ecosystems and value chains.
- Mapping stakeholder connections and value chains to assess critical mass for ecosystem participation, and identify gaps and missing actors.
- Hosting hackathons.

Framing

Communicating policy priorities to ecosystems enables them to explore how their goals and activities can be better aligned to the needs of society. Framing can also be achieved through participatory approaches (see Box 2.3 on ecosystem prioritisation and selection). Activities and interventions relating to framing include:

- Commissioning participatory approaches to identify shared visions and ethical standards for the future of innovation.
- Publication of strategies, agendas and plans.
- Selecting and prioritising areas of innovation, including national mission overarching frameworks.
- Promoting the incorporation of anticipatory approaches by innovation ecosystems.

Championing

Clear championing by government provides ecosystems with legitimacy that enables them to attract new members and can connect them to international ecosystems and value chains. This is demonstrated by the case of the JIC ecosystem in South Moravia (Box 2.10). Activities and interventions relating to championing include:

- Public awareness campaigns and other outreach programmes.
- Inclusion of innovation ecosystems in government strategies.
- Speeches by politicians.

Box 2.10. South Moravia, Czechia: JIC Regional innovation ecosystem

Initiated in 2003, JIC Regional innovation ecosystem is funded by the region of South Moravia and four universities (Masaryk University, Brno University of Technology, Mendel University in Brno and University of Veterinary Sciences Brno). It is tasked to help university startups and support industrial development in the region. By acting as a facilitator for stakeholders to formulate joint strategies, it empowers entrepreneurs to reach goals for regional innovation. Furthermore, JIC supports entrepreneurship activities and services.

In an interview with the OECD, a representative of JIC pointed out that political support is a crucial driver for the development of the regional innovation ecosystem:

> *"Sustained political support is an important driver. Throughout the past 20 years, there has never been a moment when the local government would doubt the topic's relevance. It has, over time, almost become part of the region's identity. It's a no brainer."*

Source: OECD interview; JIC (n.d.[51]), *Our Story*, https://www.jic.cz/en/our-story/.

Market building

Governments can stimulate the development of markets for new innovations directly through procurement, or indirectly through a range of instruments such as consumer-level incentive schemes for niche products. Activities and interventions relating to framing include:

- Procurement of innovative products and services by government.
- Consumer-level incentive schemes.

Providing

Non-financial resources such as expertise, training, data and infrastructure can help to unlock barriers in ecosystem and innovation development. Activities and interventions relating to providing include:

- Training provision to ecosystem partners, such as strategic foresight.
- Complex analysis (e.g. SWOT analysis).
- Creation of foresight intelligence reports (for example, the Emerging Technologies Radar in Box 2.11).
- Facilitation of workshops.
- Provision of concrete infrastructure such as demonstration plants.
- Provision of information services and access to datasets.
- Technology extension and business advisory services supporting knowledge transfer and co-creation.

Box 2.11. United Kingdom: Emerging Technologies Radar

The Department for Environment, Food and Rural Affairs (Defra) in the United Kingdom produces an annual report on emerging technologies that could contribute to the success Defra and its supporting agencies, public bodies and Public Sector Research Establishments (the 'Defra group') across its objectives.

A longlist of emerging technologies gathered through a horizon scan is mapped against priority objectives published in the Defra group's Outcome Delivery Plan. The resulting map is known as the Emerging Technologies Radar, which categorises technologies against their potential impact for Defra and their technological maturity. In 2022, the radar was developed by leveraging the knowledge of stakeholders across the Defra group and its 'supplier ecosystem', as well as using Artificial Intelligence tools to identify and analyse emerging technologies.

The radar highlights how technological development may help Defra achieve its strategic goals. For example, to increase productivity in the agri-food and drinks industry while meeting climate targets, it identifies digital twins, internet of things and predictive analytics as potentially key technologies.

Source: Murdoch, J. (2022[52]), "Scanning the horizon for the innovations of the future - Defra digital, data and technology", https://defradigital.blog.gov.uk/2022/02/10/scanning-the-horizon-for-the-innovations-of-the-future/; DEFRA (2022[53]), *Emerging Technologies Radar*, https://drive.google.com/file/d/1pnbNugujjreQiNThQ82hN-fd1ebupVre/view?usp=embed_facebook.

Funding

Different approaches to attracting and disbursing funding provide governments with a range of levers to promote innovation and overcome barriers. Activities and interventions relating to funding include:

- Science and innovation challenges, prizes and awards.
- Tax or social contributions relief for firms investing in R&D and innovation.
- Loans and credits for innovation in firms.
- Tax relief for individuals supporting R&D and innovation supporting knowledge transfer and co-creation.
- Funding demonstration of innovations.

Regulating

Approaches to regulation that promote knowledge sharing and enable experimentation can support stakeholders to more safely develop and test innovations. Activities and interventions to support include:

- Intellectual property regulation and incentives.
- Regulatory sand-boxes and living labs.

Box 2.12. Anticipatory approaches to improve regulatory agility

Komet, Sweden

In 2018, the Swedish Government established the Committee for Technological Innovation and Ethics (Komet) with the mission to "help the Government to identify policy challenges, contribute to reducing uncertainty surrounding existing regulations, and accelerate policy development linked to new technologies". The committee works closely with the Swedish government to ensure that regulations are up to date with emerging technologies and with the fast pace of technological development.

One of the processes to support the creation of coherent regulatory frameworks is the use of a future oriented model for collaboration, testing and experimentation in controlled environments. This model aims to support the Swedish government to "proactively address improvements technology could create to citizens, business and society, but also to highlight the conflicting goals that may arise". Through this model Komet seeks to achieve a common ground and understanding of ongoing technological developments and identify possible solutions that can avoid ethical risks and encourage sustainable and responsible innovation.

UK Civil Aviation Authority

In 2018, the UK Civil Aviation Authority (CAA) launched the Innovation Hub. The Innovation Hub aims to support innovators by facilitating access to expertise and guidance on regulation and providing safe environments for the testing of new aviation systems.

Central to the Innovation Hub is the Innovation Sandbox. The Sandbox acts as a platform for aviation innovations to be tested through a cooperative approach that encompasses workshops, live trials and simulations. The learning that is generated through these activities enables the CAA to anticipate future regulatory challenges and accelerate the development of new policies and regulations.

Source: Hernández, G. and M. Amaral (2022[54]), "Case studies on agile regulatory governance to harness innovation: Civilian drones and bio-solutions", https://doi.org/10.1787/0fa5e0e6-en.

A tool to address ecosystem needs through the function-based approach

Activities undertaken by ecosystem partners will reveal challenges and needs that cannot be easily or obviously addressed by the present ecosystem partners. Innovation ecosystem support teams can collate these needs and work with other government actors to consider how they can collaborate to address them through a coordinated approach. Regular assessment of ecosystem needs using the function-based approach can help government to understand overarching needs and adapt types of support and policies to continue facilitating ecosystem development.

The matrix tool in Table 2.9 is intended to help groups of government actors work together identify how they might collaboratively facilitate anticipatory ecosystem development. For each need identified by an ecosystem, government actors can consider how it might be addressed through existing activities and interventions related to each function. Following this, additional actions can be identified and agreed upon. Key government actors for each action should be identified to facilitate coordination and provide accountability.

Table 2.9. A meso-governance matrix tool to coordinate government support

Ecosystem need: EXAMPLE				
Function	How might we address this need by…?	Existing support	Proposed action	Key government actors
Orchestrating	Connecting people and organisations and facilitating coordination			
Framing	Clearly articulating policy decisions and priorities; promoting anticipatory approaches			
Championing	Promoting ecosystem activities and products to funders and customers			
Market building	Becoming a customer or incentivising uptake			
Providing	Providing non-financial resources and infrastructure to support ecosystem activities			
Funding	Providing funding and monetary incentives to ecosystem partners			
Regulating	Experimenting with regulation approaches that are favourable to innovation			

Source: OECD.

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Part II The governance of anticipatory innovation ecosystems in the Latvian context

3 The policy and governance context for anticipatory innovation ecosystems in Latvia

This chapter explores challenges and opportunities for the development of anticipatory innovation ecosystems in Latvia through a descriptive analysis of policy priorities, current governance structures, policy frameworks and systemic reforms in the field of research and innovation.

This project has been driven by Latvia's ambitions to work with ecosystems to stimulate the discovery of opportunities for innovation in a rapidly changing and uncertain world. To explore how anticipatory innovation ecosystems might be established and supported in the Latvian context, a desktop review of policy documents and assessments was combined with research interviews of key stakeholders from the Investment and Development Agency of Latvia (LIAA), Ministry of Economics (MoE), Latvian Council of Science (LCS) and Riga Technical University (RTU).

The chapter intends to place the work on anticipatory innovation ecosystem into an overall context of Latvia's activities in related fields. The first part will briefly describe the macroeconomic context of the Latvian Research and Innovation System and provide an overview of the relevant policy developments. It will then consider Latvia's governance structure, policy framework, main support measures and recent reforms that have taken place. Further, the chapter will provide information about ongoing initiatives to support collaboration platforms including initiatives for ecosystem formation and draw conclusions on the synergies and consistencies among them. Lastly, the chapter will address the evolving role of LIAA in support of innovation ecosystems and its capacity to deliver on its mandate.

The economic context to Latvia's innovation policy approach

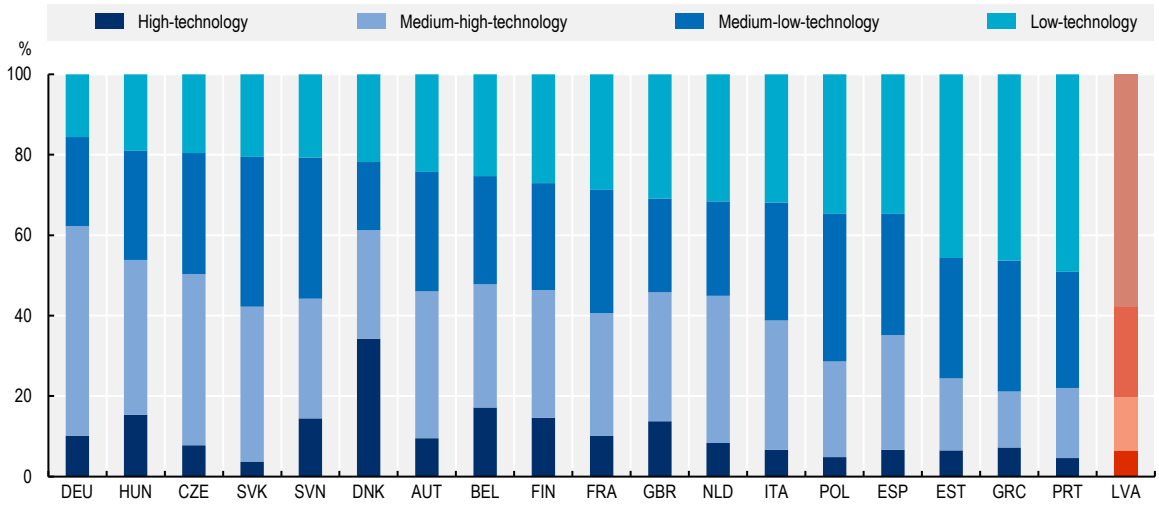
Over the past decades, the Latvian economy has shown significant growth rates and enjoyed continuing catch-up in per capita incomes with the more affluent OECD countries (OECD, 2022[1]). Nonetheless, Latvia's income level still stands at around 70% of the EU and OECD country average. (EC, 2022[2]; OECD, 2022[1]). In order to promote an increase of living standards, national policies have emphasised the pivotal role of the knowledge economy. The National Development Plan 2021-2027 stresses the role of people as most important national resource and the need to make use of existing knowledge and skills as an advantage for growth. The plan outlines the objective to channel the country's limited resources into knowledge creation, acquisition and transfer (CSCC, 2012[3]). Building on this, Latvia defines the objective of its national research and innovation (R&I) framework as the promotion of economic transformation towards higher value-added activities (Latvian Ministry of Education and Science, 2020[4]; Government of Latvia, 2021[5]).

Regarding the overall economic structure, Latvia's focus has been on moving towards higher value goods and services (meaning, usually but not always, higher technology). Currently, Latvia's service sector generates the highest share of value-added (Figure 3.1). Tradable sectors, including agriculture, forestry, fisheries, manufacturing, and transport, constitute only 26% of the total economy, a decrease from 33% in 2010. Manufacturing and other industry comprise roughly 15% of the value-added activities. The share of high-tech manufacturing in 2020 was 8%, with medium-high-tech and medium-tech accounting for respectively 14% and 19%. Low technologies representing 58% of the overall sector dominate the manufacturing industry (Government of Latvia, 2021[5]).

While the relative share of high-tech manufacturing has increased since 2000, its impact on the overall productivity in Latvian economy is still insignificant. See Figure 3.2 for an overview of gross value-added in manufacturing by technological intensity compared to other OECD countries. It shows that high- and medium-high-tech still contribute only a minor share to the productivity growth due to their small share in output (Latvian Ministry of Economics, 2021[6]). Businesses in Latvia rely heavily on the acquisition of machinery for technological upgrading and export is predominantly based on low value-added products and services that is dependent on external demand. The dominance of low value-added sectors in Latvian economy is an important bottleneck for its structural transformation (Latvian Ministry of Education and Science, 2020[4]).

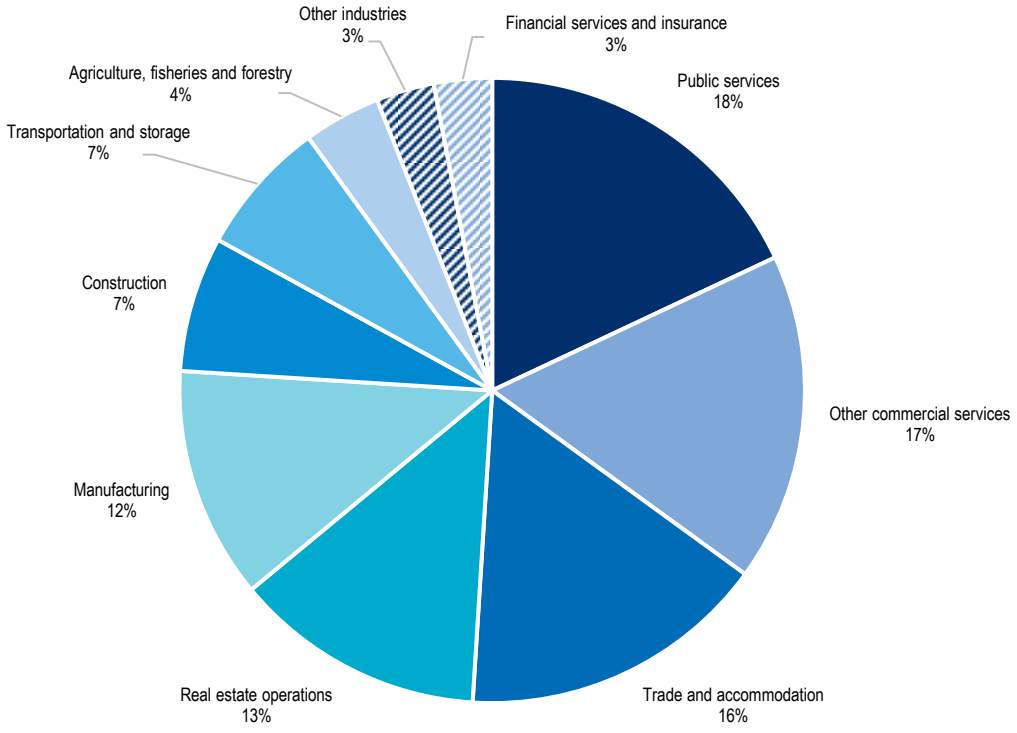
Figure 3.1. Added-value structure of the Latvian Economy, 2020

Gross value added in manufacturing by technological intensity, current prices, %, 2018



Note: Based on Eurostat aggregation of the manufacturing industry according to technological intensity, based on NACE Rev.2.
Source: Eurostat.

Figure 3.2. Latvia's manufacturing by technological intensity, 2018



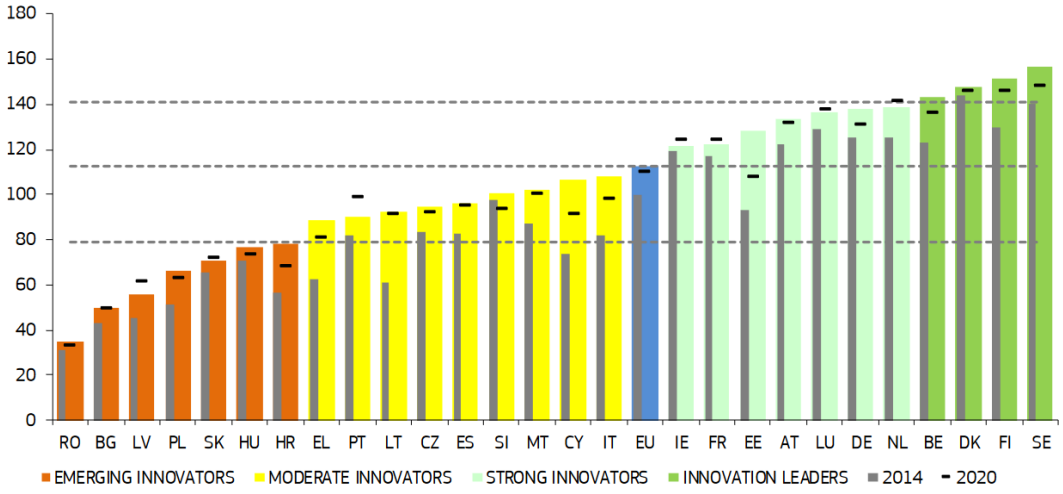
Source: Latvian Ministry of Economics (2021[6]), *Latvia's Macroeconomic Overview*, https://www.em.gov.lv/lv/media/11553/download.

Innovation parameters in Latvia are below the EU and OECD average. Much of Latvian business' competitiveness is driven by low labour costs with innovation playing only a minor role. While the share of

technological equipment and intellectual property of GDP has slightly increased from pre-2008 crisis levels, it remains low compared to the EU average. Gross research and development spending as a share of GDP, at around 0.7%, makes up only about one quarter of the European average (OECD, 2022[1]). As a country moving towards high-income status, innovation will need to play an increasingly important role. In order to improve productivity and competitiveness, it will be essential for Latvia's industry to engage more deeply in technological development as well as inward technology transfer. This implies focusing on knowledge- and not just efficiency-based growth and hence on making and using a greater investment in research and innovation (R&I) (OECD, 2022[1]).

The European Union classifies Latvia as an emerging innovator country which means its performance is well below the EU average, currently at 50.8% (Figure 3.3) (EC, 2022[2]). Latvia showed a gradual, steady increase of innovation performance in the period 2014-2019 and a decline in 2020 and 2021 (Figure 3.4). In the European Innovation Scoreboard's comparative perspective, the relative strengths of Latvian innovation performance include the levels of tertiary education, trademark applications and enterprises providing ICT training. The sharp decline in the innovation score between 2020 and 2021 is associated with a decrease of venture capital investment and development of environment-related technologies (EC, 2022[2]). Overall, start-up rates in Latvia are well above average of most OECD countries which speaks for its dynamic, entrepreneurial culture (OECD, 2022[7]). However, while Latvia has a growing number of knowledge-intensive start-ups with international reach, their aggregate contribution to the overall innovation performance is likely to remain small (OECD, 2022[1]). According to an OECD assessment, Latvian stakeholders perceive that innovation diffusion to SMEs and start-ups does not work well (OECD, 2022[1]). Lack of internal funding, limited access to affordable funding for smaller firms and high anticipated costs of innovating are among the innovation obstacles perceived by firms (OECD, 2022[1]). To improve innovation performance there will also need to be significant transformation within existing companies of which about 30% are government owned (EC, 2018[8]) . In addition, Latvian stakeholders, both with a policy and business background, acknowledge the importance of strengthening cooperation between business and academia (OECD, 2022[7]).

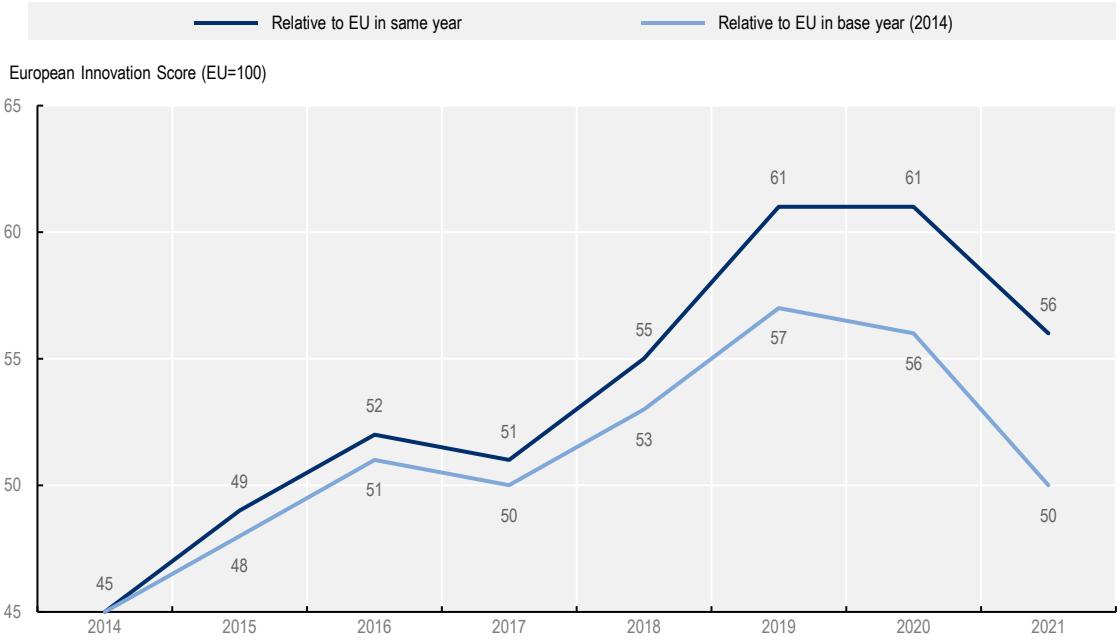
Figure 3.3. Performance of EU member states' innovation systems, 2015-21



Note: Coloured columns show countries' performance in 2022, using the most recent data for 32 indicators, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data, relative to that of the EU in 2015. Grey columns show countries' performance in 2015 relative to that of the EU 2015. The dashed lines show the threshold values between the performance groups, where the threshold values of 70%, 100%, and 125% have been adjusted upward to reflect the performance increase of the EU between 2015 and 2022.

Source: EC (2021[9]), *European Innovation Scoreboard 2021*, https://ec.europa.eu/docsroom/documents/46013/attachments/1/translations/en/renditions/native.

Figure 3.4. Innovation performance of Latvia, 2014-21

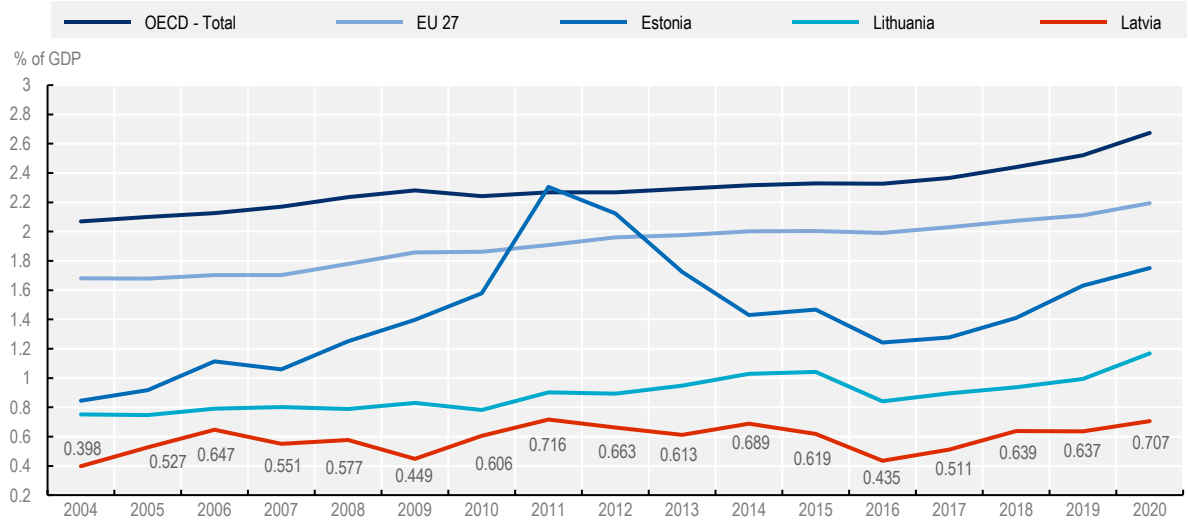


Source: EC (2021[10]), *European Innovation Scoreboard 2021 - Latvia*, https://ec.europa.eu/docsroom/documents/45922.

Over the course of the last decades the Latvian R&I system has suffered from underfunding and a range of systemic issues. As the country was among the European Member States worst affected by the financial crisis starting in 2008 which resulted in a significant decrease of state spending on R&I that has not returned to target levels since. The objective defined in the national strategic development documents was to increase R&I investments to 1.5% of GDP by 2020 (CSCC, 2012[3]) following the ambitious goals of the EU Lisbon Strategy.[1] Latvia never accomplished this objective and until 2020 F&I spending has not exceeded the 0.71% threshold. Figure 3.5 plots the comparative levels of gross domestic spending on R&D in the three Baltic States and the average EU and OECD levels. It showcases that gross domestic spending on R&D in Latvia are not only three times lower than in the OECD and EU countries, but also significantly lags behind the investments made by the neighbouring Baltic countries – Lithuania and Estonia. Moreover, private Latvian R&D investment is significantly lower than in other OECD countries and stagnating (OECD, 2022[7]). In 2020, it was 0.22% of GDP, about the same as it had been 10 years earlier. This is well below the EU average of 1.53% of GDP (EC, 2022[2]).

Fiscal austerity measures of the financial crisis and insufficient national funding for R&I have led to a disproportionate reliance on the EU Structural Funds for the development of the Latvian R&I system (EC, 2018[8]). Due to budget restrictions, only few departments beyond the Ministry of Education and Science and the Ministry of the Economics developed and funded their own research strategies. Except during the planning phase of structural funds periods, collaboration on research and innovation across government agencies has been limited (with exceptions of recent State Research Programmes – see below). The importance of increasing the share of national investment in R&I has been raised in major external assessments of the Latvian R&I system.[2] While more targeted policy efforts have resulted in a gradual increase of national R&I spending, this increase is relatively small and its impact remains limited. The target of reaching a R&I expenditure of 1.5% of GDP has been manifested in the national strategy documents as a target to be reached by 2027 (CSCC, 2020[11]).

Figure 3.5. Gross domestic spending on R&D, 2004-20



Source: OECD (n.d.[12]), *Gross Domestic Spending on R&D*, https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm.

The R&I sector in Latvia is part of the European Research Area, which means that national R&I policy needs to take into account not only national development priorities, but also European guidelines, global trends and challenges. The Guidelines for Research, Technology and Innovation 2021-2027 underline that innovative solutions are needed to address societal challenges regarding public health, inequality, quality food, access to clean and efficient energy, ensuring inclusive public services, secure and qualitative living environment (Latvian Ministry of Education and Science, 2020[4]). National R&I strategies refer to seven societal challenges as outlined by the EU, namely areas with high potential benefit for citizens: health; demographic change and wellbeing; food security; sustainable agriculture and forestry; marine, maritime, inland water research and bio economy. Equally, the 17 UN Sustainable Development Goals[3] are recognised as important guidelines for steering national R&I efforts (Latvian Ministry of Education and Science, 2020[4]). From this wide array of challenges, the National Development Plan of Latvia for 2021-2027 singles out climate change, geopolitical shifts, inequalities, rapid technological development and increased migration as new challenges for the Latvian society and national security that require R&D investment (CSCC, 2020[11]).

Latvian research and innovation policy in the last decade

The following section will give an overview of Latvia's approach to innovation over the course of the past years. It will examine the governance structure of research and innovation policy; describe the policy framework and ongoing policy measures in the field of innovation and research and take a lot at some recent reforms. This will give an overview of the main stakeholders involved decision-making, how Latvia's innovation efforts have evolved over time and the current initiatives under way.

Governance structure of R&I policy in Latvia

The governance structure of research and innovation policy in Latvia is comprised of a political layer responsible for high-level steering and oversight and a policy and administrative layer responsible for strategic management. Figure 3.6 illustrates this governance structure and the various bodies involved. At the political level, the Cabinet of Ministers and Parliament are the two institutions making high-level decisions on research and innovation policy, for example, the priority research directions and deciding the

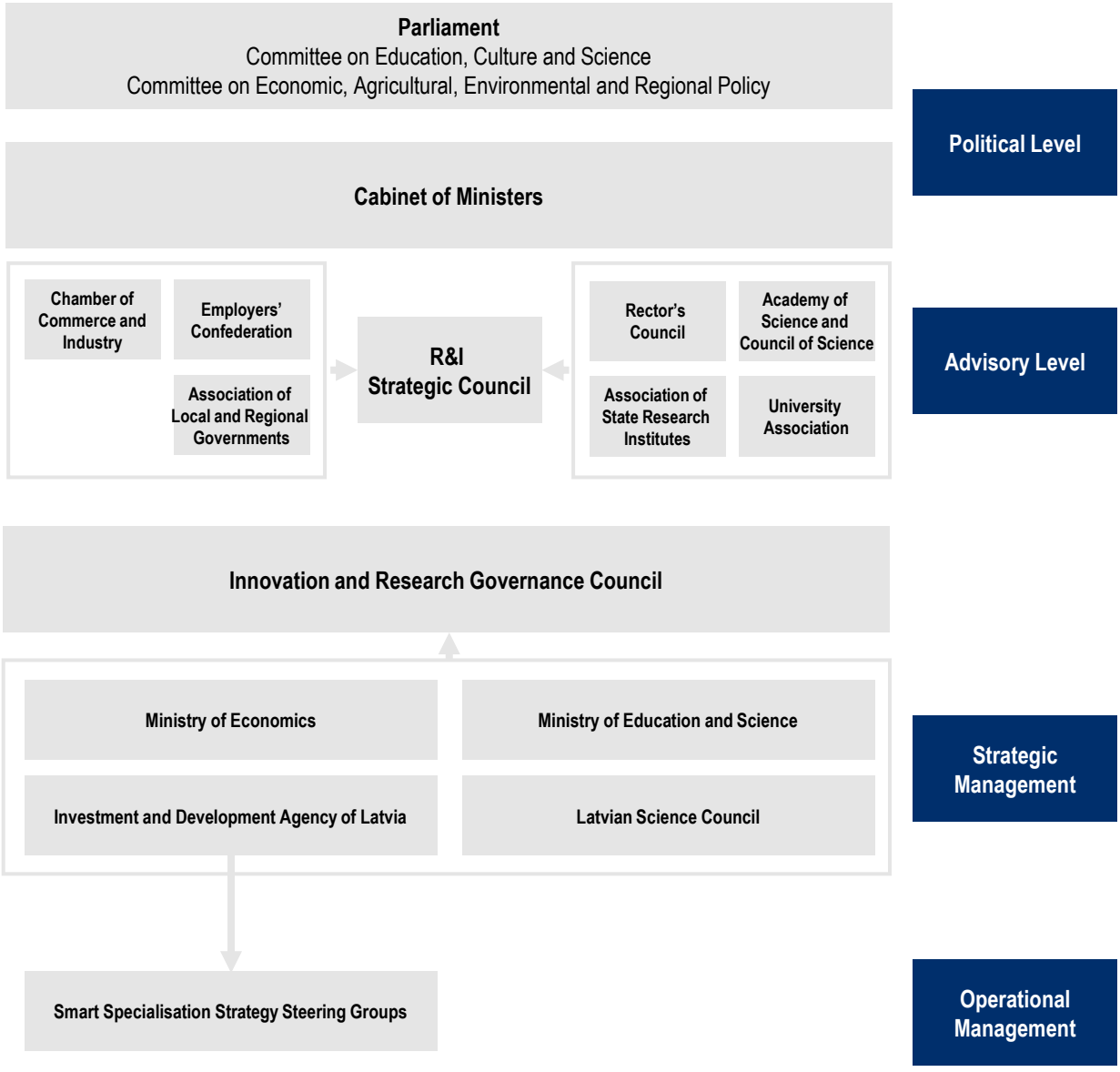
budget available for this policy area. Parliamentary committees may initiate discussions and invite ministers and civil servants to report on the progress in various research and innovation policy topics. The Cabinet of Ministers approves regulations related to the policy.

In 2014, Latvia established a Research and Innovation Strategic Council that provides advice to the Cabinet of Ministers and the Parliament. The Prime Minister chairs the Council and takes initiative to convene Council meetings bringing together a number of key research and innovation actors. Ministers participate according to the topics discussed. Higher education institutions, public research organisations, the Academy of Science and organisations representing businesses and local governments are also members of the Council (EC, 2019[13]). While the Council is designed as a strategic coordinating institution providing a platform for discussing major policy decisions, its actual activity has been minimal. Between 2018 and 2020, the Council did not hold any meetings. This shows that the body's de facto influence in the innovation space is limited.

On the administrative level, there has been a recent change in Latvia's governance structure. In 2022, Latvia created the Innovation and Research Governance Council to strengthen a collaborative management of the research and innovation system. The Council will support triple helix collaboration by identifying joint activities, facilitating information exchange and mobilising support mechanisms (Latvian Ministry of Economics, 2022[14]). The Council reports to the Research and Innovation Strategic Council and brings together two ministries that have been instrumental to Latvia's R&I system, the Ministry of Education and Science (MoES) and the Ministry of Economics (MoE), as well as two institutions: the Investment and Development Agency of Latvia (LIAA) and the Latvian Council of Science. The Ministry of Education and Science leads research and higher education policy planning, designs key policy documents and coordinates the implementation of policy measures. Furthermore, the MoES designs and monitors the European Structural and Investment Funds (ESIF) programmes for research support. The Ministry of Economics is responsible for the development of policies regarding business support and innovation. The departments of the MoE are working in close collaboration with the EU Structural Funds to design, introduce and supervise Structural Funds programmes and projects related to enterprise support and innovation. Due to a recent change, the formal responsibility of designing, implementing and monitoring the Research and Innovation Strategies for Smart Specialisation (RIS3) lies in the hands of both Ministries – the MoES used to have a more pronounced role with the MoE supporting.

A subordinate institution to each ministry takes part in the Innovation and Research Government Council: the Investment and Development Agency of Latvia (LIAA) (linked to the MoE) and the Latvian Council of Science (LCS) (linked to the MoES). LIAA facilitates foreign investment and promotes competitiveness and business development of Latvian entrepreneurs. In 2004, LIAA became one of the main funding agencies responsible for administering ESIF programmes and implementing state support programmes in entrepreneurship and innovation. In recent years, LIAA has taken on a stronger role in the innovation space, diffusing innovation and connecting stakeholders in business, academia and research. The Latvian Council of Science, since July 2020, has been an institution of direct administration under the supervision of the Minister for Education and Science. The LCS aims to implement the state science and technology development policy, and to ensure expertise, implementation and supervision of research programmes and projects financed from the state budget, as well as from the ESIF and other foreign financial instruments delegated in regulatory enactments (Latvian Cabinet of Ministers, 2020[15]).

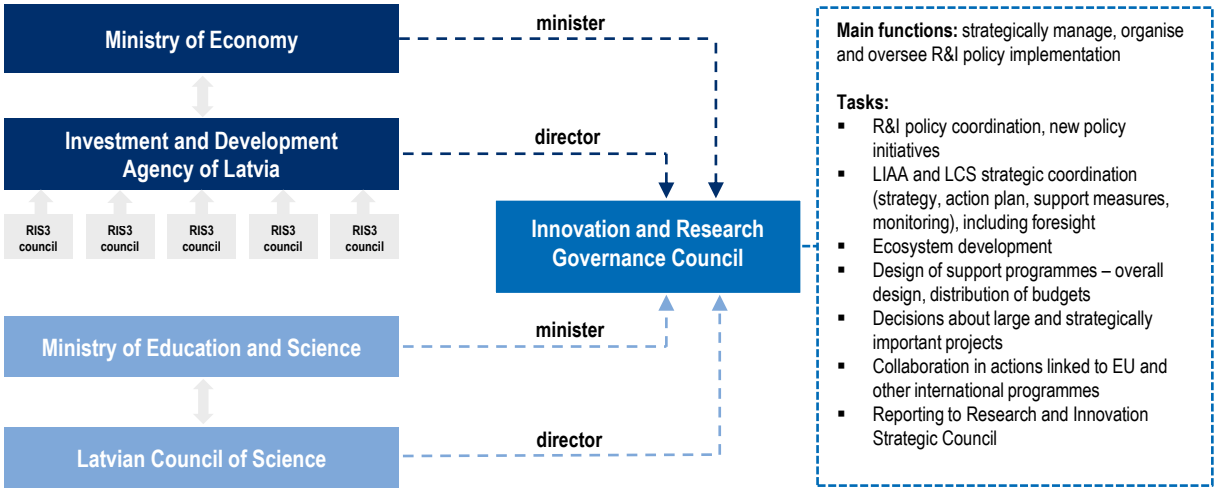
Figure 3.6. Governance of Latvian R&I system as of September 2022



Latvia created the new Council (see overview in Figure 3.7) to strengthen a collaborative management approach of the research and innovation system. Compared to the R&I Council at advisory level, the Innovation and Research Governance Council will play a more operational role and aims to support collaboration between industry, academia and public sector institutions. This includes the identification and strategic coordination of joint activities, facilitating information exchange and mobilising relevant support. The Council will assist entrepreneurs in attracting funding; support Latvian businesses in increasing exports and enable collaboration between companies and researchers. The Council will also enable more targeted exchange of information between LIAA and LCS. For example, the Latvian Science Council will share insights into its work supporting research projects at low technology readiness levels with LIAA in order to identify potential commercialisation activities. Similarly, LIAA plans to gather intelligence on the research needs of businesses and feed it back to the LCS. Another topic the Council will oversee is LIAA's work with innovation ecosystems; see more in the section below. Overall, the Council is a mechanism to channel needs identified on the ground, such as through ecosystem or academic collaboration, to the

attention of policymakers. The de facto influence and level of engagement of the Council remain to manifest over time.

Figure 3.7. Structure and functions of the Innovation and Research Governance Council



Source: Based on Latvian Ministry of Economics/Ministry of Education and Science (n.d.[16]), "Presentation to the Research and Innovation Strategic Council", https://www.mk.gov.lv/lv/latvijas-petniecibas-un-inovacijas-strategiskas-padomes-sedes.

Alongside the governance of research and innovation policy, the promotion of innovation in the public sector is of increasing importance in Latvia. In 2018, the Latvian Innovation Laboratory was set up at the State Chancellery. The year 2023 marks the start of its third distinct phase of operation, providing mentoring and consulting services on innovative methodologies for public policy design, piloting and implementation. The Innovation Laboratory is the main driver for public administration innovation, seeking to build a user-centred mindset across the Latvian public sector innovation ecosystem and continuously upskill public administration on innovative methodologies for policymaking. It promotes cross-sectoral, cross-institutional and cross-departmental collaboration in development of policies and services.

A scan of the Innovation System of the Public Service of Latvia was carried out by the OECD in 2021 in collaboration with the Innovation Laboratory (OECD, 2021[17]). Based on the conclusions of the scan, as part of the *Public Administration Modernisation Plan 2023-2027*, the Innovation Laboratory will lead the development of public administration innovation policy in Latvia. In 2023, the Innovation Laboratory is undertaking a technical support instrument (TSI) project supported by the European Commission's DG Reform to build innovative capacity in the public administration, capitalise on the existing infrastructure of the Innovation Laboratory and expand its impact to both national and municipal levels. A three-year Recovery and Resilience Fund (RRF) financed project will focus on the development of a national innovation ecosystem of public administration, establishing fully fledged legal and operational infrastructures for innovation in public administration.

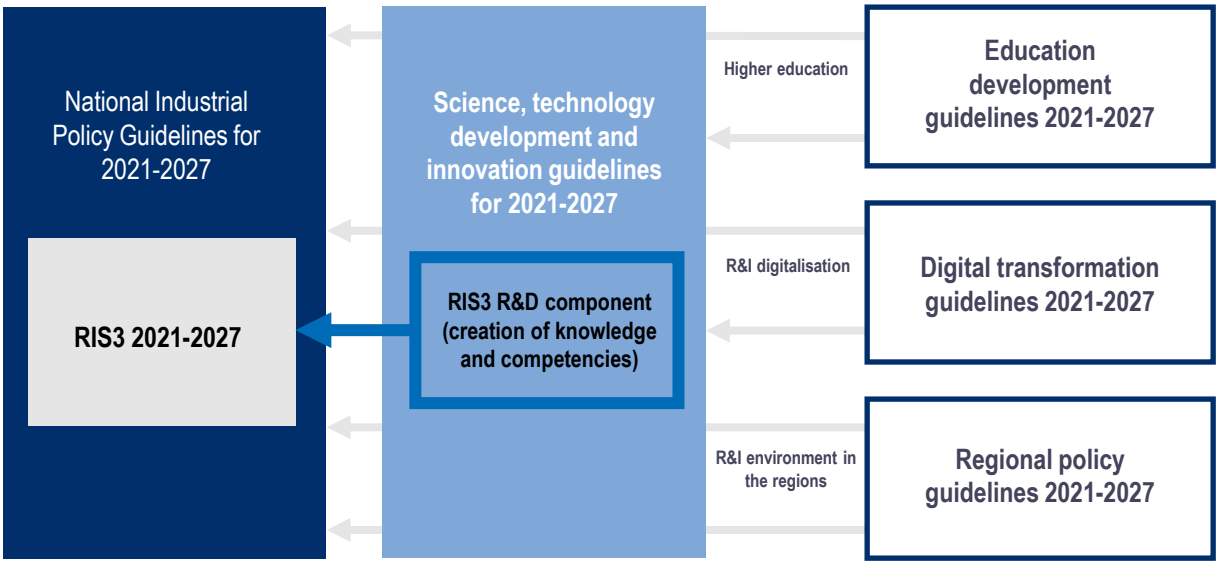
Policy framework and innovation and research initiatives

Both the Ministry of Education and Science and the Ministry of Economics set the direction of research and innovation policy in their respective policy fields in Latvia. Figure 3.8 shows the key policy planning documents comprising the framework that guides policy measures. Key documents are the *National Industrial Policy Guidelines for 2021-2027* developed by the Ministry of Economics and the *Guidelines for Science, Technology and Innovation for 2021-2027* developed by the Ministry of Education and Science. Since the planning period of 2021, the National Industrial Policy Guidelines are the key document defining

focus areas for research, development, and innovation funding related to Latvia's Smart Specialisation Areas (RIS3). While the Ministry of Economics is the main responsible authority for their implementation, all line ministries are jointly responsible for ensuring the implementation of tasks related to their policy area as set out in the guidelines. Policy planning documents in higher education, digitalisation and regional development horizontally feed into R&I policymaking, and, where possible, the R&I policy framework incorporates dimensions from these policy areas.

The high-level policy framework (National Industrial Policy Guidelines for 2021-2027) emphasises that innovation ecosystems can play an important role in achieving R&I policy objectives. The guidelines describe the mechanisms for developing ecosystem strategy and assign new tasks to LIAA in coordinating the ecosystems. Nonetheless, the funding mix does not include dedicated resources to support these activities. International experts have pointed to the insufficient scale of programmes supporting research-industry links and missing support to explore industry needs in Latvia and beyond. They have made recommendations to better institutionalise collaboration with industry (Arnold, Knee and Vingre, 2021[18]). Among Latvian stakeholders, the need to strengthen cooperation between business and academia in order to achieve effective tech transfer and interconnection is widely acknowledge (OECD, 2022[7]) d.

Figure 3.8. Key policy planning documents providing policy framework



Source: Based on Latvian Ministry of Economics/Ministry of Education and Science (n.d.[16]), "Presentation to the Research and Innovation Strategic Council", https://www.mk.gov.lv/lv/latvijas-petniecibas-un-inovacijas-strategiskas-padomes-sedes.

Table 3.1 below lists the key R&I policy measures that have been agreed upon under the European Structural Investment Fund (ESIF) for the funding period of 2021-2027. The availability of funding varies from programme to programme – certain measures have budgets attached to them while others still need further development before a funding call can be launched. The ESIF sets specific requirements for projects to align with smart specialisation areas (RIS3). On the Latvian side, the Central Finance and Contracting Agency (CFCA) and the Development Finance Institution, ALTUM, manage the funding administration of several R&I ESIF programmes. They are not involved in any broader support activities (see more in section 2.3.), the strategic coordination lies with the Ministry of Education and Science or the Ministry of Economics and partly LIAA.

For Latvia's work supporting innovation ecosystem, the listed measures represent the available pathways for ecosystem partners to secure government funding. Some measures target only individual beneficiaries (companies or research organisations), while some can be used to fund the development of collaborative

projects such as the development of new products and technologies in RIS3 specialisation areas. The latter, thus, offer an opportunity to fund initiatives that ecosystem members collectively identified. However, none of the measures explicitly supports ecosystem development and orchestration activities, which appears to be the missing element in the overall R&I policy mix.

Table 3.1. Overview of key R&I policy measures in funding period 2021-27

Measure	Responsible institutions	Type of support
Development of new products and technologies in RIS3 specialisation areas	MoE and CFCA	Grants to companies and research institutions for individual and collaborative R&D projects.
Support for the development of entrepreneurship	MoE and LIAA	Incubators Training (mini-MBA) Support for export activities Innovation vouchers
Acquisition of innovative equipment	MoE and ALTUM	Loans for purchase of equipment and training of employees to operate the equipment
Loans for technology development	MoE and ALTUM	Loans to support risky technology development and prototyping
Loans for transfer of modern technologies	MoE and ALTUM	Loans for purchase of modern technologies in RIS3 areas
Guarantees and export guarantees	MoE and ALTUM	Guarantees (for investment loans, leasing) and export guarantees
Loans for business start-ups	MoE and ALTUM	Loans for investment Business angels fund
Support for venture capital funds	MoE and ALTUM	Investment in several venture capital funds to support growth of SMEs
RIS3 research and innovation centres	MoES	Developing research infrastructure in RIS3 specialisation areas
Practical research projects	MoES	Fundamental and applied research, experimental development, IP establishment
Mobility, exchange of experience and cooperation activities to improve international competitiveness of science	MoES	Stipends and grants for experienced researchers and postdoctoral researchers in Latvia and diaspora
Support for participation in HORIZON programme	MoES	Co-funding to HORIZON and functioning of National Contact Point
Grants for students, doctoral students and postdoctoral researchers	MoES	Innovation programmes for students and research grants for doctoral students, postdoctoral researchers

Recent systemic reforms in Latvia's research and innovation system

Latvia implemented two types of reforms in the field of research and innovation over the past years – R&I governance reforms and research funding system reforms. The governance reforms affect both the system's 'research' and 'innovation' approaches while research funding system reforms have had a more significant effect on research institutions. The two nonetheless remain interlinked as performance of research institutions is crucial for successful industry-academia collaboration as an essential part of the R&I system. In recent years, there have not been any significant reforms of innovation policies.

R&I governance reforms

As described above, both the Ministry of Economics and the Ministry Education and Science are in charge of the R&I system. No single organisation or body was in charge of strategic steering and a systemic perspective in the past. This has partly changed due to the introduction of the RIS3, as the Commission requires Latvia to develop a systemic view on achieving defined goals as part of their funding efforts (EC, 2018[8]). It is expected that the creation of the Innovation and Research Governance Council in 2022, as described above, will additionally bring opportunities to better coordinate efforts, involving both the main

institutions at policy-making level (the two ministries) as well as the ones at policy implementation level (LIAA and LCS).

The implementation of R&I policy is in the hands of various organisations. In addition to LIAA and LCS, the Central Finance and Contracting Agency (CFCA) manages several essential R&I ESIF programmes. This entails that CFCA organises funding calls, reviews submissions and organises contractual arrangements. At the same time, LIAA and LCS are in charge of building capacity of R&I stakeholders and creating links between industry and academia. LIAA is also responsible for coordinating the innovation ecosystems (see further information below). Thus, different institutions engage with R&I stakeholders for various purposes, and beneficiaries of policy efforts do not have a single contact point in government when needing assistance. In the perception of some stakeholders interviewed, dispersed responsibility can hinder Latvia's ability to build institutional capacity to support R&I stakeholders and can be a barrier to providing high-quality funding opportunities to stakeholders.

Regarding the State Research Programmes, there have been efforts made to ensure a broader range of research initiatives. Sectoral ministries have the option and budget to launch their own programmes in their policy fields since 2018, when previously only the Ministry of Education and Science could plan and implement such programmes (EC, 2018[8]). Ministries make use of this opportunity to various degrees; some design their own State Research Programmes to support research in a particular area while others choose not to. For example, the Ministry of Economics designed a programme to fund energy research and the Ministry of Defence funds research on innovations in defence sector (Latvian Council of Science, 2022[19]).

Research funding system reforms

In 2014, an international assessment of Latvian research institutions and a World Bank evaluation of Latvia's higher education funding model led to the initialisation of systemic reforms. Following World Bank recommendations, Latvia developed a new higher education financing model based on three pillars: Base financing, performance-based financing and innovation financing. This was designed to ensure a better balance between stability, performance, and innovation orientation (World Bank, 2014[20]). In addition, Latvia consolidated academic structures and streamlined governance structures in some institutions. The aim of the reforms was to promote the development of stable human capital in R&D by 2030, strengthen Latvia's innovation capacity and to consolidate the science system (EC, 2018[8]).

The consolidation of research structures back in 2014 provided new mechanisms for allocating scientific funding. It increased the share of competitive research funding based on a set of performance criteria. This allowed allocating funding in a more selective way to those research institutions with the best results (EC, 2018[8]). The most recent international research assessment of research institutions[4] found that the reform (and other developments) contributed to an overall improvement of research performance. This included an increase of publications in international journals, the extension of international collaboration networks, considerable investment in research infrastructure and better research management. Institutional mergers decreased the fragmentation of research activities with room for further improvements. The evaluation showed that the positive effects of merging of institutions as well as overall cultural shifts of the research field require significant time. For example, shifting the focus to internationally relevant research questions, building and sustaining international partnerships and shifting mindsets towards performance outcomes will still require future efforts (Arnold, Knee and Vingre, 2021[18]).

Latvia's innovation ecosystem concept

The following section will examine a range of initiatives Latvia has launched in an effort to support collaborative innovation between Latvian stakeholders across industry, academia and the public sector. These include Latvia's smart specialisation strategy and connected RIS3 ecosystems, collaboration

platform initiatives such as clusters or competence centres, efforts to support mission-driven innovation and innovation ecosystem formation. The section will examine commonalities and differences between the approaches in order to identify potential synergies.

Smart Specialisation Strategy and RIS3 ecosystems

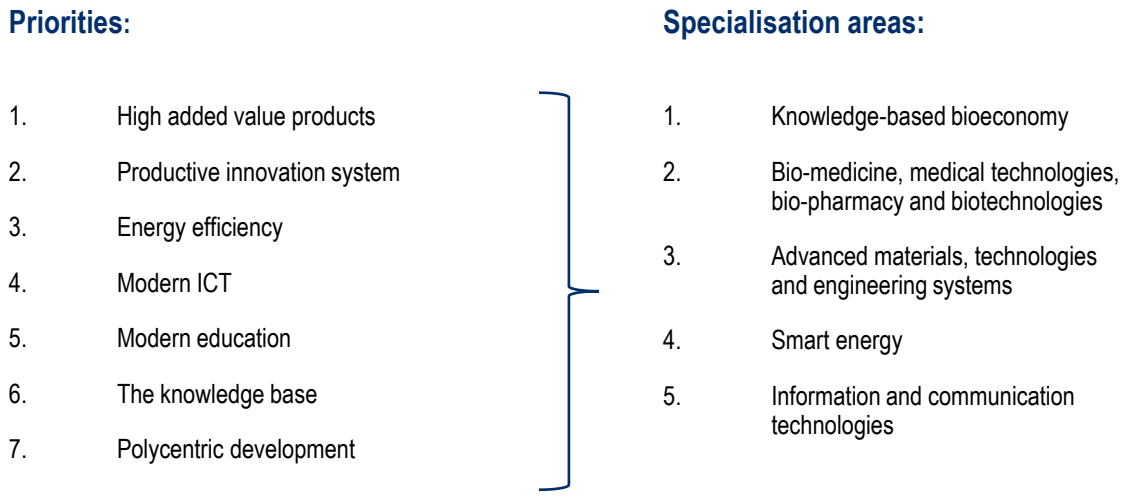
Developed as part of the reformed cohesion policy of the European Commission, Smart Specialisation is a strategy for economic transformation promoted by the European Union. It takes a place-based approach meaning that it aims to leverage assets available to regions and Member States. The strategy builds on the potential of 'entrepreneurial discovery' where the government allows for stakeholder involvement and empowers those actors most capable of realising their potential. The approach is designed to make more effective use of resources by identifying areas for regional research and innovation (R&I) specialisation.

Latvia first developed its RIS3 in 2014 as a response to the ex-ante conditionality for receiving the EU Structural and Investment Funds (ESIF). The main ambition of the European Commission for the RIS3 conditionality was to promote the concentration of public R&D investment in a selected number of R&I specialisation areas to create interregional comparative advantages for European regions. Latvian R&I policy makers also saw the necessity to use the EU Structural Funds available for the period 2014-2020 primarily to consolidate and strengthen the foundations of national research and innovation system and improve the R&I governance.

The Latvian RIS3 developed in 2014 presented a conceptually new and complex strategy providing a balanced and complementary support toolkit to strengthen the overall national innovation capacity. The Ministry of Education and Science led this initial strategy process. It involved a comprehensive analysis of sectoral export potential, assessment of knowledge capacity in Latvia and structured inputs from the stakeholder community as part of the Entrepreneurial Discovery Process (EDP). Latvia defined the objectives to initiative structural changes of production and export in traditional sectors, promote the growth in high added-value sectors (new products and services) and support sectors with horizontal impact and contribution to economic transformation. The strategy outlined seven investment priorities and five thematic specialisation areas as listed in Figure 3.9.

In 2015, the Latvian Ministry of Education and Science developed a more detailed description of the five thematic specialisation areas. This included the scale of each knowledge area, core challenges, existing public funds and regulations and most importantly the mapping of the main actors in each of the innovation ecosystems (Latvian Ministry of Education and Science, 2020[21]). The Commission saw the five broad RIS3 thematic areas as vehicles for structuring ESIF and national R&I investments and in Latvia, they served as a point of reference of national strategic directions in research and innovation.

Figure 3.9. Priorities and specialisation areas of Latvian RIS3



Source: Latvian Ministry of Education and Science (2013[22]), *About the Development of Smart Specialisation Strategy*, https://www.izm.gov.lv/en/media/3748/download.

Up until 2020, Latvia's implementation focus for the smart specialisation strategy was to strengthen scientific capacity of research institutions as well as enterprises and promote cooperation through various support programmes. This shifted with the second RIS3 Monitoring Report published in 2020. It concluded that although the EU Structural Funds in 2014-2020 and other R&I instruments had improved the innovative capacity of individual academic and industry institutions, the approach lacked an integrated approach to fostering innovation in the smart specialisation areas as a whole (Latvian Ministry of Education and Science, 2020[4]). This included promoting innovation by developing the physical, entrepreneurial, and legislative environment of the RIS3 areas to support innovation efforts (Government of Latvia, 2021[5]). The report called for more emphasis on strategic value chain development in the RIS3 niche areas through a structured dialogue with stakeholders and coordinated action plan, as well as changes in the RIS3 governance model.

From 2021 onwards, Latvia shifted the main responsibility for the RIS3 development, including the organisation of the Entrepreneurial Discovery Process, from the Ministry of Education and Science to the Ministry of Economics. This was a way to recognise the central role of the smart specialisation strategy in Latvia's economic transformation. The Ministry of Education and Science retained its responsibility for matters related to scientific and educational capacity in RIS3 areas. This includes the development of and access to research infrastructure for technology transfer. Similar to the Ministry of Education and Science, other sectoral ministries remain involved in RIS3 development within the framework of their mandate.[5] The National Industrial Policy Guidelines for 2021-2027 also introduce the term 'RIS3 value chain ecosystem' and assigned responsibility for launching and coordinating these RIS3 ecosystems to LIAA. The guidelines explain that they are a collaboration between private, public and academic sectors in RIS3 specialisation areas and supplement or deliver key components to the products or services they provide, creating end product or service value (Government of Latvia, 2021[5]). The guidelines prescribe that each ecosystem defines and builds upon a jointly defined strategy. The ecosystem approach should build on:

- A comprehensive mapping of the ecosystem and result in strategy development.
- Coordination of joint activities for the ecosystem members.

In addition, the guidelines provide a draft outline of what each ecosystem strategy should include (e.g. R&D objectives, human resources objectives, internationalisation objectives, activities, performance indicators, etc.).

The Guidelines 2021-2027 confirmed the continued relevance of the five broad RIS3 areas, describing their importance for the Latvian economy as follows:

1. **Knowledge intensive bio economy** – Dominance of traditional industries in the national economy. The productivity and value-added per employee in agriculture, forestry, woodworking, food and drink industry in Latvia is below the EU average. To strengthen productivity and more resource intensive production, it is necessary to stimulate innovation in these sectors. Latvian research institutes have strong competences in multiple areas of bio economy, including sustainable and effective agriculture, innovative food and feed products, food safety, sustainable forestry and wood supply chains, research on bio resources, regional development.
2. **Biomedicine, medical technologies, pharmaceuticals** – Strong research potential as it is an important, competitive, and internationally recognised research field with rich tradition, scientific excellence and innovation activities. Thematically, biomedical research in Latvia covers both traditional medical research and clinical research, and increasingly digitalised healthcare.
3. **Photonics and smart materials** – Strong research potential with a particular importance for the transformation of the Latvian economy towards more value-added production. Topical thematic niches include implant materials, biomaterials, composite materials and polymers, think layers and coverages, machines, tools and systems, functional materials for photonics, electronics, nanotechnologies, nanocomposites and ceramics. The knowledge base in photonics and smart materials is mainly concentration in universities and state research institutions.
4. **Smart energy and smart mobility** – Efficient and user-cantered technologies and services, in particular in the areas of energy, transport and ICT, are a global trend and fundamental for sustainable economic activities and urban development. ICT and digital technologies are means to make cities more effective, accessible, and usable, simultaneously moving towards less CO2 emissions and adapting to climate change challenges.
5. **Information and Communication Technologies** – Horizontal impact on all other RIS3 areas. The impact of ICT sector on the national GDP is about 5%, a share that has significantly increased in the last 10 years. Latvian research potential in ICT lies in thematic niches such as electronics and robotics, algorithms and computer models, computer linguistics, data storage and transfer systems, earth observation, artificial intelligence and machine learning, education technologies and digitalisation, as well as cybersecurity. (Government of Latvia, 2021[5]). Since 2018, Latvia launched more targeted activities to develop strategic value chain ecosystems in RIS3 thematic areas through demonstration, piloting and testing activities. As part of a pilot project, the Ministry of Economics and LIAA developed three RIS3 ecosystem strategies in 2019-2020, feeding in expertise of other ministries and stakeholders. These ecosystems are:
    - Smart cities with a pilot theme **smart mobility**.
    - Smart materials with a pilot theme **photonics.**
    - Biomedicine with a pilot theme **precision medicine**.

The goal defined in the National Industrial Guidelines 2021-2027 is to select at least five strategic value chain ecosystems (one per RIS3 thematic area) placing emphasis on targeted ecosystem governance involving public, private and academic stakeholders. Latvia plans the implementation of its smart specialisation strategy through these ecosystems, building on synergies between scientific excellence and industrial needs. The ecosystem strategies shall serve as guidelines to ensure an integrated innovation approach: from identification and analysis of value chains to improvement of regulatory environment, internationalisation, attraction of investment, development of human resources and strategic governance. RIS3 ecosystem strategies are expected to map the existing competences and support tools complementing them with missing capabilities and functions. Forward-looking and foresight approaches will ensure the modelling of long-term development perspectives.

Latvia will develop annual action plans based on the ecosystem strategies and dynamically review them to account for emerging local and global developments and trends. LIAA is tasked with the development of the initial long-term RIS3 development strategies in each of the five specialisation areas. Dedicated RIS3 ecosystem strategic governance leader groups will develop annual action plans that will be coordinated with ecosystem partners. The National Industrial Guidelines 2021-2027 foresee two main activities as part of the RIS3 ecosystem value chain approach:

1. Mapping: analysis of the existing situation and strategy definition.
2. Coordination: involving a range of concrete and mutually connected activities.

Other collaboration platform initiatives

Latvia undertakes other initiatives that promote the development of collaboration platforms, similar to the ecosystem approach. Among these initiatives are

- Competence centres.
- Clusters.
- Industry associations.
- Regional initiatives of the Knowledge and Innovation Communities (KICs) as part of the European Institute of Innovation and Technology (EIT).

Table 3.2 provides a concise overview on distinctions between these initiatives. The following section will describe the work done in recent years under each of the programmes, their strategic direction and focus areas. This allows to identify synergies and differences between the various initiatives Latvia takes to enable collaboration platform initiatives. The insights described are derived from available government documents as well as a series of personal interview with key policymakers in the R&I landscape.

Table 3.2. Initiatives that promote links among innovation ecosystem actors

Programmes/initiatives	Objectives	Funding	Responsible organisation
Competence centres	Programme to increase the competitiveness of Latvian industry through fostering collaboration between research and businesses by supporting applied research projects for the development of new products and technologies.	In the period 2014-2020, around EUR 80m of which 80% came from the European Structural Funds	Ministry of Economics
Cluster programme	Programme promotes the creation of cooperation networks among industry, research organisations, higher education organisations and other entities that operate in the same sector, product or service niches or value chains to promote industrial competitiveness, export of higher added-value production.	In the period 2014-2020, around EUR 6.2m of which 85% came from the European Structural Funds	Ministry of Economics
Industry associations	Public, non-governmental organisations that join businesses in dedicated sectoral areas to help developing the industry by addressing sectoral challenges and representing the industry voice in policy-making initiatives and governance processes.	Membership fees and other funding sources	Independent
EIT KIC Regional Innovation Scheme	European programme aiming to build pan-European innovation ecosystems in thematic challenge areas through integration of the 'knowledge triangle' –	Annual budgets awarded by individual KICs for implementation of defined	Riga Technical University as key coordinator of the scheme in Latvia

	business, research, education actors, as well as public administrations.	activities	

During the previous funding period, (2014-2020) the Ministry of Economics funded **eight competence centres** as an effort to increase the Latvian industry's competitiveness. The programme fosters collaboration between research and businesses by implementing applied research projects for the development of new products and technologies. The overall programme budget amounted to EUR 80m, of which 80% came from the EU Structural Funds and 20% from private co-financing (Latvian Ministry of Economics, 2018[23]). The competence centres are in the areas of direct relevance to RIS3:

- Forestry and woodworking.
- Agriculture and food.
- Biomedicine, medical technologies, biopharma and biotechnologies.
- Smart materials.
- Modern production technologies and engineering systems.
- Machinery (electronics).
- ICT.
- Smart energy.

The competence centres have been an overall Latvian success story. A review of the R&I funding system in 2018 by the H2020 Policy Support Facility expert team assessed that they were the most successful instruments in Latvia so far in creating bridges between research centres and industry (EC, 2018[8]). In particular, the clear funding mechanisms and their orientation towards industry needs was fruitful. The centres work with almost all of Latvia's largest and most active enterprises undertaking research and development activities. They also collaborate closely with the respective industry associations of each field. Through this interconnectedness they have de facto become an essential sectoral discussion platform allowing for exchange on R&I (Government of Latvia, 2021[5]).

Another support instrument connected to ecosystem formation is the cluster programme. From 2014-2020 Latvia implemented 14 cluster projects with a total budget of EUR 6.2m, 85% funded by EU Structural Funds. Cluster activities contribute to the realisation of RIS3 goals. The Ministry of Economics assessed that the clusters successfully implemented export promotion activities and accumulated the necessary administrative capacities for their realisation (Government of Latvia, 2021[5]). The expert assessment performed in the framework of Interreg Europe project CLUSTERS3 however pointed out that the structure of the programme lacked effective triple helix implementation in practice. In addition, large enterprises were not sufficiently engaged to ensure successful cluster operations. According to the experts, the cluster programme funding was insufficient to reach defined ambitions and objectives and cluster membership did not reach the critical mass (Latvian Ministry of Economics, 2018[24]).

A long-standing mechanism for industry collaboration networks in Latvia are sectoral industry associations, which foster collaboration between enterprises in concrete domains (based on NACE[6] classification). Historically, the strongest associations existed in classical export-oriented economic sectors such as woodworking, metalworking, electronics and pharmaceuticals. This may evolve in the future. While industry associations play an important role in the work of competence centres, clusters and other innovation support programmes, there is not always an alignment of efforts. Each of the funding programmes has distinct goals and activities, which can create bottlenecks for technology transfer and knowledge absorption by industry. As a result, the Ministry of Economics recognised in the current funding period that there is a need to create a more holistic support mechanism to promote the achievement of RIS3 objectives (Government of Latvia, 2021[5]).

Latvia is also part of the pan-European innovation ecosystem building efforts through the association to the Knowledge and Innovation Communities (KICs) of the European Institute for Innovation and Technology (EIT). Riga Technical University (RTU) has taken up an active lead as the main Latvian partner engaging with the outreach scheme of four KICs – EIT Climate-KIC, EIT Food, EIT Urban Mobility and EIT Raw Materials. The cooperation with the EIT started in 2016, when KICs launched partnership schemes dedicated specifically to modest and moderate innovator countries in Europe. Since then, the Innovation Ecosystem Development Unit of the RTU Knowledge and Innovation Centre has grown substantially in size and mandate. It is taking a hands-on approach to connecting Latvian innovation ecosystem partners with European counterparts. RTU has become a recognised partner for KICs and, in essence, performs the role of a central entry point for moderating networking, information on upcoming calls and support opportunities between KICs and Latvian R&I ecosystems.

Developing work on mission-oriented innovation

Another work stream that touches upon elements of ecosystem mobilisation and co-creation of several organisation relates to missions. The work on mission-oriented innovation in Latvia stems from another strand of work that LIAA was tasked with in 2021 – the development of Latvia's national brand image. The working group in charge of ideation assessed that a state's brand is closely associated with its actions, and less the result of communication efforts. Inspired by the mission-oriented innovation approach that gained popularity across European countries (in particular the work of Mazzucato (2018[25])), the working group concluded that goal orientation needed to be a priority. To improve Latvia's international image as a small European country, the country needs to align stakeholders to solve societal challenges of local and global relevance. This mission-driven approach captures the essence of how various organisations and sectors can achieve strategic alignment in the name of an ambitious, inspiring and joint goal (Mazzucato, 2018[25]; OECD, 2021[26]).

Selecting a suitable mission to feed into the branding exercise took place in 2021 over a six-month period. The parameters of the mission theme were its local and global importance, involvement a wide range of diverse stakeholders and uptake of external knowledge in its implementation. The team sourced and crystallised ideas in the form of surveys, interviews, workshops and other discussion and deliberation platforms. Finally, they selected a mission on clean water, water innovation and technologies: mission Sea 2030, similar to the EU mission "Restore our Ocean and Waters by 2030". Other potential ideas related to the EU Cancer mission or forestry, but these either faced the resistance of companies unwilling to take part in open innovation or had a potential negative image. "Mission Sea 2030" covers all types of water innovation, water resource preservation technologies and stresses the critical importance of clean water technologies for a sustainable future.

One year after LIAA adopted "Mission Sea 2030", first signs indicate that the theme will gain traction. There is a notable progress in research achievements in related fields and some enterprises have adopted investment projects connected to the mission goals. In September 2022, the RIS3 Innovation Council plans to adopt more concrete mission KPIs to assess the achievements of the mission-oriented approach across various dimensions. The current mission implementation mechanism is a consistent and dedicated streamlining of mission objectives across policy initiatives, ecosystem objectives, and action plans of a wide range of stakeholders. LIAA is also preparing dedicated communication campaigns to 'translate' the core ideas of the mission approach for wider society. Similar deliberation activities will launch in the future to select one or two additional missions in other thematic areas. This would allow to engage a wider range of stakeholders and build on the momentum of this new model of collaboration.

Synergies and inconsistencies of ecosystem and other collaboration platform approaches

While the described programmes all have an element supporting collaborative innovation, they each exist in a different context and have their own programme logic. The main commonality between most approaches is Latvia's commitment to its smart specialisation strategy:

The competence centre and cluster programme implemented in the period 2014-2020 targeted the five original RIS3 domains; hence, thematically there is some alignment between the broad smart specialisation areas and concrete collaboration platforms among the relevant actors. Competence centre and cluster initiatives have formed important links and connections that pre-date the start of the ecosystem initiatives.

Industry associations have a strong sectoral orientation and are recognised lobby organisations in economic and industrial policy deliberations. They are frequent go-to partners for consultations and gathering of stakeholder inputs, including for the RIS3 entrepreneurial discovery process. Nonetheless, it is unclear if they play a facilitating role in the formation of cross-sectoral initiatives or solely remain advocates of specific sectoral policy interests. The exact role could differ among the various organisations.

Contrary to the other programmes, the EIT KIC regional initiatives have rather limited connection to the RIS3 ecosystem approach. While the representatives of Riga Technical University are aware of all the existing innovation support instruments at national level, synergies between the EIT KICs and national RIS3 strategy have been almost non-existent. The innovation support instruments implemented by LIAA have distinct objectives rather than a focus on how the programme would support beneficiaries along the entire innovation journey from the idea to market rollout. The EIT KICs tackle this aspect well at European level. Due to the fragmentation of programme objectives, defined goals, criteria for application and other, local synergies with the KIC initiatives are hard to discern. Beneficiaries also recognise the substantial effort needed to apply to LIAA programmes noting that funding frequently remains insufficient (or does not cover a full prototype development process). Meanwhile, the RTU (Riga Technical University) Knowledge and Innovation Centre employs almost 60 people on a project basis and gradually accumulates competences in providing innovation support services. Through interactions with other KIC ecosystems, they bring a much-needed insight into European-level developments into the national R&I landscape. These can offer important macroeconomic knowledge for defining RIS3 strategic niches. At present, the interviewees share the impression that ministries do not sufficiently recognise the value generated by RTU networking and engagement activities for the formulation of RIS3 strategy. In large parts, this is due to the complexity of the EIT as an instrument that forges pan-European cross-sectoral innovation ecosystems tackling defined societal challenges.

Due to its recent initiation, interconnections between the missions-driven approach by LIAA and the smart specialisation strategy remain to be seen.

LIAA's role in supporting innovation ecosystems

The following section looks at the role LIAA has played in supporting ecosystems to develop and flourish. It examines the reorganisation of the institution, its role in the R&I policy and implementation space and the steps taken to coordinate RIS3 ecosystems. The observations stem from continuous exchanges with LIAA, several joint activities with ecosystem partners and a series of interviews with key policymakers in the agency, other institutions and ministries.

The organisation's evolving role in Latvia's innovation policy landscape

LIAA has a mandate to increase export and competitiveness of Latvian companies, facilitate foreign investment and implement tourism development and innovation policies. In addition to its role in export and investment promotion, the agency is in charge of implementing ESIF programmes for business support since 2004. With the 2007-2013 funding period, the programmes became gradually more complex and started focusing on building links between key innovation institutions, industry and academia. The agency implemented new forms of funding instruments including support for competence centres and clusters, aimed to enable technology transfer. LIAA also started experimenting with various forms of funding instruments to support these programmes. These were the first instances in which the agency evolved from its role as a funding distributor to introducing new mechanisms to facilitate strategic collaboration in the innovation space. This continued in the ESIF funding period 2014-2020 when Latvia first launched its smart specialisation strategy in the RIS3 areas. Up until the current funding period, LIAA did not hold a strategic mandate to ensure meeting the RIS3 framework and objectives. While the agency did administer funding measures with a contribution to RIS3 targets, it was unable to undertake strategic planning and coordination of RIS3 activities.

As outlined above, along with planning the current policy and funding period (2021-2027), LIAA obtained a new role in coordinating the RIS3 ecosystems. The agency was assigned responsibility for granting support to ecosystems. This entails a comprehensive mapping of each ecosystem to feed into strategy development as well as the coordination of joint activities of ecosystem members.

For LIAA, this responsibility marked a turning point in the agency's role within Latvia's R&I system. LIAA is now responsible for what has been identified as an essential part of Latvia's innovation approach: launching and coordinating RIS3 ecosystems, including the development of strategy and elements of orchestration.

LIAA's current mandate and resources to fulfil its role

To fulfil its coordinating role, LIAA is trying to sustain ongoing dialogue between ecosystem members and mapping competencies, ideas and potential collaborations. LIAA also reviews the RIS3 strategies and aims to include specific activities to support the achievement of those activities in the organisation's activity plan. There is an understanding among LIAA leadership that the agency can work not only as an administrator of business support but can also have an active role in driving the development of large industrial projects. That includes an active role in seeking funding opportunities and promoting Latvian businesses internationally. However, this also requires the active support and participation of industry players representing the ecosystem. Based on consultations with LIAA, the Ministry of Economics and members of several ecosystems, it appears that the parties are still on their way to understanding their roles and working arrangements that would best deliver the objectives defined in the policy planning documents. This also includes the evolving relationship between the agency and the steering mechanism of its line ministry.

The National Industrial Policy Guidelines for 2021-2027 delegate a complex and resource-intensive task to LIAA. LIAA plans to assign a team of five people to coordinate each ecosystem. However, only the core coordinator would work on this task full-time. The other four team members are representatives of LIAA technology scout and start-up units. However, these staff members have other daily responsibilities and contribution to RIS3 ecosystem coordination is only one of several tasks. Furthermore, LIAA plans to engage representatives from the Investment Department and Export Promotion Department. In addition to staff effort, LIAA has a budget of EUR 300 000 over five years to support ecosystem strategy development. LIAA can use this funding to digitalise coordination activities, collect data or perform other support activities.

Coordination or orchestration of innovation ecosystems is essential for any ecosystem to produce outputs and succeed. Ecosystem coordinators must align partners and identify joint value propositions, and this

task requires specific competencies, skills and tools. Furthermore, ecosystem coordinators need to provide support to set a strategic direction and define priorities. In addition, the coordinators must understand the particular industry's national and international landscape and possess orchestration skills. Trust between ecosystem partners and coordinators has been identified as a crucial element in ecosystem success, and building trust takes time. LIAA as a public sector organisation has a different standing than a stakeholder from academia or the private sector who may have pre-existing relationships with ecosystem partners due to past collaborations. This may mean that LIAA needs to invest into building trust-based relationships in order to efficiently perform the coordinator role. Finally, policymakers also need to consider having an exit strategy for ecosystem support. That is currently not defined. The ecosystem coordination activities are linked to the six-year policy and funding planning period, but there is no clear strategy for what the role of LIAA will be after this period.

Based on consultations with policymakers, LIAA and ecosystem members, LIAA currently does not fully have the resources required to meet the expectations placed on the organisation by high-level policy objectives. In addition, LIAA is a public administration organisation with minimal options to recruit employees with the knowledge, skills and experience required to orchestrate innovation ecosystems successfully. Interview partners shared their concern that the renumeration that LIAA can offer is a barrier to attracting staff with the right profile to conduct the complex innovation ecosystem coordination task. The ambitious policy objectives in innovation ecosystem building currently are not supported by appropriate dedicated resources to support the policy implementation. If unchanged, the progress of innovation ecosystem development will be slow (or none), and thus it is unlikely innovation ecosystems will produce ecosystem outputs and benefits for their members.

Based on international experience, although the government has a significant role in innovation ecosystem initiation (by providing funding) and can be an active player in ecosystem orchestration, industry and academia usually lead the ecosystem work. Governments either provide funding to ecosystem members to support their orchestration efforts or hires external neutral service providers with expertise in the area. For example, Business Finland ecosystem funding beneficiaries work with specific industry associations that take the lead in ecosystem coordination. In addition, government funding for ecosystem coordination is linked to specific performance indicators that ecosystems must meet to receive ecosystem orchestration support. The role of the government innovation agencies (as LIAA) in these models is to ensure quality services are delivered to the ecosystems, monitor the ecosystem development progress, and facilitate peer exchange and learning between different ecosystems.

International reviews of innovation ecosystem orchestration also highlighted that government organisations recognise the role of innovation ecosystems in R&I development and act to initiate ecosystem creation and development. But the review did not find examples of ecosystems that government organisations coordinate. It takes specific skills and knowledge to orchestrate an innovation ecosystem. It is believed that industry needs-driven ecosystems should be orchestrated by organisations that possess the skills and knowledge and are R&I producers. For example, innovation agencies like Business Finland, Vinnova, and Innovate UK have the resources to recruit staff with the necessary expertise. Still, these organisations do not directly facilitate ecosystems but provide a framework, oversee, and monitor the process.

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Notes

[1] The Lisbon Strategy was launched in 2000 by the EU heads of state pledging that by 2010 the European Union would become "the most competitive and dynamic knowledge-based economy in the world". Leveraging investment in R&D became a key element of this strategy following the Barcelona European Council's objective to raise overall R&D investment to 3% of GDP by 2010 (European Council, 2000[27]).

[2] For instance, in European Semester Country Reports, EC Horizon 2020 Policy Support Facility Expert Groups, International Research Assessment Exercises, OECD Country Reviews and others.

[3] See https://sdgs.un.org/goals.

[4] An International Evaluation of Scientific Institutions' Activity undertaken for the Ministry of Education and Science.

[5] For example, the Ministry of Agriculture with respect to bio economy, the Ministry of Health with respect to biomedicine, the Ministry of Environment and Regional Development for the application of RIS3 principles in regional planning, etc.

[6] NACE is the 'statistical classification of economic activities in the European Community "and is the subject of legislation at the European Union level, which imposes the use of the classification uniformly within all Member States, see https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF.

4 Towards a process for anticipatory innovation ecosystem development in Latvia

This chapter proposes a three-phase process for the development of anticipatory innovation ecosystems in Latvia, illustrated by insights generated by concrete interventions and research conducted as part of this project. In addition, it features a detailed review of practical engagements with four of the main RIS3 ecosystems: smart materials and photonics, smart mobility, bioeconomy and biomedicine.

Anticipatory Innovation Governance through innovation ecosystems: action research in Latvia

Through its RIS3 ecosystems, Latvia aims to leverage the collective intelligence of stakeholders from government, industry, academia and civil society to achieve two goals. First, to stimulate the exploration and discovery of opportunities for innovation in a rapidly changing and uncertain world. Second, to inform policy so that government can take timely action to enable these opportunities to be seized (Government of Latvia, 2021[1]). These joint objectives require the coordination of micro- and macro-governance processes so ecosystem partners and government can respond to the information and anticipatory knowledge they generate and maintain a necessary momentum of collaboration and action for innovation (Autio, 2021[2]).

As described in Chapter 2, this coordination and the structures that enable it are context dependent. This means that the identification of appropriate governance arrangements is best achieved through experimentation, rather than "adopting ideal models and best practices" (Guzzo and Gianelle, 2021[3]). The decision in Latvia to orient innovation ecosystems towards anticipatory innovation further necessitates experimentation to explore governance arrangements and processes that can enable the effective application of anticipatory approaches.

Over a two-year period from 2020-2022, the OECD worked closely with the Investment and Development Agency of Latvia (LIAA) to explore how the development of innovation ecosystems in Latvia could be facilitated through effective anticipatory innovation governance. The programme of work consisted of three inter-related elements. First, analysis of theory and international case-studies to explore how an anticipatory focus for innovation ecosystems can be supported through public governance, and better understand the impact this might have on the anticipatory capacity of government (the resulting approach outlined in Chapter 2). Second, the assessment of Latvian stakeholders' capacity for anticipatory innovation governance at the micro- and meso-levels to support innovation ecosystems and respond to the insights they generate. Third, testing and developing approaches based on this analysis, and the resulting model, through practical interventions with ecosystem stakeholders in Latvia. These interventions engaged actors in four ecosystems identified by LIAA: photonics and smart materials, biomedicine, bioeconomy, and smart mobility. Overall, more than 80 participants took part in seven workshops representing government, industry (incl. state-owned companies), research and academia, as well as other types of organisations.

This process of research and experimentation allowed the governance approach to be refined, revealing three phases of relevance to the public governance of anticipatory innovation ecosystems in Latvia: Initiation, Development and Maintenance, Exit. In addition, it demonstrated the potential of innovation ecosystems to generate rich and useful anticipatory insights to inform more proactive government action.

The three phases are distinguished by different types of activity undertaken by different types of stakeholders. The initiation phase demands meso-governance coordination to determine an overarching purpose for the government support of ecosystems and to identify the roles that government actors will play. During development and maintenance, activities to establish micro-governance processes among ecosystem partners are coordinated with meso-governance actions so that anticipatory knowledge is produced and acted upon by both ecosystems and government. The exit phase focuses on the approaches that government can use to determine the ongoing value of their support of an ecosystem and identify opportunities to withdraw.

Insights from practical interventions carried out with LIAA and Latvian stakeholders will be detailed throughout this chapter. In the first section examining three governance phases, a process for the development of anticipatory innovation ecosystems in Latvia will be proposed, illustrated by insights generated by concrete interventions and research as part of this project. The second section of this chapter will feature a more detailed review of practical engagements with four of the main RIS3 ecosystems: smart

materials and photonics, smart mobility, bioeconomy and biomedicine. Each section will give an overview of the strategic insights and anticipatory knowledge generated. It will look at the ecosystems' ambitions, trends and developments in their contextual environment, actions to improve ecosystem resilience and the challenges they face. These insights can serve as examples for the kind of knowledge that can be generated through the engagement with ecosystems to feed back into Latvia's governance and policy systems.

Table 4.1. Overview of phases for the public governance of anticipatory innovation ecosystems in Latvia

Phase	Objective	Actions
Initiation	Determine a shared understanding of overarching programme objectives and logic	Ensure that goals, priorities and expectations for the programme are discussed and agreed by relevant stakeholders at the meso-governance level, for example the Innovation and Research Governance Council.
		Provide government actors with information about anticipatory innovation governance innovation ecosystems and opportunities for discussion so that key stakeholders understand the benefits and limitations of the approach (Chapter 1 provides information on this).
		Collaboratively develop a programme-level theory of change with meso-governance stakeholders in order to identify key activities and roles they should play to support the programme, as well as gaps in capacity.
	Select and prioritise ecosystems for government support	Choose a clear, evidence-based approach for the assessment, selection and prioritisation of ecosystems, for example foresight-based or quantitative (see Box 2.3).
		Build LIAA's analytical capacity to assess the viability and needs of specific ecosystems.
		Provide political support to confirm and legitimise the selection of specific ecosystems.
	Establish roles for government stakeholders to facilitate coordination	Relevant government actors can use the meso-governance framework (Chapter 2) at the initiation phase to discuss the roles they will play in relation to ecosystems and identify opportunities for coordination.
	Establish approaches for monitoring and evaluation	Following agreement on programme level goals, identify approaches and indicators for the monitoring and evaluation of the programme and individual ecosystems. A combination of formative evaluation to support ongoing ecosystem development (see Box 2.9 and Annex A) and impact evaluation using indicators such as share of firms co-operating on innovation activities and turnover is valuable to generate a holistic understanding of ecosystem needs and potential.
Development and maintenance	Harvest information about ecosystems	LIAA to gather information about ecosystem partners and their relationships through interviews and workshops in order to inform next steps of ecosystem engagement.
	Identify micro-governance processes to prioritise	LIAA to apply the micro-governance framework (Chapter 2) to identify gaps and needs for each specific ecosystem.
	Plan, design and facilitate activities to develop micro-governance processes	LIAA to use resources such as the Observatory of Public Sector Innovation toolkit navigator to identify and tailor appropriate methods to address the priority micro-governance processes.
		LIAA to create a detailed plan for how the methods should be delivered (online of offline), communicated, who should participate, how knowledge generated should be gathered, and what next steps should be.
	Harvest insights generated by ecosystem activities and reassess needs and priorities	LIAA to collect, manage and analyse insights generated by ecosystem activities, and communicate them effectively to ecosystem partners.
		LIAA to support ecosystem partners to assess how new insights generated through ecosystem engagement can inform continued ecosystem activity. A theory of change can provide a useful framework to assess the relevance of new information to ecosystem goals and activities.
	Assess ecosystem needs and insights and coordinate government functions to provide support and influence policy	LIAA to communicate needs and insights uncovered through ecosystem engagement to the Innovation and Research Governance Council and other relevant government actors.
		Innovation and Research Governance Council and other relevant government actors to apply the meso-governance framework to explore how government functions and policies can be aligned to ecosystem needs.

Phase	Objective	Actions
Exit	Identify opportunities to reduce or withdraw government support to ecosystems	LIAA to use the formative evaluation toolkit (see Box 2.9 and Annex A) to monitor the development of micro-governance processes in each ecosystem and determine the potential for ecosystem partners to take on more responsibility for them.
		Innovation and Research Governance Council to gather information on the impact of ecosystem activities every three years using indicators such as share of firms co-operating on innovation activities and turnover to assess their effectiveness. This time-frame takes into account the time required to build ecosystem relationships.

Phases for the public governance of anticipatory innovation ecosystems in Latvia

Phase 1: Initiation

The initiation phase is focused on establishing a robust meso-governance framework to ensure that there is legitimacy and support for anticipatory innovation ecosystems. In addition, it enables government to increase its capacity to leverage anticipatory knowledge generated by innovation ecosystems and align their activities towards policy priorities.

Determine a shared understanding of overarching programme objectives and logic

Setting clear scope and purpose is a key first step in establishing a successful programme for the development of multi-stakeholder initiatives such as anticipatory innovation ecosystems (Matti et al., 2022[4]). Without a shared understanding of the objectives and logic of a programme, expectations for it may be misaligned, leading to a lack of confidence in the process and challenges for coordination. In contrast, a clear scope and purpose enables stakeholders to determine their roles, coordinate activities and develop a sustainable strategy to support the development of anticipatory innovation ecosystems. Alignment of the programme to clear policy objectives across government departments enhances its legitimacy and facilitates further engagement from non-government stakeholders.

Latvia's *Guidelines for the National Industrial Policy 2021-2027* presents key details about the objectives and expectations for innovation ecosystems in Latvia (Government of Latvia, 2021[1]). However, interviews and collaboration with stakeholders in Latvia revealed a lack of clarity and shared understanding about how they could be achieved and monitored (Box 4.1), and scepticism about government's support for ecosystems among ecosystem partners. For example, interviewees both within LIAA and in the private sector reported to the OECD that awareness at the political level of LIAA's activities concerning ecosystems is not always particularly strong and that stakeholders often need to lobby for support for projects in order to obtain consistent funding, legitimacy and backing.

Key actions

- Ensure that goals, priorities and expectations for the programme are discussed and agreed by relevant stakeholders at the meso-governance level, for example the Innovation and Research Governance Council.
- Provide government actors with information about anticipatory innovation governance and innovation ecosystems and opportunities for discussion so that key stakeholders understand the benefits and limitations of the approach. For example, engaging diverse stakeholders to explore the future enables them to identify valuable identify opportunities for innovation, but this process can be time-consuming and challenging (see Chapter 1 for more detail).

- Collaboratively develop a programme-level theory of change with key stakeholders (such as the Innovation and Research Governance Council) in order to identify key activities and roles they should play to support the programme, as well as gaps in capacity.

Box 4.1. Action-research in focus: Developing a programme-level theory of change

Latvia's *Guidelines for National Industrial Policy 2021-2027* document identifies the impact and outcomes that the government hopes to achieve through innovation ecosystems and existing challenges for collaboration and innovation in Latvia, focusing on increasing exports and R&D expenditure.

The document acknowledges the importance of taking environmental and climate issues into account for smart specialisation, as well as being responsive to future challenges. It sets out roles and responsibilities for government stakeholders and proposes a process for the development of long-term ecosystem strategies and regularly reviewed action plans. LIAA is identified as the coordinator for the development of strategies and action plans.

Over two participatory workshops in January and April 2022, the OECD supported LIAA to develop a programme-level theory of change in order to identify concrete outcomes and determine the activities and inputs that would be required to achieve these. In spite of the detail included in the Guidelines, discussion within the workshops revealed that expectations for the activities and outcomes anticipatory innovation ecosystems in Latvia differed both within LIAA and among ministries, and that relevant measures to monitor ecosystem development were poorly understood. Furthermore, the roles of government stakeholders in supporting the programme were unclear, and LIAA did not have sufficient capacity or expertise to undertake the range of activities required to deliver the desired outcomes.

Select and prioritise ecosystems for government support

The OECD identifies five methods for governments to select and prioritise ecosystems for support: quantitative, mixed-methods, foresight-based, industry-led and grand challenge focused (see Box 2.3 in Chapter 2). Each of these methods aims to allow governments to determine the viability of innovation ecosystems by assessing their potential impact and whether there is a critical mass of stakeholders willing to collaborate. Their application requires capacities in information gathering, analysis and stakeholder coordination. Adopting a clear, evidence-based approach can help to address potential political tensions associated with selection. Nonetheless, political legitimacy is still important to promote engagement with and support of new ecosystems.

Latvia's Guidelines for National Industrial Policy 2021-2027 identifies five broad areas for the development of RIS3 ecosystems: knowledge intensive bioeconomy, biomedicine, photonics and smart materials, smart energy and smart mobility and information and communication technologies (ICT). Prior work to support the development of ecosystems in the area of biomedicine, photonics and smart materials and smart mobility helped to ensure that each had a critical mass of stakeholders willing to engage in ecosystem activities, and that these activities could be tailored to their needs. However, interviews with stakeholders in Latvia (outlined in chapter 3) revealed that LIAA lacks the capacities to assess the viability of new ecosystems identified as priorities by government and the political legitimacy to galvanise engagement. Currently, LIAA attempts to support all ecosystems in parallel with a limited number of staff lacking time to engage with the specifics of each industry and group of stakeholders. Due to the lack of resources to analyse the macro-economic and policy context of each ecosystem, this work remains broad without clear priorities and focus. This in turn limits the ability to leverage ecosystem engagement to generate key insights for policy and governance that LIAA can feed back into the system.

Key actions

- Choose a clear, evidence-based approach for the assessment, selection and prioritisation of ecosystems, for example foresight-based or quantitative (see Box 2.3).
- Build LIAA's analytical capacity to assess the viability and needs of specific ecosystems.
- Provide political support to confirm and legitimise the selection of specific ecosystems.

Establish roles for government stakeholders

Coordinated meso-governance of anticipatory innovation ecosystems is necessary to ensure that their needs are addressed, policies to frame and support their actions complement rather than contradict each other and the knowledge they generate becomes actionable for government. The meso-governance functions framework described in Chapter 2 is a tool for government stakeholders to assess their complementarities and establish how they can coordinate their actions.

Interviews with stakeholders in Latvia revealed that the roles and responsibilities of ministries to ecosystems were sometimes poorly coordinated and unclear to ecosystem partners. For example, the Ministry of Agriculture oversees the bioeconomy domain and led on the development of a national bioeconomy strategy, but its involvement in the development and direction of the bioeconomy ecosystem is not yet defined. Interactive workshops with government actors and LIAA further identified that the development of anticipatory innovation ecosystems necessitates a shift in roles for ministries and agencies (Box 4.2), and that LIAA does not currently have sufficient capacity to undertake its expected roles (Box 4.1; Chapter 3). Figure 4.1 outlines a potential governance structure in which the Innovation and Research Governance Council coordinates meso-governance, with LIAA playing a key intermediary role to communicate policy direction to the innovation ecosystems and communicate insights generated by the ecosystems to the Innovation and Research Governance Council.

Key actions

- Relevant government actors can use the meso-governance framework (Chapter 2) at the initiation phase to discuss the roles they will play in relation to ecosystems and identify opportunities for coordination.
- Innovation and Research Governance Council to act as a platform for the coordination of meso-governance and the communication of policy priorities to innovation ecosystems through LIAA.

Box 4.2. Action-research in focus: exploring roles of government stakeholders to support ecosystems

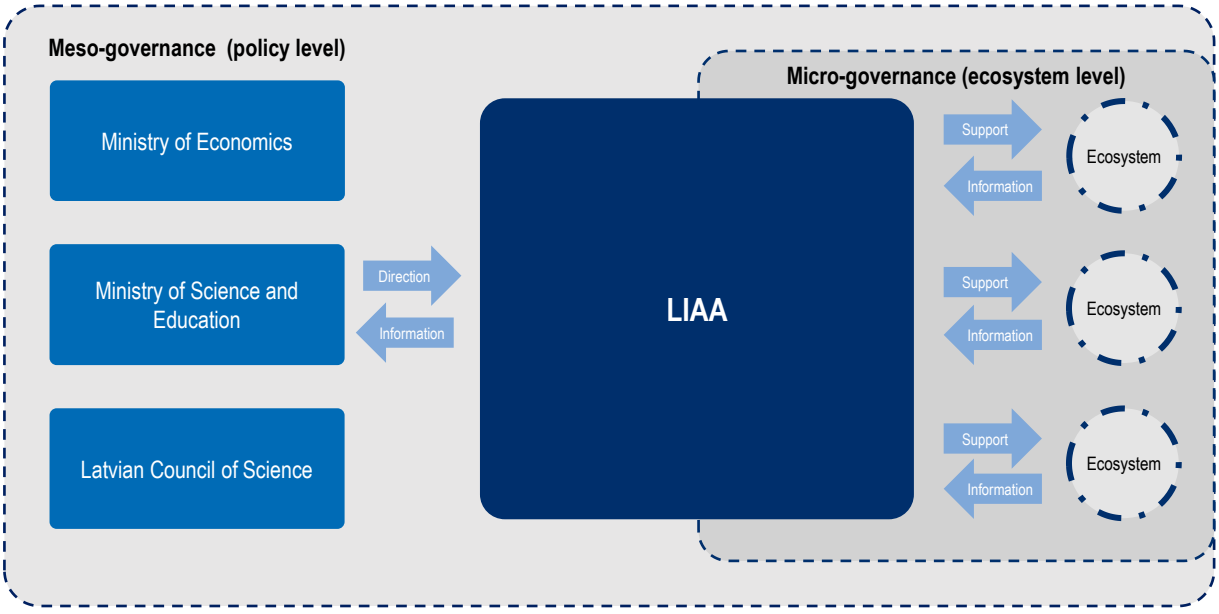
In December 2021, the OECD and LIAA convened 18 representatives from LIAA, the Ministry of Education and Science, the Latvian Council of Science and the Ministry of Economics. Workshop participants were split into three groups to discuss the key benefits of innovation ecosystems in the Latvian context, and what roles government and agencies could play in developing successful ecosystems. An early version of the meso-governance functions framework was used to prompt discussion.

Participants found that the support requirements of ecosystems necessitated that institutions perform a variety of functions, reshaping usual expectations for their roles and functions. LIAA, for example, was understood as transitioning from **Funding** and **Championing** to increasingly **Orchestrating** stakeholders and potentially supporting the development of new approaches for **Regulation**. It was discussed that government could play a greater role in **Providing** infrastructure for innovation, such as

testing infrastructure. Anticipatory innovation ecosystems were also understood as a valuable tool to generate knowledge identify improvements to policy and regulation.

The meso-governance functions framework prompted participants to discuss the importance of enhancing the government's approach to regulation, improving the provision of public infrastructure to support testing and scaling, and better connecting ecosystems to funding opportunities in Latvia and beyond.

Figure 4.1. Proposed governance structure for anticipatory innovation ecosystems in Latvia



Establish approaches to monitoring and evaluation

Monitoring and evaluation of innovation ecosystems enables government stakeholders to determine the level and type of support they need, as well as their potential for successfully achieving their desired outcomes. Choosing appropriate methods and indicators for monitoring and evaluation at the meso-governance level is important to ensure that ecosystems are not judged against unrealistic expectations, and that appropriate support can continue to be provided. As outlined in Chapter 2, ecosystems can benefit from setting their own outcome indicators. These may inform monitoring and evaluation at the meso-governance level.

Formative evaluation

An anticipatory innovation ecosystem is characterised by dynamic, interacting processes which facilitate the engagement of diverse stakeholders, orientation around shared goals, collaboration and the ability to anticipate, learn and adapt. The sustainability and productivity of the ecosystem is dependent on its ability to maintain these processes in a changing environment. As a result, monitoring of ecosystem development should prioritise the assessment of each process with a view to identifying and undertaking required actions to enhance or adjust them. This is known as a formative or process evaluation.

As part of this project, the OECD worked with consultants to develop a formative evaluation toolkit that combines survey and interview approaches. The toolkit enables ecosystem partners' perceptions on the relevance and usefulness of the workshops to be monitored and analysed with reference to the micro-governance processes (see Box 2.9 and Annex A).

Impact evaluation

Attributing causal outcomes to anticipatory innovation ecosystems is a challenge, given the non-linear and emergent nature of innovation in an uncertain and complex environment. Mature micro-governance processes and relationships between stakeholders can take a number of years to develop (approximately two years according to Business Finland, meaning that short term analysis of their concrete impacts can cause it to appear as though ecosystems are ineffective. Nonetheless, regular assessment at the national and regional levels using common innovation indicators can allow governments to explore the broad effects of anticipatory innovation ecosystems. In addition, surveys and interviews with innovation ecosystem partners can support monitoring. The OECD Oslo Manual describes how these indicators can be selected and provides a guide on data collection.

Typically observed innovation metrics are reflected in compound scoreboards like the European Innovation Scoreboard (EC, 2021[5]), and the OECD's Innovation Indicators. Relevant indicators for assessing the impact of innovation ecosystems are likely to focus on the "share of firms co-operating on innovation activities" with organisations across the Quadruple Helix; the OECD's Business Innovation Statistics and Indicators list sets out seven such indicators (OECD, n.d.[6]). In assessing ecosystems in Finland, Business Finland, indicators include average turnover, employment, export growth, value added, R&D activity, number of new products, services and solutions developed (Box 4.3) (Piirainen et al., 2020[7]).

Key actions

- Following agreement on programme level goals, identify approaches and indicators for the monitoring and evaluation of the programme and individual ecosystems. A combination of formative evaluation to support ongoing ecosystem development (see Box 2.9 and Annex A) and impact evaluation using indicators such as share of firms co-operating on innovation activities and turnover is valuable to generate a holistic understanding of ecosystem needs and potential.

Box 4.3. Business Finland: Monitoring and evaluation of innovation ecosystems

Business Finland provides funding to business ecosystems in order to promote innovation. It combines formal monitoring focusing on measurable indicators (e.g., export growth) and less formal engagement with the ecosystem to understand holistic development:

> *"When Business Finland provides funding, the companies have to report the costs. Business Finland has regular meetings with the ecosystems where they follow what has been done and how the costs occur. Business Finland might also propose some other Business Finland services, for example, export support. We try to see the ecosystems holistically, which requires monitoring and meeting companies regularly." (Senior Director at Business Finland)*

In the report *Impact Study: World-class Ecosystems in the Finnish Economy*, Business Finland provides a practical framework to monitor and evaluate innovation ecosystems in order to support the development of ecosystems. The framework has a two-fold approach:

- Impact logic of ecosystems' activities i.e., understanding the development of the funded ecosystems and assessing their evolution in the future.
- Evaluation and assessment of Business Finland's impact in supporting ecosystems.

The framework follows a theory of change structure. It monitors the **Inputs** (amount of financial and human resources); **Activities** (the types and amount of collaborative activities conducted by the ecosystem that entail joint efforts and build mutual trust); and **Outputs** which are structured per development phase i.e., emergence, startup, growth/expansion and maturity/renewal. Across these four

development phases the outputs can pertain to setting up new collaborations (emergence), attracting and binding talent (start-up), entering new markets (growth/expansion), and market leadership (maturity/renewal).

Additionally, the framework monitors **Outcomes** which are the result of joint activities conducted by ecosystem members. These can be the development of new products, services and solutions. However, the outcomes can also be the result of gaining access to new markets through increased visibility and recognition as well as increased collaboration, dynamics and interdependence.

Finally, the **Impacts** generated by the ecosystem are those linked to Business Finland's "impact goals of economic renewal and growth through new billion-euro ecosystems". The indicators to measure impact goals are turnover, value added, employment, productivity, and export growth.

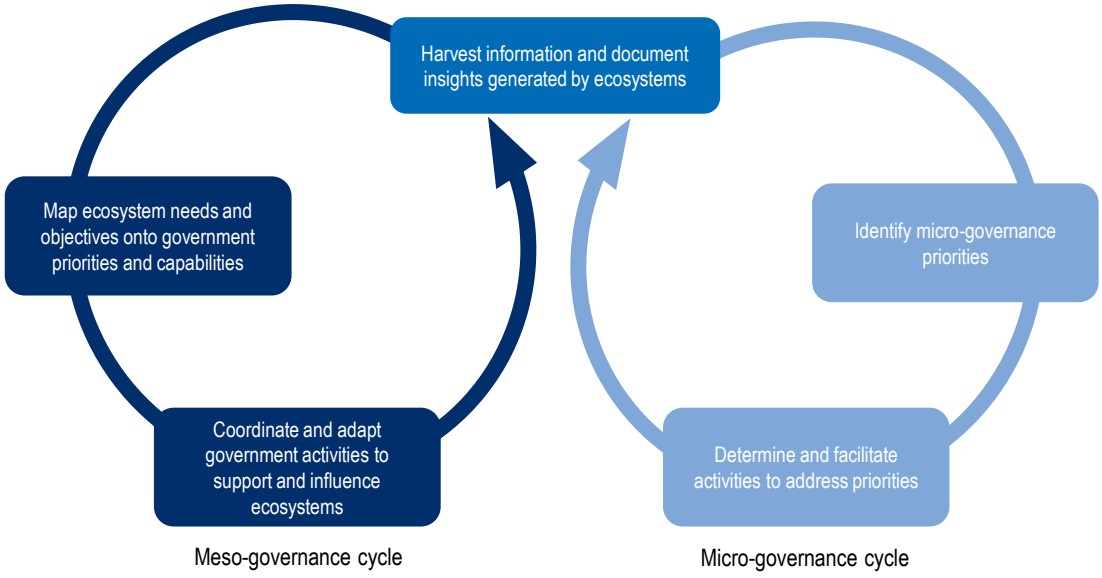
Nevertheless, the report highlights that there are challenges in measuring these indicators as "monitoring company level data does not yet reflect the development of the ecosystem as it is likely that (especially in large companies), only a fraction of their KPIs reflect the business relevant for the ecosystem. Therefore, these macro-level indicators should be supplemented with additional (qualitative) data".

Source: OECD interview; Piirainen, K. et al. (2020[7]), *Impact Study: World-class Ecosystems in the Finnish Economy, Part A – A New HoPE*, https://www.businessfinland.fi/4aa4e1/globalassets/finnish-customers/news/news/2020/world-class-ecosystems-report-2020.pdf.

Phase 2: Development and maintenance

An anticipatory innovation ecosystem is a *process* through which diverse stakeholders explore uncertainties in the future in order to identify opportunities for collaboration and innovation. The process continually generates knowledge that can lead to better collective decisions by ecosystem partners and by government to facilitate anticipatory innovation.

Figure 4.2. Governance cycles for the development and maintenance of anticipatory innovation ecosystems



The 'development and maintenance' phase describes how this process can be sustained through interlocking cycles of micro- and meso-governance activities, in which ecosystem level activities generate actionable knowledge about the future and ecosystem needs, and government actors make sense and act on it. For example, an online foresight workshop with members of the bioeconomy ecosystem in Latvia revealed tensions between objectives set out in the national bioeconomy strategy. Participants identified six key steps to address these and improve the ecosystem's resilience in the face of future challenges, including and greater ministerial coordination.

Early stages of ecosystem development are likely to require intensive orchestration and knowledge management by ecosystem support teams to establish micro-governance processes, while meso-governance must be responsive to ecosystem needs. As micro-governance processes are established and ecosystems mature, support teams may be able to reduce their inputs and activities while retaining their role as a knowledge broker between the micro- and meso-governance levels.

Micro-governance: Harvest information about ecosystems

Following the definition of overarching programme objectives and logic at the meso-governance level and the selection of ecosystems, focus can be placed on developing micro-governance processes. Each ecosystem is unique, and therefore requires individual assessment to determine which micro-governance processes should be prioritised at any one point.

To conduct an initial assessment, the ecosystem support team will need to collect and analyse information about ecosystem partners, their relationships to one another, and the environment in which they are operating. Engaging actors who regularly interact with ecosystem stakeholders, such as business incubator and science commercialisation support staff, can help to rapidly surface relevant information and identify knowledge gaps. This can be accomplished through interviews and workshops (Box 4.4). The micro-governance framework can be applied to identify the types of information that are required.

Key actions

- LIAA to gather information about ecosystem partners and their relationships through interviews and workshops in order to inform next steps of ecosystem engagement and the design and of appropriate activities.

Box 4.4. Action-research in focus: identifying opportunities for ecosystem partner engagement

In October 2021, the OECD facilitated an online workshop with eleven LIAA technology scouts and innovation ecosystem coordinators to consider the development potential and needs of three ecosystems in the areas of space innovation, forestry and 5G in healthcare. It revealed that LIAA would benefit from improving its capacities to collect and analyse information about emerging or potential ecosystems.

A series of online activities, structured around a digital 'canvas' were developed to enable the assessment of each potential ecosystem based on knowledge held by LIAA employees. Facilitators from the OECD guided participants to:

- Identify potential ecosystem actors in the public sector, academia, industry and civil society, and categorise them as 'key ecosystem decision-makers', 'stakeholders who can influence the ecosystem' and 'stakeholders affected by the ecosystem'.
- Identify the influential actors in each ecosystem, and consider their motivations for participation.
- Assess the existing foundations and challenges for the development of each ecosystem.

- Identify desired outcomes for LIAA to achieve through ecosystem engagement.
- Determine next steps to achieve the desired outcomes.

The workshop revealed knowledge gaps that LIAA would need to address before proposing activities with ecosystem partners, as well as specific challenges for the initiation of each ecosystem. These included:

- Space ecosystem: Limited knowledge of potential ecosystem partners, and a lack of collaboration between research and industry.
- Forestry ecosystem: Limited knowledge of potential ecosystem partners and their current relationships. No existing ecosystem structure.
- 5G and healthcare ecosystem: A need to engage SMEs and work with healthcare providers to build trust and establish test-beds. Challenges in getting information from biomedicine stakeholders in Latvia.

Micro-governance: Identify micro-governance processes to prioritise

Ecosystem partners and support organisations can map the micro-governance processes onto information about ecosystems to identify which processes to prioritise in subsequent activities. For example, by assessing an ecosystem's relationships, rules, roles and resource management capabilities against the descriptions detailed under *collaboration* (Chapter 2), gaps and areas for development can be identified. Prioritisation helps ecosystem partners and support teams to select and tailor tools and methods to support the development of each ecosystem. Micro-governance processes are interrelated, meaning supporting the development of a particular process will have a beneficial impact on the others. For example, any activity which brings together ecosystem stakeholders is also likely to increase capacity for collaboration.

Practical work with LIAA revealed how prioritisation is dependent on good information about ecosystem stakeholders and their relationships (Box 4.5).

Key actions

- LIAA to apply the micro-governance framework (Chapter 2) to identify gaps and needs for each specific ecosystem.

Box 4.5. Action-research in focus: prioritising micro-governance processes

LIAA chose to focus on testing approaches for anticipatory innovation ecosystems in the four areas of: smart materials and photonics, biomedicine, smart and green mobility, and bioeconomy. Drawing on information presented by LIAA, LIAA and the OECD collaborated to identify key micro-governance processes to prioritise for each area.

- Smart materials and photonics: Anticipation, learning and adaptation, shared goal orientation.
- Biomedicine: Anticipation, learning and adaptation, shared goal orientation.
- Bioeconomy: Anticipation, learning and adaptation, engagement of diverse stakeholders.
- Smart and green mobility: Anticipation, learning and adaptation, engagement of diverse stakeholders.

Developing the capacity of each ecosystem to collaborate was also considered important, but not as an immediate focus.

Subsequent workshops with ecosystem partners revealed that while the areas of prioritisation for smart materials and photonics, biomedicine and smart and green mobility were relevant, a greater focus should have been placed on enhancing the ecosystem partners' capacity for collaboration within the bioeconomy ecosystem.

Micro-governance: Plan, design and facilitate activities to develop micro-governance processes

After choosing micro-governance processes to prioritise, ecosystem partners and support teams must identify and facilitate activities to support their development. Many toolkits exist that can help ecosystem partners and support organisations to select activities and methods which develop micro-governance processes. The Observatory of Public Sector Innovation Toolkit Navigator can enable the identification of appropriate methods. The capacity and knowledge to select and tailor tools and methods must be complemented by the ability to communicate their value to ecosystem partners, facilitate collaboration and analyse the insights that this generates. This may require subject matter expertise in the area of ecosystem development.

Following six workshops which engaged ecosystem stakeholders in Latvia, a formative evaluation revealed key considerations to ensure that activities are able to generate valuable insights and support further ecosystem development.

Communication

- Invitations should be sent at least a month in advance to increase the chances of participation.
- Goals and objectives of each activity should be clearly articulated to participants within invitations, and should focus on the overarching value of collaborating as part of innovation ecosystem.
- It should be clearly communicated how each activity is expected to contribute to the broader goals for ecosystem development.
- At the start of each activity, it is necessary to provide a clear agenda and re-iterate the value of participation.

Participation

- The consistent participation of decision-makers from key organisations was identified as an important driver of trust and progress. Ecosystem support teams should invest in developing engagement plans which take into account the incentives and goals of key stakeholders.
- Not every activity will be relevant for all stakeholders. Participants suggested that future workshops could be structured by distinct activities and tasks for different stakeholders.

Facilitation

- Facilitation skills were seen as important to ensure that activities were well understood, and that all participants had an opportunity to speak and be heard.

Online workshops and tools

- Online collaboration tools (for example, Padlet, Mural) are effective at enabling stakeholders to share information and opinions.
- Online workshops are considered to be more useful for later stages of ecosystem activity when ecosystem partners know one another better.

In-person workshops

- In-person workshops are effective at enabling stakeholders to meet each other and forge connections, and were considered to be particularly important in the early stages of ecosystem development.
- One-day workshops are more likely to engage relevant stakeholders than longer two-day events (as occurred with the biomedicine ecosystem).

Knowledge management

- A system for gathering and analysing information generated by the ecosystem is necessary to enable informed decision-making.
- Each activity should be concluded with clear follow-up actions, and an indication of how the information it has generated will be used to further the development of the innovation ecosystem.

Key actions

- LIAA to use resources such as the Observatory of Public Sector Innovation toolkit navigator to identify and tailor appropriate methods to address the priority micro-governance processes.
- LIAA to create a detailed plan for how the methods should be delivered (online or offline), communicated, who should participate, how knowledge generated should be gathered, and what next steps should be.

Micro-governance: Harvest insights generated by ecosystem activities and reassess needs and priorities

The interactions between innovation ecosystem stakeholders and with others generate information that is useful both to the ecosystem and to the meso-governance level. Systems and capabilities to enable the capture, analysis and communication of this information enhance the capacity of the ecosystem to anticipate, learn and adapt and inform ongoing decision-making.

As discussed in Chapter 2, a collaboratively developed theory of change can be a valuable tool to for ecosystem partners and support teams to document assumptions and assess the continued relevance of objectives, the activities that are intended to achieve them, and the resources that they require. Where new information calls into question elements of the theory of change, ecosystem members and support organisations can use it to systematically explore how they might change their actions to continue moving towards desired goals. After this step, the micro-governance cycle re-starts at *Identify micro-governance processes to prioritise.*

Key actions

- LIAA to collect, manage and analyse insights generated by ecosystem activities, and ensure that they are communicated to ecosystem partners effectively (Box 4.6). Summaries of action points for the ecosystem, responsibilities for those action points, and an implementation timeline can help to maintain ecosystem momentum and accountability.
- LIAA to support ecosystem partners to assess how new insights generated through ecosystem engagement can inform continued ecosystem activity. A clear roadmap or theory of change for ecosystem development can help ecosystem partners to recognise how their activities contribute the objectives and development of the ecosystem and contextualise ongoing engagements.

Box 4.6. Action-research in focus: follow-up communications with ecosystem partners

Following each online workshop with ecosystems in Latvia, the OECD produced a short, visual report of approximately 10 pages to document key discussion points and insights generated through the participation of ecosystem stakeholders. This covered:

- The objectives of the workshop.
- A list of attendees.
- A summary of workshop activities.
- A summary of information generated through the workshop (e.g. trends and future changes, challenges to be addressed, goals).
- Proposed next steps and objectives for ecosystem collaboration.

Examples of this content appears in the second half of this chapter. The formative evaluation identified a need for a more detailed summary of action points following each ecosystem activity.

Meso-governance: Assess ecosystem needs and insights and coordinate government functions to provide support and influence policy

Through interaction, ecosystem members identify challenges and needs that cannot be addressed entirely by ecosystem members. In addition, they generate valuable anticipatory knowledge that can help governments to become more proactive.

A collective approach to sense-making among relevant government stakeholders is valuable to enable a coordinated response to ecosystem needs and the identification of related policies and support mechanisms.

Key actions

- LIAA to communicate needs and insights uncovered through ecosystem engagement to the Innovation and Research Governance Council and other relevant government actors.
- Innovation and Research Governance Council and other relevant government actors to apply the meso-governance framework to explore how government functions and policies can be aligned to ecosystem needs.

Phase 3: Exit

As discussed under approaches to monitoring and evaluation, micro-governance processes provide a framework by which ecosystem development and needs can be monitored and assessed. Initiating these processes is likely to require a high level of coordination from an ecosystem support team, for example creating prototype agreements to develop the capacity to collaborate or establishing a knowledge management approach to develop the capacity for anticipation, learning and adaptation.

While the processes must be regularly reviewed and renewed in response to internal and external developments, ecosystem support teams may be able to progressively delegate this responsibility to other ecosystem partners. Doing so can allow them to reduce the level of their activity with and ecosystem and focus their attentions elsewhere. On the other hand, regular formative and impact evaluation activities may reveal that certain ecosystems are unable to develop in maturity or deliver value. In this case, government may wish to withdraw its support.

Given the value of ecosystems as mechanisms for the generation of knowledge about the future that can enable governments to become more anticipatory and proactive, it is of continued benefit for government stakeholders to play a role in the meso-governance of innovation ecosystems.

Key actions

- LIAA to use the formative evaluation toolkit (see Box 2.9 and Annex A) to monitor the development of micro-governance processes in each ecosystem and determine the potential for ecosystem partners to take on more responsibility for them.
- Innovation and Research Governance Council to gather information on the impact of ecosystem activities every three years using indicators such as share of firms co-operating on innovation activities and turnover to assess their effectiveness. This time-frame takes into account the time required to build ecosystem relationships.

Insights from action research and next steps for ecosystem development

Over seven workshops, the OECD and LIAA engaged actors in four ecosystems identified by LIAA: photonics and smart materials, biomedicine, bioeconomy, and smart mobility. Overall, more than 80 participants took part in the seven workshops representing government, industry (incl. state-owned companies), research and academia, as well as other types of organisations.

The rich insights they generated identify next steps for the development of each ecosystem, gaps and challenges to address through government intervention, and signals of future change that could help the government of Latvia to proactively address future challenges and opportunities in a range of areas. These are detailed in the ecosystem case studies below. Overall findings and priorities for future action are summarised at the end of the chapter.

Exploring and testing ambitions for the Smart Materials and Photonics innovation ecosystem

Representatives working with Photonics and Smart Materials participated in online workshops on 7 April 2021, 5 April 2022 and 16 June 2022. The workshops were designed and facilitated by the OECD to enable participants to apply anticipatory approaches to identify shared goals for the future, explore future changes that might affect the ecosystem, and set out next steps for ecosystem collaboration.

Findings

Ambitions for the Smart Materials and Photonics ecosystem

Participants in the workshop on 5 April 2022 were invited to propose ambitions for the ecosystem to achieve by 2030, using an online collaborative tool. These were plotted by participants against an axis of ‘Not at all challenging’ to ‘Extremely challenging’, before they voted on the most important ambitions. This revealed two priority ambitions: **‘Latvia has a powerful innovation system, and is an innovation leader in the EU’**, and **‘There are sufficient STEM students to support the development of photonics and smart materials in Latvia’**. On 6 June 2022, participants were asked to re-assess these ambitions, and agreed that they should still be prioritised.

Future changes that may impact the ecosystem

On 5 April 2022, participants were asked to identify possible future changes that may affect the ecosystem's ability to achieve its ambitions. The outcomes of this horizon-scanning approach were structured under the PESTL framework.

Table 4.2. Horizon scanning: possible changes that may affect the Smart Materials and Photonics ecosystem

Category	Possible future changes
Political	• New Cold War • Government priorities are redirected to new pandemics and defence and security • Continued global crises • EU breaks apart • Populists gain majority in the EU governments
Economic	• Decrease in EU investments in R&D • Global economic recession • World is shifting to the Asian market • Budgets are focused on defence
Social	• Low willingness to study STEM across Europe • USA attracts talent away from Latvia and Europe • Failure to attract enough people in science and education • Ageing and shrinking population • Antivaxxer, anti-5G movements expand
Technological	• Disruptive innovations in science that render previous R&D obsolete
Legislative	• Sharp changes in laws and regulations that are unfavourable to R&D and innovation

Note: Horizon scanning exercise conducted on 5 April 2022.

Actions to improve ecosystem resilience and achieve shared ambitions

In activities on 5 April 2022, and in the following workshop on 16 June 2022, participants identified concrete outputs to achieve and actions for ecosystem partners and LIAA to undertake in order to support ecosystem development and achieve shared ambitions in the face of the potential changes that were identified.

Table 4.3. Outputs and actions to strengthen the development of the Smart Materials and Photonics ecosystem

Outputs	Actions
Engage stakeholders through communication	1. Create and maintain a list of ecosystem success stories for the general public, politics, industry, investors 2. Popularise STEM education through investment in a constant public relations channel
Develop a shared action plan	3. Prepare a shared 'to-do' list of complementary activities for different ecosystem actors 4. Develop clear guidelines on the directions for R&D that are important to Latvia 5. Map the strengths of different organisations in Latvia to inform coordinated actions
Conduct regular foresight and analysis	6. Regularly and jointly analyse the ecosystem's SWOT and identify 'low hanging fruit' (every 1-2 years) 7. Develop and regularly update at least 3 different scenarios for future development of the ecosystem 8. Identify short- and medium-term focal points for the ecosystem
Commit to national and international cooperation	9. Identify and cooperate with other ecosystems nationally and internationally, for example the PhotonDelta ecosystem in the Netherlands 10. Facilitate a bottom-up approach for ecosystem management in which government is an active player

Note: Actions identified on 5 April 2022.

In the June workshop, a stimulus of a list of actions undertaken by other ecosystems (identified through OECD research) was provided to prompt discussion and support decision-making. Participants identified key actions for achieving the ambitions of 'Latvia has a powerful innovation system, and is an innovation leader in the EU', and 'There are sufficient STEM students to support the development of photonics and smart materials in Latvia'. These were:

- Establish links with international ecosystems and value chains.
- Establish graduate programmes.
- Create living labs.
- Hold Quadruple Helix workshops.

Functions and roles for ecosystem development

The discussions highlighted the need for ecosystem members to be more proactive and communicative, for LIAA to take on a more proactive role, and for increased engagement with civil society.

Table 4.4. Stakeholder functions and roles for ecosystem development.

Stakeholder	Actions
LIAA	• Gather information from ecosystem members about their needs and what they are able to contribute to the ecosystem in order to develop an ecosystem prospectus or portfolio • Be proactive in proposing topics or issues for ecosystem members to collaborate on • Identify international ecosystems for engagement and potential partnership
Industry	• Share skills needs and proactively collaborate with Latvian and international education providers to develop a skills pipeline • Communicate strengths and capacities to encourage students and organisations internationally to engage with the Latvian innovation ecosystem
Research	• Develop stronger connections to universities internationally • Communicate strengths and capacities to encourage students and organisations internationally to engage with the Latvian innovation ecosystem
Government	• Coordinate funding to support the development of graduate schemes and a skills pipeline for photonics and smart materials in Latvia • Encourage stakeholders to collaborate through innovation ecosystems by offering funding to organisations working in partnership

Note: Exercise conducted on 16 June 2022.

Challenges to address for ecosystem development

Interviewees participating in the formative evaluation highlighted that an initial strategy for the Smart Materials and Photonics ecosystem was previously developed, including concrete short-term and long-term action points. However, it appears this initial strategy is not known to all actors, neither are the principles for its development. As one interviewee stated:

> *"I don't think other ecosystem players know the existing strategy on smart materials [except the leading research organisation who was driving it]. [With respect to this process three years ago], it was not clear who was invited in the ecosystem formation, who was left out and why. There was no wider discussion on the focus of the ecosystem either." (Representative of Smart Materials and Photonics ecosystem)*

This highlights the need for a greater focus on knowledge management and clearly defined rules and processes for collaboration.

Proposed next steps

Meso-governance:

- **Orchestrating**: There is a need to appoint at a minimum one full-time ecosystem coordinator, either within LIAA or externally funded. The coordinator or support team needs to level up ecosystem orchestration by ensuring regular engagement of partners through written communication and meetings. Ecosystem partners need regular input and opportunities to engage in order to stay invested in the ecosystem development, for example through a regular newsletter, online meetings and interactive workshops with a clearly defined purpose, agenda and follow-up.
- **Providing**: The coordinator in collaboration with LIAA and the Council can also take steps to establish links with complementary ecosystems abroad, both in the Baltics and internationally. Given the clear need for skilled graduates to develop photonics and smart materials in Latvia, the Ministry of Education and Science and other government actors could support the ecosystem by orchestrating relationships with skills providers and championing opportunities for work within the smart materials and photonics ecosystem internationally. This could be designed as co-funded temporary work and research placements in relevant organisations abroad or could be setup as a regular exchange programme between graduates and young professionals in the photonics and smart materials field.

Micro-governance:

- **Engagement of diverse stakeholders:** Discussions showed that the ecosystem partners see a particular need to engage more strategically with stakeholders in Latvia (government, research experts, universities) as well as internationally, in particular with other ecosystems and universities working on similar topics. To serve this need, the ecosystem coordinator can collect interests and contacts from ecosystem partners to undertake a stakeholder mapping and then define engagement forms for each of the groups. For example, this could include the preparation of materials for discussion at the Innovation and Research Council meetings as a form to engage with policymakers. To engage with substance experts, the ecosystem could organise networking events with organisations of relevance or substantive engagements with experts such as topical panel discussions, peer-learning sessions or disseminate analysis produced by the ecosystem in writing.
- **Shared goal orientation**: While strategic priorities and practical actions (Tables 4.2 and 4.3) have been defined by the ecosystem, there is no coherent connection between strategy and action. The theory of change approach could be leveraged to define priorities in an actionable yet flexible way (see Chapter 2 and Box 2.7). Ecosystem partners need to define which capabilities to leverage in what capacity in order to reach the desired objectives and attach time-bound, measurable goals to each priority. This could be done using a digital tool available to all ecosystem members in order to create transparency and ownership. Based on these key priorities, the ecosystem can proceed to define a shared action plan which also takes into account innovation goals for Latvia. LIAA could support the creation of this document by working with ecosystem partners to collaboratively develop a theory of change or roadmap. The agency needs to fulfil its role of feeding government priorities into the discussion based on objectives defined in the Council.

Exploring and testing ambitions for the Bioeconomy innovation ecosystem

On 12 April 2022, stakeholders in Latvia's bioeconomy ecosystem participated in a strategic foresight workshop led by the OECD in order to support the development of micro-governance processes and stress-test the Latvian Bioeconomy Strategy 2030 (LIBRA) that was published in 2017 under the leadership of the Ministry of Agriculture and translated into English in 2018 (Government of Latvia, 2018[8]).

Participants were sent links to the LIBRA strategy in advance of the workshop. Within the workshop, they worked together to review the 2017 LIBRA strategy statement against potential future scenarios for the bioeconomy ecosystem. To elicit this reflection, participants were asked to:

1. **Imagine**: Describe a world in which the strategic vision, as outlined in the LIBRA strategy, has been achieved.
2. **Assess**: Work backwards from the future and identify what factors or assumptions contributed to the success of Latvia's Bioeconomy strategy.
3. **Stress-test**: Explore how the strategy would be affected if key assumptions and factors underlying the strategy did not succeed as expected.

During the workshop, it became apparent that very few participants had reviewed the strategy, or knew how it had been developed. As a result, a representative of Ministry of Agriculture gave a short introduction. While the lack of engagement with the strategy challenged the initial objectives of the workshop, the interaction between participants generated useful insights for the future development of the ecosystem.

Findings

Trends and events create tensions between objectives for the Bioeconomy ecosystem

Participants recognised that the Russian invasion of Ukraine was a crucial concern to consider before reflecting on a success story for the Bioeconomy's strategy. As one participant pointed out: "life has changed after the 24th of February and we need to review our tactics and strategic agenda". The conflict, and the uncertainties it generates, called into question assumptions in the LIBRA strategy and highlighted tensions between objectives and trends. For example:

- ***Forestry and wood:*** Two strategic goals were identified by stakeholders as key for the development of forestry: increase in productivity of forest land and increasing the value of goods produced. It was highlighted that as southern regions are affected by climate change, Latvia could become a key player in the production of wood and innovative methods to increase its value. However, energy crises resulting from the conflict in Ukraine may encourage the continued production and export of low-value woodchips, limiting the availability of resources and the drive for innovation.
- ***Food:*** Given the impact of the conflict on food markets, participants viewed that a success story for this sector in Latvia would mean exploring new markets, beyond the exports of grains. For example, one participant envisioned a world in which Latvian companies will be leading the production of protein goods from leguminous plants. A tension was identified between the need to increase food production, and a movement away from fertilizers and agrochemicals in order to promote biodiversity.

Actions to increase the resilience of the Bioeconomy ecosystem

Participants identified fragmentation at the meso-governance level and a lack of coordination between stakeholders as key challenges to stimulating innovation and addressing the tensions inherent in setting goals for the ecosystem. As a result, they identified six actions to promote ecosystem development through the four micro-governance processes.

Table 4.5. Actions to increase the resilience of the Bioeconomy ecosystem

Engagement of diverse stakeholders	1. Build cooperation within scientific institutions
Shared goal orientation	2. Create clear action plans in line with the bioeconomy strategy with support from relevant ministries
Collaboration	3. Strengthen local value chains 4. Link projects for bioeconomy innovation in Latvia 5. Create coordination systems among ecosystem partners
Anticipation, learning and adaptation	6. Gather information and collaboratively make sense of new ways on how bioeconomy can promote practices for value creation in conjunction with biodiversity maintenance

Note: Actions identified on 12 April 2022.

Challenges to address for ecosystem development

Interviews as part of the formative evaluation revealed that one of the main bottlenecks for the formation of Bioeconomy ecosystem is that these **diverse organisations do not associate themselves as belonging to one ecosystem**. Bioeconomy includes a wide range of industries representing food, feed, non-food and bioenergy sectors, each with their own drivers, challenges and outlooks for the future. It appears that the overarching term 'bioeconomy' does not describe clearly enough the focus for coherent ecosystem activities. Another important hindering factor is the noticeably lower drive and motivation for industry to think about innovation in these more traditional business sectors. As an interviewee acknowledged:

> *"I think ecosystem players do not fully understand the term 'bioeconomy' [where focus is placed on innovation in the traditional sectors], hence sometimes it is difficult to involve them in activities. It is also important to fully understand the readiness of bioeconomy industry to invest time, effort, and money in innovation. Industry is often very cautious how to scale research results and sometimes they simply lack ambition and motivation to work on more value-added products and new markets as they hold a certain local market share and find that sufficient." (Representative of Bioeconomy ecosystem)*

Linked to the lack of clear understanding about bioeconomy as a field of activity, also **this domain of policy is fragmented in terms of strategy design and implementation**. The issues with the national bioeconomy strategy were cited, which is the responsibility of the Ministry of Agriculture. The ministry oversees the bioeconomy domain at the national level, yet it is not monitoring any real strategy implementation activities. In the meantime, other organisations that implement R&I strategies and activities are frequently not even aware of the pre-existing strategic policy frameworks for bioeconomy development, hence real cross-sectoral and cross-institutional innovation initiatives are hampered.

Proposed next steps

Meso-governance:

- **Orchestrating:** Currently, organisations do not have a strong sense of belonging to the ecosystem. There is a need for a dedicated support team to take on a series of activities to clarify which organisations want to engage, what their level of commitment is and what they can contribute to and gain from the ecosystem. This will only be possible with the help of an internal or external coordinator facilitating the ecosystem's development on a continuous basis.
- **Framing:** Strategic discussions may lead to a rethinking of the developed LIBRA strategy and may result in a new focus for ecosystem partners. The Innovation and Research Governance Council could work more closely with the Ministry of Agriculture to explore the ways in which they can coordinate to achieve objectives of the LIBRA strategy and identify priorities for ecosystem

direction from among trade-offs and tensions discussed by ecosystem members. These can then be communicated back to the ecosystem.

Micro-governance:

- **Collaboration:** Ecosystem members currently lack commitment to engage in joint activities and collaboration within the ecosystem. With the help of a dedicated coordinator, the ecosystem needs to identify which members want to stay engaged and which joint objectives form the basis of this commitment. Activities identified in the past will likely need to be re-examined to create a new basis for future collaboration. The ecosystem could start by undertaking activities to identify the current level of trust between ecosystem partners and determine how stronger relationships can be built. Further collaborative workshops employing approaches such as participatory system mapping may help ecosystem partners to recognise their interdependencies and lay the foundation for future coordination and collaboration.
- **Shared goal orientation:** Once a core group of motivated ecosystem partners has been identified, the group needs to identify common objectives, also by reassessing components of the LIBRA strategy to adjust to present priorities of those organisations committed to future collaboration. Activities which facilitate a close, collective assessment of the revised strategy can help ecosystem stakeholders to better understand the roles they can play to achieve the objectives it sets out, identify synergies and tensions, and enable the development of a coherent roadmap of actions for the ecosystem. It will be important to match objectives with actions that the partners are committed to take so that progress can be measured going forward.

Exploring ambitions and future changes for the Smart Mobility innovation ecosystem in Latvia

Stakeholders in Latvia's Smart Mobility ecosystem participated in an online strategic foresight workshop led by the OECD on 14 June 2022. Through structured online activities that combined discussion with individual work using the collaborative platform Padlet, participants worked together on three key questions about the future of the Smart Mobility Innovation Ecosystem in Latvia:

1. What does success for the ecosystem in the future look like?
2. What future changes and trends might affect the ecosystem?
3. How do we better prepare to achieve success?

Findings

Ambitions for the ecosystem

Participants identified eleven ambitions for ecosystem development within four categories.

Table 4.6. Ambitions for the Smart Mobility ecosystem

Category of ambition	Possible future changes
Social and environmental	• Improved quality of life for citizens • Reduced congestion • Reduced greenhouse gases and air pollution
Technological	• Mutual compatibility of smart city devices • High quality open data and APIs

Category of ambition	Possible future changes
Economic	• Development of a scalable product that can be sold internationally • Flourishing local Urban Mobility operators • Greater efficiency in innovation development
Ecosystem functioning	• Strong, open and transparent collaboration between industry, R&D, education, government and public • Stakeholders working towards a common goal • Improved ability to think for the long-term

Note: Ambitions identified on 14 June 2022.

Trends and potential changes that may impact the ecosystem

Participants participated in a horizon scanning exercise to share and collate trends and potential future changes.

Table 4.7 Trends and potential changes that may impact the Smart Mobility ecosystem in Latvia

Category	Possible future changes
Political	• Governments remain slow at adopting new technologies • Geopolitical issues in countries that provide raw materials • Greater political alignment to identify optimal solutions for climate change • Lack of long-term commitments and aligned regulation in policy due to fragmented interests • Low emission zone in Riga • Military conflict in the Baltic region • EU policies strongly shape regulation in mobility
Economic	• New financial crisis initiated by spiralling inflation • Sustainable transitions for individuals and businesses supported by tax credits • Energy prices increase dramatically
Social	• Growing inequality • Trend for walkable cities and increasing hostility to cars • Working from home continues in the long-term, and car use and ownership declines • Loss in trust of governments and concern about surveillance • Demand for fossil fuel powered vehicles declines / does not decline
Technological	• Major battery power breakthrough increases range of electric vehicles (EVs) • Public transport responds to real-time data instead of fixed routes • EV charging infrastructure does not keep up with demands of users • Key component price increase makes tech too expensive • Testing of new technologies remains slow and bureaucratic, hampering innovation
Legislative	• Sharp changes in laws and regulations that are unfavourable to R&D and innovation
Environmental	• Climate change increases bicycle use in winter • Climate change increases migration due to areas becoming uninhabitable • Greenhouse gas output of transport keeps rising in spite of innovation

Note: Trends identified on 14 June 2022.

Actions to improve ecosystem resilience and achieve shared ambitions

Participants proposed actions to increase the ecosystem's chances for success in the face of three most impactful changes and trends they identified.

Table 4.8. Identified actions to improve the resilience of the Smart Mobility ecosystem in Latvia

Trend	Actions to increase resilience
Working for home continues in the long-term, and car use and ownership declines	1. Increase engagement of civil society to understand their developing needs and design bottom-up solutions 2. Encourage active mobility (pedestrian and cycle infrastructure) in order to promote health benefits
New financial crisis initiated by spiralling inflation	3. Focus on increasing the accessibility of personal and public transport
Testing of new technologies remains slow and bureaucratic, hampering innovation	4. Foster capacities for agile project management and experimentation in government to facilitate the testing of new solutions 5. Aim to increase the number of smart city pilots 6. Simplify the authorisation process for the testing of new initiatives by facilitating vertical coordination in government 7. Develop new rules for government procurement to encourage the adoption and development of novel solutions

Note: Actions identified on 14 June 2022.

Challenges for ecosystem development

According to interviews conducted as part of the formative evaluation, the Smart Mobility ecosystem appears to be already a well-knit collaboration network where actors know each other quite well and are receptive of the overall ecosystem building philosophy and mindset. The main stumbling blocks for this ecosystem formation are all practical ecosystem building aspects, including **understanding of the mandate of the ecosystem initiative as a policy instrument**, as well as the **lack of knowledge of the most appropriate ecosystem governance, orchestration, and funding models**. As an interviewee put it:

> *"For the ecosystems to function we need two things - power and money. Without a strong mandate, ecosystems for an untrained person will resemble simple associations or discussion groups without much value added. The other problem is funding. In Latvia we often have the cases that there are good ideas, but nothing happens beyond the proposal stage [due to missing discussion on impactful funding models]." (Representative of Smart Mobility ecosystem)*

This highlights a need for more effective meso-governance to provide legitimacy to the ecosystem and develop funding channels.

Proposed next steps

Meso-governance:

- **Orchestrating:** To advance ecosystem activities, there needs to be at least one full-time coordinator, either from LIAA or funded externally. The ecosystem needs to establish a collaborative structure which means for example defining the frequency and format of engagements, setting up writing communication formats, identifying digital platforms for information sharing and defining roles and responsibilities between the coordinator, LIAA and the ecosystem partners. The coordinator needs to develop a series of activities that allow to determine which ecosystem partners are committed to engage going forward and in what capacity they want to contribute to ecosystem development. Without clear 'rules of the game' the ecosystem will not be able to reach its innovative potential.
- **Funding:** Once there is a clear commitment from ecosystem partners, the Innovation and Research Council can play an important role in helping the ecosystem to identify funding sources, both from public and private channels. For example, a Council meeting could be used for a strategic discussion on funding opportunities and what links can be made within government to give

ecosystem partners the necessary support and access. It will be an important responsibility of the coordinator to identify opportunities, communicate them to ecosystem partners and help drafting proposals for funding bids.

- **Regulating:** The Innovation and Research Council could work more closely with cities and regulators to develop opportunities for testing in controlled environments. This would give ecosystem partners a chance to try out new innovations and get direct feedback from users on a smaller scale before making further investments into any given idea.

Micro-governance:

- **Collaboration:** The ecosystem currently lacks a basic structure of engagement. Ecosystem partners are not continuously engaged so there is a need to identify their expectations and needs in order to tailor activities accordingly. With the help of a coordinator, the ecosystem needs to bring partners together to identify a governance structure going forward, including regular written communication, in-person events to build relationships and workshops to start developing shared objectives. A dedicated workshop facilitated by LIAA to discuss different approaches to setting out rules, determining roles and managing resources is likely to be valuable. Case studies, such as the 6G Flagship (Box 2.4) and BioWin Health Cluster (Box 2.8) can provide concrete examples, and peer-exchange sessions with representatives of other ecosystems using online conferencing software can help the Smart Mobility ecosystem members to consider what governance structures and processes will work best in their context.

Exploring a vision, identifying changes and setting ambitions with the Biomedicine innovation ecosystem

On May 17 and 18 2022, around 25 representatives from industry and academia working in the field of biomedicine took part in a 1.5-day in-person workshop in Riga hosted by LIAA and facilitated by the OECD. The intervention took part at a relatively early stage of ecosystem development. It was designed to enable members of the ecosystem to strengthen collaboration, collectively explore uncertainties and change in the future and harness these insights to identify shared goals allowing to facilitate anticipatory innovation.

Findings

Harnessing insights about the Biomedicine ecosystem

To harness diversity of stakeholders and strengthen a common understanding among participants, the group was invited to interview each other and identify characteristics about each organisation and where they currently stand regarding innovation. The below graphs show that most of the organisations that invested time in developing the ecosystem stem from the private sector. The majority of organisations in the ecosystem consider themselves as innovative. The exercise also revealed that mature organisations make up the dominant part of participants, with only a limited number of start-ups present.

In a subsequent activity, participants collectively identified the main resources and capabilities present in the ecosystem. This included listing the main partners of relevance to any potential ecosystem activity and innovative projects, as listed in Table 4.9.

The participants also listed a wide list of tools and infrastructure at their disposal, including massive gene sequencing infrastructure, medical technology accelerators or numerous valuable networks (Horizon 2020, clinics and doctors on national and international level, international research specialists).

In addition to existing resources, the activity also revealed some of the needs the ecosystem identified in order to effectively collaborate on biomedical projects. For example, participants discussed the need for guidelines on the use of data or frameworks for the safe use of open data tools in the field of medicine.

Figure 4.3. Types of organisations and innovation capacity in the Biomedicine ecosystem

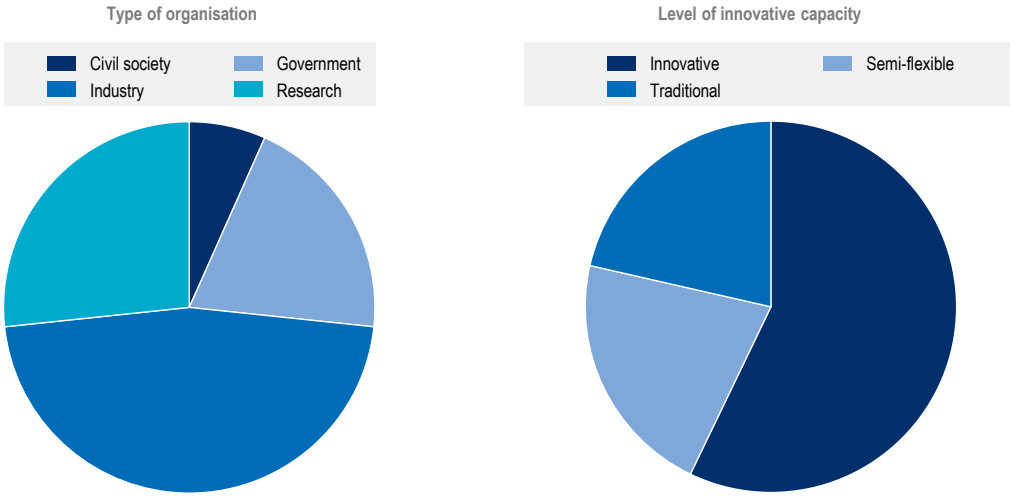


Table 4.9. Relevant partners for the Biomedicine ecosystem

Main partners identified	
Distributors	Laboratories
Manufacturers	Hospitals
Small and medium enterprises	Healthcare workers
Start-ups	Doctors
Patient rights protection organisations	LIAA
Non-governmental organisations	EEN
Pharmaceutical companies	State agencies
Universities	Research institutions
	Ministries

These insights show what kind of targeted information ecosystem support can generate for the purpose of well-informed policymaking. The direct access to organisations can be an asset to better understanding Latvian industries and research organisations in the biomedicine field. This can allow to harness inputs for policymaking, develop target support mechanisms and generate a better understanding of the needs and priorities of stakeholders in the Latvian economy.

Future changes that may impact the ecosystem

Ahead of the in-person workshop, a number of participants took part in an online horizon scanning workshop on 22 February 2022 to identify potential future changes of relevance to the ecosystem based on the PESTLE framework (Table 4.10). These included societal factors such as resistance to new technologies by patients or doctors, **rising mistrust** in evidence and expertise in society at large, **lack of skills** (human capital, medical expertise, research). The group also identified economic factors such as potential funding gaps (lack of state investment, research funding, decreasing EU funds) as well as overall **economic crises** including a challenging climate in the pharma industry specifically. Regarding technology, participants discussed the potential of biology and engineering to increasingly merge into one **field of bioengineering**, the potential take-up of **precision medicine** for rare diseases or the overall rapid growth of the bioeconomics field. Furthermore, participants discussed environmental factors such as

a **lack of raw materials** needed for biomedical research and commercial activities or increasing impacts of global warming on the industry at large. When it came to political factors, the group discussed the potential **lack of regional cooperation** between industry actors, both within Latvia and with neighbour crisis and the geopolitical context of, at the time, **rising tensions in Russia** and Ukraine.

The in-person workshop in Riga built on some of these potential changes, discussing the importance for the ecosystem to closely monitor changes in the **digital health** field, trends in **medical technology**, also coming from other sectors (such as large global technology corporations) and developments in **pharmaceutical research and development**.

Table 4.10. Horizon scanning: possible changes that may affect the Biomedicine ecosystem

Category	Possible future changes
Political	• Lack of regional cooperation between industry actors, both within Latvia and with neighbour countries • Emerging countries will move ahead in the biomedicine field, leaving EU behind • Geopolitical crisis in Russia / neighbour countries
Economic	• Inconsistent funding associated with change in university system • Lack of available funding in Latvia • Lack of understanding in state investment and research funding • Long term gap in research and innovation support • Crisis in the pharma industry • Economic crisis
Social	• Unwillingness of doctors to use innovative technologies (e.g. precision medicine) • Rising mistrust of evidence and expertise (e.g. vaccine hesitancy) • Cultural change in medicine • Change medicine state financing (from No. of procedures approach, to result oriented approach) • Latvians abroad returning to Latvia • Lack of highly educated and skilled labour for research • Lack of availability of skilled healthcare workers • Lack of human capital with discovery skills
Technological	• De-bureaucratisation of innovation support • Biology and engineering merging in bioengineering (as IT now) • Take up of precision medicine for rare diseases (e.g. cancer in children) • Digital transformation in the medical field (e.g. the Children's Hospital) • Growth in the bioeconomic field
Environmental	• Global warming will get out of control • Sudden lack of raw materials

Note: Identified on 22 February 2022.

Developing shared ambitions for the Biomedicine ecosystem

During the workshop in Riga, participants were invited to identify ambitions for the ecosystem, based on the individual and organisational objectives they brought into the group. The exercise guided them towards the development of a shared vision that would define priorities for actions in the coming months and years.

The group identified the importance of engaging key partners (Table 4.9) in an effort to harness their support. In particular, the collaboration with administrative authorities in order to solve policy and regulatory barriers was important. For example, this could include working with the Ministry of Justice to give input to the development of new laws regarding the use of patient data. Other priorities identified focused on internal collaboration within the ecosystem, communication and the exchange of resources, see Table 4.11.

Table 4.11. Shared ambitions for collaboration of the Biomedicine ecosystem

Ambitions for the organisation of the ecosystem
• Involve strategic partners throughout ecosystem activities
• Strengthen partnership between industry participants – state, industry and research
• Collaborate with administrative authorities to co-develop legislation and policies supporting innovation activities
• Enable strong cooperation between the ecosystem members
• Create conditions to continuously share data and resources were needed
• Create a joint communication strategy to share the ecosystem's goals and capabilities with external stakeholders

Note: Identified on 17 and 18 May 2022.

When discussing the ecosystem's overall vision, the group identified the following priorities, looking at both internal governance as well as innovation ambitions:

- Secure sustainable and strategic financing.
- Make relevant data available for all ecosystem partners to use.
- Ensure equal access to health care data.
- Support a cross-ministerial working group to support ecosystem projects.
- Develop well-being focused innovation, moving from treating illness to improving quality of life and well-being.

Building on these high-level ambitions, participants discussed concrete next steps for the ecosystem to take

1. Define the format and approach for ecosystem communication.
2. Develop approach to foster cooperation of decision makers, experts and makers.
3. Create living labs to collectively undertake experimentation and research projects.
4. Create master's and doctoral programs in the field of biomedicine to develop talent in Latvia.
5. Create data and information sharing infrastructure and standards.
6. Create a link with international ecosystems.

Challenges to address for ecosystem development

According to interviews conducted as part of the formative evaluation, the Biomedicine ecosystem has been working on improving collaboration between stakeholders through a number of activities over the past years. Ecosystem members know each other well and benefit from each other's competencies where needed.

The main problem they identified was a lack of **continuity in the ecosystem development activities**. The ecosystem is at a prolonged stage of formulating goals and objectives and clear follow-up actions are missing. This is mainly due to the **lack of commitment and investment from ecosystem members**. Thus, the full ecosystem potential is currently not materialised. As one interviewee put it:

> *"We have had discussions and meetings about ecosystems before (without the involvement from the OECD), and it has not resulted in any real action. Maybe we need to start with small-scale projects for the stakeholders to see the benefits of the ecosystem." (Representative of Biomedicine ecosystem)*

Another **aspect of Biomedicine ecosystem is its global reach** and hence also the need for more international interactions and collaboration activities that are not confined with only national policy context. This is an activity that the ecosystem should develop further. As an interviewee pointed out:

> *"It is good to develop local cooperation, but the drug industry exceeds the local ecosystem and is more European and international. I think it would be good to have a lobby that promotes Biomedicine ecosystem, enhances support mechanisms, and establishes links with policymakers. So, to have that kind of lobby is one of Latvia's biomedicine ecosystems' primary tasks." (Representative of Biomedicine ecosystem)*

Proposed next steps

Meso-governance:

- **Orchestrating:** It is advisable to assign at least one central coordinator, either within LIAA or externally and identify additional capacity for analytical support. This could entail producing anticipatory insights such as trends analysis, following international regulatory changes and continuously assessing Latvia's position vis-à-vis international peers.
- **Framing:** The ecosystem identified its goal as improving the well-being of Latvians, bringing quality of life to citizens. From a meso-governance perspective, there is an opportunity to connect this ambition to policy objectives. The Innovation and Research Governance Council can identify ongoing policy programmes linking to ecosystem objectives in order to identify support mechanisms for ecosystem activities and communicate ecosystem needs to the wider policy community.
- **Regulating**: The Innovation and Research Governance Council should review the ecosystem's regulatory needs (for example regarding the handling of patient data) and decide on concrete steps to feed these into the drafting of new regulation in partnership with the Ministry of Justice.
- **Providing:** There is an opportunity to stimulate innovation through non-financial support, for example by providing foresight intelligence on trends and changes in biomedicine, the provision of infrastructure or information services or by providing access to datasets.

Micro-governance:

- **Engagement of diverse stakeholders:** Ecosystem partners are determined to collaborate closely and leverage each other's interests to reach common objectives. The ecosystem now needs to involve strategic partners on a continuous basis. This means defining clear priorities to be communicated to the Innovation and Research Council regarding the ecosystem's needs for new regulation or adjusted policies. It can also mean the creation of links with international ecosystems working in similar sectors through targeted peer-learning. Finally, the ecosystem partners wish to foster joint initiative with universities, both in Latvia and abroad to develop graduate and doctoral programmes allowing to develop future talent for the ecosystem.
- **Orientation around shared goals:** While ecosystem partners have identified concrete steps for ecosystem development, a lack of continuity, commitment and investment from stakeholders has previously hampered progress. By supporting the ecosystem to collaboratively develop a theory of change and identify stakeholders responsible for specific activities and outcomes, LIAA can develop a sense of commitment, accountability and continuity among ecosystem partners.
- **Collaboration:** The ecosystem partners want to develop a strategic format and approach for ecosystem communication and put in place tools and structure allowing for data sharing and information exchange. As with the Smart Mobility ecosystem, a dedicated workshop facilitated by LIAA to discuss different approaches to setting out rules, determining roles and managing resources is likely to be valuable. Case studies, such as the 6G Flagship (Box 2.4) and BioWin Health Cluster (Box 2.8) can provide concrete examples, and peer-exchange sessions with representatives of other ecosystems using online conferencing software can help the biomedicine

ecosystem members to consider what governance structures and processes will work best in their context.

Summary of findings and next steps for ecosystem development

Across ecosystems, a clear need for orchestration support has been revealed. LIAA can play a key role in ensuring that ecosystem engagements occur regularly, that they engage relevant stakeholders, and that their purpose and outcomes are clearly communicated. The complex and cross-sectoral needs of ecosystems, for example regarding regulation, funding and access to data and information, reveals an important role for the Innovation and Research Governance Council to improve meso-governance coordination and connect ecosystems to relevant government actors. Specific actions include promoting links with regulators and mapping relevant funding opportunities.

At the micro-governance level, the foresight workshops promoted a greater understanding of shared objectives, future challenges and the resources and knowledge that ecosystem partners can access. However, ecosystems have so far struggled to identify and coordinate concrete actions to achieve shared goals. For this reason, LIAA can provide valuable support to develop ecosystems' shared goal orientation and capacity for collaboration, for example by facilitating the development of ecosystem-level theories of change and proposing rules, roles and approaches to manage resources for each ecosystem.

Table 4.12. Priorities for supporting anticipatory innovation ecosystems in Latvia

Ecosystem	Meso-governance priorities	Micro-governance priorities
Smart Materials and Photonics	**Orchestrating:** • Appoint ecosystem coordinator (internal or external) • Ensure frequency and continuity of engagements (written and in-person, e.g. a newsletter and workshop series) • Establish links with complementary ecosystems • Identify external partners for collaboration and network-building (e.g. through stakeholder mapping and outreach) **Providing:** • Provide support to develop talent in the field of photonics and smart materials in Latvia • Ministry of Education and Science and other government actors to build connections with skills providers • Champion opportunities for work placements in relevant organisations abroad (both in research and business)	**Engage diverse stakeholders:** • Engage with stakeholders in Latvia and internationally (e.g. carry out a stakeholder mapping and identify touch points) • Establish links with other ecosystems and universities (e.g. through peer-learning organised in collaboration with ecosystem coordinator) **Shared goal orientation:** • Connect strategic priorities to concrete action (e.g. using elements a theory of change structure) • Attach time-bound, measurable targets to each priority and assign individual ownership • Schedule meetings to share and discuss progress
Bioeconomy	**Orchestrating:** • Appoint ecosystem coordinator (internal or external) • Ensure a continuous group of engaged partners (e.g. by contacting all participants of past events and identify needs and availabilities and consider defining a narrower focus of the ecosystem) • Clearly communicate purpose, agenda and follow-up actions for each engagement ahead of time and share outputs, progress and next steps with all ecosystem partners afterwards • Innovation and Research Council to define objectives for support going forward (tied to the high-level objectives defined for overall ecosystem support) **Framing:** • Identify priorities for ecosystem direction based on policy objectives and communicate to ecosystem so it can feed into the reorganisation process • Innovation and Research Governance Council to work more closely with the Ministry of Agriculture to support ecosystem strategy	**Collaboration:** • Identify which members want to stay engaged and which joint objectives form the basis of this commitment (e.g. by identifying which members are ready to commit time and resources and narrowing the ecosystem's scope to tailor it to their needs) • Take stock of past activities to identify what knowledge to build on (e.g. by combining insights into a common document to present and discuss with ecosystem partners) • Undertake activities to promote ecosystem belonging and awareness, such as participatory systems mapping **Shared goal orientation:** • Establish a core group of motivated ecosystem partners (potentially with a narrower focus) • Identify common objectives, also by reassessing components of the LIBRA strategy (e.g. by asking partners to rate or prioritise objectives) • Match objectives with actions that the partners are committed to and that can be measured, for example though a theory of change

Smart Mobility	**Orchestrating:** • Identify ecosystem coordinator (internal or external) • Establish a collaborative structure (e.g. by defining meeting regularity, setting up a mailing list and defining written content, establishing an online platform for information sharing, planning engagements for the coming year etc.) • Determine which ecosystem partners are committed to engage going forward • Identify in what capacity ecosystem partners want to contribute to ecosystem development **Funding:** • The Innovation and Research Council to help the ecosystem identify funding sources, both from public and private channels (use Council meetings to identify opportunities, assign coordinator to create links and support ecosystem partners with submission of funding applications) **Regulating:** • The Innovation and Research Council to work more closely with cities and regulators to develop opportunities for testing in controlled environments	**Collaboration:** • Identify a governance structure going forward taking input from case studies such as 6G Flagship and BioWin Health Cluster (incl. regular written communication, in-person events and workshops, one-year plan of ambitions) • Take first steps to developing shared objectives (e.g. by identifying high-level objectives and matching them to key results with help of a theory of change structure; only define objectives that are matched with concrete commitment of ecosystem partners to take action)
Biomedicine	**Orchestrating:** • Important for further advancement to assign at least one full-time coordinator (internal or external) plus additional analytical capacity **Framing:** • Support the ecosystem's value proposition to improve well-being of Latvians by connecting it to policy objectives & policy programmes (topic to discuss in a Council meeting) • Identify support mechanisms for ecosystem activities (e.g. making connections to policymakers where needed, showcasing ecosystem work in public fora, carrying out trends analysis) • Communicate ecosystem needs to the wider policy community **Providing:** • Provide useful inputs such as foresight intelligence, access to infrastructure or information services (e.g. access to datasets) **Regulating:** • Discuss the ecosystem's regulatory needs in Council meetings • Decide on concrete steps to feed needs into the drafting of new regulation, for example regarding the handling of patient data	**Engage diverse stakeholders:** • Involve strategic partners on a continuous basis (e.g. through stakeholder mapping and outreach plan) • Define priorities to be communicated to the Innovation and Research Council regarding the ecosystem's needs for new regulation or adjusted policies • Create links with international ecosystems working in similar sectors through targeted peer-learning (e.g. online engagement using digital tools such as Padlet or mural for co-creating insights; in-person study visits at a later stage) • Foster joint initiative with universities to develop graduate and doctoral programmes to develop future talent for the ecosystem (possibly in collaboration with other ecosystems abroad) **Collaboration:** • Define strategic format and approach for ecosystem communication • Put in place tools and structure for data sharing and information exchange (such as online platforms, open-source software, dedicated events e.g. hackathons) • Define the role of decision makers, experts and makers as part of the community

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5 Action points for Latvia to become a frontrunner in the development of anticipatory innovation ecosystems

A combination of interviews, literature review and action research in Latvia has enabled the identification of specific action points for Latvia to become a frontrunner in the development of anticipatory innovation ecosystems. This chapter lists key action points and proposes responsible stakeholders.

Action points for Latvia

The opportunity to collaborate with LIAA and ecosystem stakeholders in Latvia has resulted in rich insights to inform Latvia's evolving management of innovation ecosystems and demonstrate how they can be leveraged to build the anticipatory capacity of government.

These findings are summarised in eight points below. Each is accompanied by a set of suggested action points to enhance the governance of innovation ecosystems in Latvia and unlock their potential to make government more anticipatory and proactive. Where relevant, these are listed under specific meso-governance functions.

Meso-governance findings

1) Understanding and expectations of anticipatory innovation ecosystems are not aligned across government, and not well communicated to potential ecosystem partners

Workshops and interviews with stakeholders from government and ecosystems revealed that there is optimism about the potential of innovation ecosystems in Latvia, yet there is little agreement on the types of impact they can generate or shared understanding of the process or time-frame for ecosystem development. As a result, commitment to supporting and engaging with ecosystems appears to be weak among actors in government, research and industry.

Action points for Latvia

Championing

- Enhance buy-in to anticipatory innovation ecosystems by educating senior government stakeholders about:
  - The benefits of anticipation, such as enabling a range of actors to converge on a shared vision for future change and stress-test strategies, as well as the limitations, notably that anticipatory approaches do seek to result in an accurate prediction of the future (see Chapter 1 for more detail).
  - The benefits of open innovation to leverage the knowledge, know-how and expertise of diverse stakeholders.
  - The importance of process-oriented formative evaluation to support ecosystem development. Formative evaluation is focused on assessing the ways that an ecosystem functions so that improvements can be made for it to continue achieving its potential. More detail is provided in Chapter 2, and a formative evaluation toolkit was developed for Latvia as part of this project (see Annex A and Box 2.9).
- Build legitimacy for anticipatory innovation ecosystems through clear and coordinated communication and commitment from the Ministry of Economics. Continued political support, as highlighted in the case of the JIC Regional innovation ecosystem in Czechia (see Box 2.10) and the BioWin ecosystem of Wallonia, Belgium (see Box 2.8) where the Minister of the Economy played a key role in supporting the cluster over a twelve-year period, is identified as a crucial driver to encourage engagement from ecosystem partners.

Framing

- Engage the Innovation and Research Governance Council to develop a coherent theory of change for the development of anticipatory innovation ecosystems as an overall programme of work, clearly promoting the use of anticipatory approaches and identifying desired impacts and alignment to policy priorities. This could involve working backwards from the goals outlined in the *National Industrial Policy Guidelines for 2021-2027* to discuss and determine intermediary outcomes and how different stakeholders might collaborate to achieve them so that a shared understanding of the innovation ecosystem programme can develop. At a larger scale, the example of Lithuania (see Box 1.7) shows how this participatory approach facilitates alignment and the identification of cross-sectoral priorities.
- Develop a concrete method to select and prioritise anticipatory innovation ecosystems for LIAA to work with, such as combining strategic foresight with analysis of potential ecosystem stakeholders in Latvia. Box 2.3 provides an overview of the benefits and challenges of different methods with summary case studies. For example, mixed-methods (combining statistical analysis, interviews and SWOT analysis) have been used in several regions to develop R&I strategies and select innovation ecosystems.

Monitoring

- Innovation and Research Governance Council to agree on a monitoring and evaluation framework to determine when support should be withdrawn from ecosystems. This might combine the formative evaluation tool (see Annex A and Box 2.9) with economic development analysis.
  - Assess the success of LIAA's involvement with innovation ecosystems based on its continued maintenance and development of the four micro-governance processes, as opposed to innovation measures such as patents. As processes are undertaken by ecosystem partners, LIAA's involvement can be reduced.
  - Conduct economic development analysis of ecosystem areas every three years to monitor the impact of the anticipatory innovation ecosystem approach. Indicators might include number and volume of foreign direct investments, ecosystem participants' turnover, employment, productivity and export growth, R&D activity, number of new markets accessed, number of new products, services and solutions developed (see Box 4.3 for the example of Business Finland).

2) The level and type of support provided to anticipatory innovation ecosystems in Latvia is insufficiently aligned to their needs, unresponsive to changes in their requirements, and poorly coordinated across government stakeholders

Interviews with ecosystem stakeholders revealed that they feel the government and LIAA are not responsive enough to the developing needs of the ecosystems, and that the role of ministries in each ecosystem is unclear. Workshops and interviews with public sector actors identified between the capacities of LIAA and the role the organisation is expected to play in the support of ecosystems.

Action points for Latvia

Providing

- Ensure that the commitment to support the development of anticipatory innovation ecosystems does not overreach the government's capacity to do so by prioritising and focusing efforts on a limited number of ecosystems.

- Ensure at a minimum one full-time coordinator per ecosystem, either by assigning this responsibility within LIAA or providing external funding. Once ecosystems have a clear engagement structure and defined objectives, it is advisable to seek additional support to undertake more substantive analysis. This can include, but is not limited to horizon scanning, trends analysis, identification of weak signals, monitoring of successes and failures in the sector in other countries, data-driven comparison of Latvian research and business with international peers.
- Create a clear, multi-year, time bound commitment from the Ministry of Economics of funding and human resources support for each innovation ecosystem.

Framing

- Create a clear mandate for the Innovation and Research Governance Council to continually steer anticipatory innovation ecosystem support.
- Ensure that the innovation ecosystem programme is clearly connected to government priorities.

Orchestrating

- Undertake regular meetings of the Innovation and Research Governance Council with clear objectives to support ecosystem development.
  - LIAA to present:
    - Key insights generated through ecosystem activities, including ecosystem challenges and needs and anticipatory insights.
    - Monitoring information about the four key ecosystem micro-governance processes.
  - Ministries and Science Council to:
    - Communicate policy priorities to LIAA so that these can guide ecosystem goals.
    - Frequently collaboratively identify how ecosystem needs can be addressed through coordinated government activities, using the meso-governance functions framework.
    - Coordinate to identify and develop funding opportunities for innovation ecosystems.
    - Consider how insights generated by ecosystems should inform government policy.
- Identify new funding structures to so that elements of ecosystem support and orchestration can be outsourced in order not to overburden LIAA. There needs to be sufficient resources to assign one full-time coordinator per ecosystem and potentially additional analytical support once the ecosystem is more mature (see under 'providing' above).

Regulating

- LIAA and Innovation and Research Governance Council to work more closely with regulators to develop new approaches to regulation which can facilitate innovation such as regulatory sandboxes. Regulatory sandboxes have been used in a number of countries, including Singapore and the UK, to provide support to organisations so that they can test potential innovations and enable regulators to understand their implications in an isolated and controlled environment (see Box 2.12 on anticipatory approaches to improve regulatory agility).

3) The connections between existing resources, initiatives and funding and the anticipatory innovation ecosystem programme are insufficient

Consultations with ecosystem actors identified coherent and consistent funding as a key issue for the development of anticipatory innovation ecosystems in Latvia. This can be partially addressed by developing enhanced funding intelligence and coordination at the meso-governance level.

Action points for Latvia

Funding

- LIAA should document existing resources and build intelligence on funding that is relevant for the development of ecosystems, including work with Competence Centres, Clusters and KICs.
- The Innovation and Research Governance Council should consistently work to identify relevant resources and funding opportunities for ecosystem needs.

4) Structures and processes for feeding insights generated by anticipatory innovation ecosystems into public sector decision processes are not sufficient to enhance Latvia's innovation system and anticipatory capacity

In spite of previous activity with ecosystem actors as part of the RIS3 programme, through clusters, competence centres and KICs, knowledge from these initiatives has not been systematically gathered, shared and acted upon in a coordinated fashion by government actors. Staff turnover within LIAA contributes to a situation in which new initiatives are undertaken with little knowledge of similar programmes.

Action points for Latvia

- LIAA to invest in developing institutional memory in order to connect ongoing and future ecosystem initiatives to past efforts and develop capacities for ecosystem management. For example, knowledge management to include documentation of tools and methods used and the insights they generate, monitoring of ecosystem micro-governance processes and formative evaluation of so that effective interventions can be identified and developed (see Annex A and Box 2.9).
- Build understanding in LIAA and the broader Innovation Research and Governance Council of how to use and apply anticipatory knowledge and approaches, such as visioning to explore preferred futures and horizon scanning to identify future changes and stress-test strategies (see the example of the Baltic Ro-Ro Shipping Ecosystem in Box 1.6).
- LIAA to leverage the knowledge generated by the anticipatory innovation ecosystems to produce a regular horizon scan of opportunities and threats for innovation in Latvia directed at policymakers (the example of the Emerging Technologies Radar in Box 2.11 shows how such information can help achieve policy objectives). The Innovation Research and Governance Council should feed this knowledge back into policy.
- LIAA to produce an annual report on challenges and opportunities for innovation ecosystems in Latvia based on an assessment of their strengths and possible future changes.

Micro-governance findings

5) Ecosystem partners recognise the potential of anticipatory approaches to promote coordination and innovation, but their knowledge of and capacity to facilitate these methods is limited

Many ecosystem actors understand the value of structured and guided collaboration to access additional knowledge and to make the ecosystem more than a sum of its parts, and respondents to the formative evaluation largely agreed that the foresight workshops resulted in an improved understanding of the trends and drivers that may affect their work in the future. However, knowledge of anticipatory approaches among

ecosystem partners is fragmented at best, and short-term concerns and financial barriers hinder their application at the levels of individual organisations and the ecosystems.

Action points for Latvia

- Develop skills within LIAA to design and deliver relevant in-person and online workshops which enable the development of micro-governance processes and the generation of anticipatory knowledge, for example developing capabilities in workshop facilitation and strategic foresight.
- Focus on developing the capacities of LIAA on the following functions:
  - Stakeholder engagement and coordination
    - Identify and engage relevant stakeholders, using methods such as stakeholder mapping and engagement plans.
    - Facilitate ongoing collaboration between ecosystem partners by building their capacity for collaboration.
  - Anticipatory knowledge generation and management
    - Select relevant anticipatory tools and methods to generate useful knowledge about the future, for example horizon scanning and roadmaps (see the example of the Baltic Ro-Ro Shipping Ecosystem in Box 1.6).
    - Collect, analyse and provide each ecosystem with information they have identified as relevant.
    - Generate and manage insights from ecosystem interactions (e.g. workshops) to inform future ecosystem decision-making.
  - Educate ecosystem partners on the benefits and limitations of anticipatory approaches, such as enabling a range of actors to converge on a shared vision for future change and stress-test strategies, as well as the limitations, notably that anticipatory approaches do seek to result in an accurate prediction of the future (see Chapter 1 for more detail).

6) Ecosystem partners require clarity about the purpose of ecosystem activities to maintain engagement and trust in the anticipatory innovation ecosystem approach

While ecosystem partners found the workshops undertaken as part of the project valuable, they felt that that one-off events have limited impact on the collective innovation processes. Systemic and regular ecosystem engagement and management is necessary to support collective innovation. To build trust and confidence in the approach, these engagements should be clearly connected to desired ecosystem goals.

Action points for Latvia

- Each ecosystem should collaboratively develop a theory of change so that the purpose of activities is clearly understood and connected to ecosystem goals. The example of PhotonDelta in the Netherlands (Box 2.7) shows how the development of this type of shared resource can enhance ecosystem agility and legitimacy.
- LIAA to apply the micro-governance framework to prioritise activities for the development of each ecosystem.
- When engaging ecosystem partners, LIAA should:
  - Ensure that the purpose of each innovation ecosystem engagement activity is clearly articulated in advance, and that participants are given time to prepare.
  - Clearly communicate the next steps and follow-up strategy for knowledge generated through ecosystem activities.

- Ensure that insights generated through innovation ecosystem engagement activities are analysed and communicated back to ecosystem partners in a timely manner.
- Assess perceptions of each ecosystem activity through the formative evaluation framework in order to inform future activities (see Annex A and Box 2.9).

7) LIAA has limited human resources, analytical capacity and expertise to deliver on its mandate and support the development of anticipatory innovation ecosystems

Based on consultations with policymakers, LIAA and ecosystem actors, LIAA currently does not currently have the resources required to meet the expectations placed on the organisation by high-level policy objectives; namely, to coordinate joint ecosystem activities and the development of ecosystem strategies across multiple ecosystems. As a public administration organisation with minimal options to recruit employees with the knowledge, LIAA faces issues developing the skills and experience required to orchestrate innovation ecosystems successfully.

Action points for Latvia

- Assess existing capacity of LIAA to support ecosystems, and prioritise the selection of the number of ecosystems that match the capacity so that the organisation is not over-stretched. Prioritisation should be informed by factors such as policy priorities, potential value-add of the ecosystem approach, and level of ecosystem partner engagement. Prioritisation is a political decision and could be undertaken through the Innovation and Research Governance Council.
- Identify available capacity both within and outside of LIAA to perform the main functions of ecosystem orchestration to develop micro-governance processes. Distribute responsibility between actors so that LIAA can leverage existing resources to its optimal capacity.
  - Identify and work with key actors who can take responsibility for specific micro-governance processes.
  - Consider funding respected stakeholders in academia and/or private sector to take on the role of ecosystem coordination and leadership.
  - Identify new funding mechanisms to outsource responsibilities from LIAA.
- LIAA to identify and connect with similar ecosystems internationally to enable peer learning with Latvian ecosystems.

8) Key ecosystem stakeholders are not consistently engaged

Ecosystem actors found that there was not consistent attendance from other key stakeholders, hindering the development of action plans and making decisions.

Action points for Latvia

- Communicate high level commitment to ecosystem support by assigning an ecosystem leadership function to a senior executive in LIAA.
- LIAA to develop engagement plans for key stakeholders which take into account the drivers and barriers to their participation.
- LIAA should ensure that the value of ecosystem participation is clearly communicated to stakeholders, and that clear insights and next steps from each ecosystem engagement are identified and shared.

6 Emerging principles for further investigation

This chapter discusses broadening the findings from Latvia. It aims to draw general principles on anticipatory innovation ecosystems from this project for use elsewhere and identifies possible directions for further work.

This section discusses broadening the findings from Latvia. It aims to draw general principles on anticipatory innovation ecosystems from this project for use elsewhere. Anticipatory innovation ecosystems have potential as a vehicle through which governments can better understand and prepare for the future by leveraging the collective intelligence of diverse stakeholders to inform policy, and by orienting their actions towards delivering different types of value through innovation. This potential can be unlocked through effective public governance which supports ecosystem development and facilitates ongoing learning and action by government based on the insights they generate.

Through this project, the OECD worked with the Investment and Development Agency of Latvia to explore how anticipatory innovation governance (AIG) could inform and enable the development of anticipatory innovation ecosystems in Latvia. The insights that this work has generated about the governance of innovation ecosystems and their ability to produce valuable anticipatory knowledge are of value both to Latvia and other countries that wish to become more proactive in their support of innovation, and more responsive to emerging trends and potential futures.

Key principles

1) Anticipatory approaches are valuable for the initiation and development of innovation ecosystems

Analysis of case studies and work conducted in Latvia (communicated in detail in Chapter 4) shows how ecosystems can apply anticipatory approaches to build their capacity for collaboration, allow ecosystem partners to identify and orient around shared goals, enable them to identify tensions and challenges in their strategies, and consider additional stakeholders it would be beneficial to engage. These core ‘micro-governance processes’ are the drivers for ecosystem development.

2) Ecosystem approaches can produce valuable anticipatory knowledge for governments

The participation of Latvian ecosystem stakeholders in anticipatory exercises generated a range of useful information. Horizon-scanning resulted in lists of possible changes and trends that could have an impact not only on innovation in Latvia, but also on areas of government activity such as healthcare and transport. For example, a financial crisis may require that access to public transport is improved, or the rapid development of biomedicine in non-EU countries may mean that connections with ecosystems in other countries should be improved. Stress-testing of strategies and objectives against these changes allowed ecosystems to consider and propose possible actions that public and private sector actors can take to better prepare for the future.

3) The Anticipatory Innovation Governance (AIG) framework identifies key mechanisms for the effective micro-governance of anticipatory innovation ecosystems

The AIG framework outlines governance mechanisms that enable knowledge about the future to be generated and acted upon. Chapter 2 of this report shows how these mechanisms are relevant to the development and maintenance of anticipatory innovation ecosystems as part of four micro-governance processes. ‘Networks and partnerships’ and ‘public interest and participation’ emerge as key to leveraging the collective intelligence of diverse stakeholders to enable ecosystems and governments to be more anticipatory and proactive. These mechanisms are particularly important in Latvia and other small states, where the capacity to leverage close networks of stakeholders to discover opportunities and develop place-based advantages is key to entering early into emerging value chains.

4) Effective governance at the policy level (meso-governance) is necessary to provide legitimacy and coordinated support for ecosystems

Analysis of case studies in Chapter 2 and the experiences of Latvian stakeholders detailed in Chapters 3 and 4 reveal that the legitimacy and support provided by government is important to generate the critical mass, momentum and commitment of ecosystem partners required to develop and sustain anticipatory innovation ecosystems. Contradictory or unclear policies and messaging from government can inhibit ecosystem development, while poor coordination and knowledge management at the meso- level reduces the capacity for policy learning and proactivity by government. A coordinating body composed of representatives from relevant ministries and agencies, such as the Innovation and Research Governance Council in Latvia, can enhance meso-governance by acting as a platform within which synergies and inconsistencies between policy and ecosystem priorities can be addressed, and knowledge generated by ecosystems can be communicated to government actors. The meso-governance functions framework detailed in this report can support greater coordination by allowing government actors to collaboratively explore the functions they can perform to support ecosystem development.

Further work

While collaboration with stakeholders in Latvia allowed the OECD to make an early exploration of the challenges and opportunities related to the application of anticipatory approaches by innovation ecosystem, the context and scope of the project meant that there have been limitations to what could be uncovered.

Further practical work to develop anticipatory innovation ecosystems and assess their impacts might include:

- Applying anticipatory approaches to more mature ecosystems to stress-test their strategies.
- Exploring how the links between ecosystems and other policy areas can be strengthened to promote the use of anticipatory knowledge by government.
- Prototyping an explicit anticipatory function within an innovation agency or ecosystem support team.
- Exploring how anticipatory approaches could be applied to mission oriented or grand-challenge led ecosystems in order to promote regular exploration of future changes.
- Analysing the functions and required skills of ecosystem support organisations.

Annex A. Methodology

The OECD Observatory of Public Sector Innovation together with the Investment and Development Agency of Latvia (LIAA) worked together over 2020-2022 to explore how the public sector can contribute to the effective governance of innovation ecosystems in a context of complex challenges and uncertainty.

The findings in this report draw on the triangulation of data emerging from semi-structured interviews, workshops, surveys and desk research.

- **Desk research**, including previous OECD reports on public governance in Latvia and innovation ecosystems, grey literature (policy briefs, reports, etc.), academic literature on innovation policy, innovation ecosystems, foresight and anticipation, and Latvian government publications.
- **Semi-structured interviews with over 40 public sector leaders, policymakers, experts and key private sector and research stakeholders** to understand the context for R&I, Smart Specialisation and innovation ecosystems in Latvia. In late 2020 and early 2021, the OECD Observatory of Public Sector Innovation conducted a series of 35 interviews with key stakeholders connected to the Latvian Smart Specialisation Strategy (RIS3) and innovation ecosystem management. Interviewees included stakeholders from the Ministry of Economics, Ministry of Education, the Investment and Development Agency of Latvia (LIAA), universities and research institutions, start-ups, medium-sized enterprises, state-owned enterprises, business associations and more. In August 2022, further interviews were conducted with representatives of the Ministry of Economy, Investment and Development Agency of Latvia, Latvian Council of Science and Riga Technical University to gain insight on the most recent changes in the R&I policy governance and implementation mechanisms and the rationale for these changes.
- **Semi-structured interviews with representatives from 10 European innovation ecosystem initiatives** to gather information on roles and governance models for innovation ecosystems. Ecosystems were selected to cover four main thematic areas that are of interest to the Latvian Investment and Development Agency (LIAA) based on the Latvian Smart Specialisation strategy. The themes cover 5G/6G, bioeconomy, biomedicine and photonics. The ecosystems were: spearhead cluster flanders.healthTech, Belgium; BioWin, Belgium; Dutch Top Sector Life Science and Health, the Netherlands; PhotonDelta, the Netherlands; Unlocking Industrial 5G, Finland; 6G Flagship, Finland; BioBall, Germany; Biotech North, Norway; Lithuanian Sunrise Valley; JIC regional innovation ecosystem in South Moravia, Czechia.
- **Six governance approach development workshops** to test and iterate developing tools and methods to support the governance of anticipatory innovation ecosystems. These engaged representatives from multiple teams within LIAA, as well as public servants from the Ministry of Economics and the Ministry of Education and Science (Table A A.1).
- **Seven ecosystem development workshops with more than 80 stakeholders** from the fields of smart mobility, smart materials and photonics, bioeconomy and biomedicine. Six of these workshops took place virtually over 90-120 minutes and engaged between 5 and 45 stakeholders in structured interactive activities. An offline workshop for the biomedicine ecosystem took place over two days in Riga on 17 and 18 May 2022, and engaged 28 stakeholders (Table A A.1). Detail on the types of activities that were undertaken can be found in Chapter 4.

- **A formative evaluation** of ecosystem development workshops. The evaluation had two key objectives. Firstly, it aimed to analyse ecosystem partners' perceptions on the relevance and usefulness of the workshops. Secondly, the evaluation sought to establish a method through which LIAA and ecosystem actors can periodically reflect on the applicability of the tools and activities for further ecosystem building. The evaluation relied on two core methods: 1) online survey of all workshop participants; and 2) interviews with a representative sample of participants. The short online survey was designed to gather a more aggregate and quantitative feedback from a large pool of workshop participants. The survey was sent to all participants (n=82) with a response rate of 46% (38 completed replies). In addition, 10 interviews were held with at least two participants from each ecosystem. The interviews complemented this quantitative feedback providing more in-depth insights on how the workshop content influenced participants' understanding of the ecosystem approach to innovation development.

Table A A.1. Participatory workshops undertaken with stakeholders in Latvia

Date	Objectives	Participants	Online / in-person
7 April 2021	• Introduce anticipatory approaches to an innovation ecosystem in Latvia • Conduct a horizon scan of future changes that could affect the ecosystem	Representatives of organisations working with photonics and smart materials	Online
28 April 2021	• Map potential ecosystems • Identify key criteria for ecosystem selection	LIAA team members	Online
27 October 2021	• Identify potential ecosystem stakeholders • Identify opportunities for engaging ecosystem partners	LIAA team members	Online
14 December 2021	• Explore and identify functions to be played by government representatives to support ecosystems	LIAA team members, Ministry of Education and Science, Ministry of Economics	Online
22 January 2022	• Develop a programme-level theory of change • Create an engagement plan for stakeholders of the biomedicine ecosystem	LIAA team members	Online
23 February 2022	• Engage key stakeholders in the biomedicine ecosystem • Identify shared issues and objectives for the future of biomedicine in Latvia • Share insights and observations from across the ecosystem • Identify next steps for collaboration	Representatives of organisations working with biomedicine	Online
5 April 2022	• Engage key stakeholders in the photonics and smart materials ecosystem • Identify shared issues and objectives for the future of Photonics and Smart Materials in Latvia • Share insights and observations from across the ecosystem • Identify future steps for ecosystem collaboration	Representatives of organisations working with photonics and smart materials	Online
12 April 2022	• Engage with and stress-test the 2018 'LIBRA' strategy for the Latvian Bioeconomy against potential future changes • Identify shared issues and objectives for the future of Bioeconomy in Latvia • Increase understanding of how strategic foresight helps make the ecosystem more resilient • Discuss how collaboration between partners can help to achieve the aims of the strategy	Representatives of organisations working in the bioeconomy	Online
21-22 April 2022	• Test developing findings about anticipatory innovation ecosystems • Prepare for ecosystem engagement workshop to be co-facilitated by LIAA and OECD in Latvia	LIAA team	In-person (Paris)

Date	Objectives	Participants	Online / in-person
17-18 May 2022	• Build an inventory of the capabilities and resources that members of the innovation ecosystem can contribute to the ecosystem • Outline key elements of a shared, future-oriented vision for the biomedicine innovation ecosystem in Latvia • Stress-test elements of this vision against possible and plausible future challenges • Set out concrete actions to enable the biomedicine ecosystem members in Latvia to develop and shape the future through innovation • Strengthen relationships across the field of biomedicine in Latvia	Representatives of organisations working with biomedicine	In-person (Riga)
14 June 2022	• Engage key stakeholders in the Smart Mobility innovation ecosystem • Identify shared issues and objectives for the future of Smart Mobility • Share insights and observations from across the ecosystem • Identify future steps for ecosystem collaboration	Representatives of organisations working on smart mobility	Online

Box A A.1. Formative Evaluation: Survey tool

Thank you for agreeing to take part in this survey about the workshop run by the OECD and Latvian Investment and Development Agency (LIAA). It will take only 10 minutes of your time. Your responses will help informing the future development of tools and approaches to support the orchestration and governance of anticipatory innovation ecosystems.

Your data will be stored securely and anonymously. The results of the survey will only be reported in aggregate format. By clicking on the 'next' button below you confirm you give us your consent to store and process your data under the GDPR rules.

1. How would you describe your organisation?
   - Government
   - Industry
   - Research/Academia
   - Other

   If 'other', please describe what type of organisation:
   - [open answer box]
2. Which innovation ecosystem are you part of?
   - Photonics
   - Biomedicine
   - Bioeconomy
   - Other

   If 'other', please describe:
   - [open answer box]
3. After which type of workshop were you asked to take part in this survey?
   - Online
   - In-person

4. As a result of attending this workshop:

Questions/answer options	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have an improved understanding of the skills, knowledge and resources of other ecosystem partners and how we can complement each other					
I have an improved understanding of goals and objectives for the ecosystem					
I am more aware of the benefits of collective learning through engagement with the ecosystem					
I feel more confident that ecosystem partners will be able to work together to innovate					
I have an improved understanding of the trends and drivers that may affect the ecosystem in the future					

5. Will you participate in future innovation ecosystem workshops/activities organised by LIAA?
   - Definitely yes
   - Probably yes
   - Don't know
   - Probably no
   - Definitely no
6. As a result of participating in the workshop, do you intend to undertake any further activities (e.g., follow-up with ecosystem partners, revision of organisational strategy, etc.)?
   - Definitely yes
   - Probably yes
   - Don't know
   - Probably no
   - Definitely no

   If, yes, what type of activities?
   - [open answer box]
7. Overall, how satisfied you are with the engagement, communication and facilitation methods used before and during the workshop:

Questions/answer options	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
Information provided prior to the workshop					
Explanation of exercises during the workshop					
Ensuring that different views and opinions were heard					
Resources and tools provided during the workshop					
Time provided to undertake workshop activities					

8. Which aspects of the workshop engagement, communication and facilitation methods do you think could be improved and how?
   - [open answer box]

Box A A.2. Formative evaluation: Interview tool

Introduction

This interview is part of a formative evaluation that will inform the future development of tools and approaches that LIAA can use to support the orchestration and governance of anticipatory innovation ecosystems. The aim of this interview is to gather feedback from workshop participants on the usefulness of the workshop content and engagement, communication and facilitation methods used, as well as understand participants' perceptions on anticipatory approaches that can support innovation ecosystem development.

The interview will last 20-30 minutes. The information that you provide will be treated in confidence by the study team. We request your permission to record the discussion for analytical purposes. The recordings will be securely stored and destroyed after the completion of the evaluation study.

Questions

- Please explain how your participation in the workshop affected your understanding of the ecosystem approach (e.g., role of the ecosystem player, common goals, collective learning, ability to work together)? Please give any examples of what you learned/understood/ understood better during the seminar
- Do you plan to implement any specific activities in your ecosystem after attending the workshop? If so, which ones? If not, why not?
- What would help you and prevent you from bringing the lessons from the workshop into practice in your ecosystem?
- Do you think that an ecosystem approach can improve innovation processes and the impact of innovation in the biomedical/bioeconomy/photonics/smart mobility sector? Why?
- How effective were the methods of communication and involvement in the workshop (e.g., pre-workshop information, explanations during the workshop, moderation of discussions, time available for activities, etc.)?

OECD Public Governance Reviews

The Public Governance of Anticipatory Innovation Ecosystems in Latvia

EXPLORING APPLICATIONS IN KEY SECTORS

This report presents a case study of applying the OECD anticipatory innovation governance framework to develop and manage anticipatory innovation ecosystems as vehicles for knowledge generation, innovation governance and co-ordinated action to achieve policy goals. Part I establishes the case for anticipatory innovation ecosystems and sets out how they can be governed through a multi-level approach. In Part II, opportunities and challenges for applying this approach in the Latvian context are identified, and recommendations are made for developing anticipatory innovation ecosystems in Latvia.

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