



Mutual Learning Exercise

R&I Foresight: An Introduction to the Current State of Play

Thematic Report

PSF CHALLENGE

HORIZON EUROPE
POLICY SUPPORT FACILITY

Independent
Expert
Report



Research and
Innovation

Mutual Learning exercise on R&I Foresight: An Introduction to the Current State of Play

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Thematic Report

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INTRODUCTION: THE CONTEXT OF THE MUTUAL LEARNING EXERCISE AND THIS PAPER

This paper has been prepared in the context of the European Commission funded Horizon Europe Policy Support Facility (PSF) Mutual Learning Exercise (MLE) on research and innovation foresight (R&I foresight)¹. The paper provides an introductory overview in the context of the MLE process. It highlights current (and some past) practices in the form of exemplary EU-level and especially national initiatives.

The paper builds on a first version shared ahead of the MLE kick-off meeting and input collected in an interactive exercise during this meeting. While an additional literature review has been realised, the paper provides only a first, but still to an extent incomplete, overview. As such, it draws on the insights and knowledge of the author and reviewers, and literature which could be identified and used within the timeframe available. Moreover, the further development of the topics will rely on contributions from the country representatives participating in this exercise, to provide a fuller picture and feed into the MLE final report. Insights on developments in foresight and especially on the impacts of foresight, rely on self-assessments and qualitative reviews, rather than full scientific evaluations, and as such information available can be more partial and incomplete than in other fields of research supporting policy.

As this paper provides an overall starting point for the MLE reflection, it therefore covers issues that will be considered in more detail in follow-up thematic papers. The figure below illustrates these connections and the focus of this paper.

¹ In the consultation process leading up to the formal start of the MLE, a set of topics within the scope of R&I foresight has been identified with the participating member states and associated states in terms of which topics should be explored further. The topics (with their respective lead experts) are: Topic 2: Institutionalising foresight capability and creating wide foresight communities in the R&I system (Jennifer Cassingena Harper); Topic 3: Citizens' engagement approaches and methods (Philippe Destatte); Topic 4: Foresight, the twin transition and potential disruptions (Paulo Soeiro de Carvalho); Topic 5: From foresight to smart specialisation to engagement on EU research programmes, missions and partnerships (Michal Pazour).

The Mutual Learning Exercise Topics and This Paper

MLE Focus: Research and Innovation (R&I) foresight

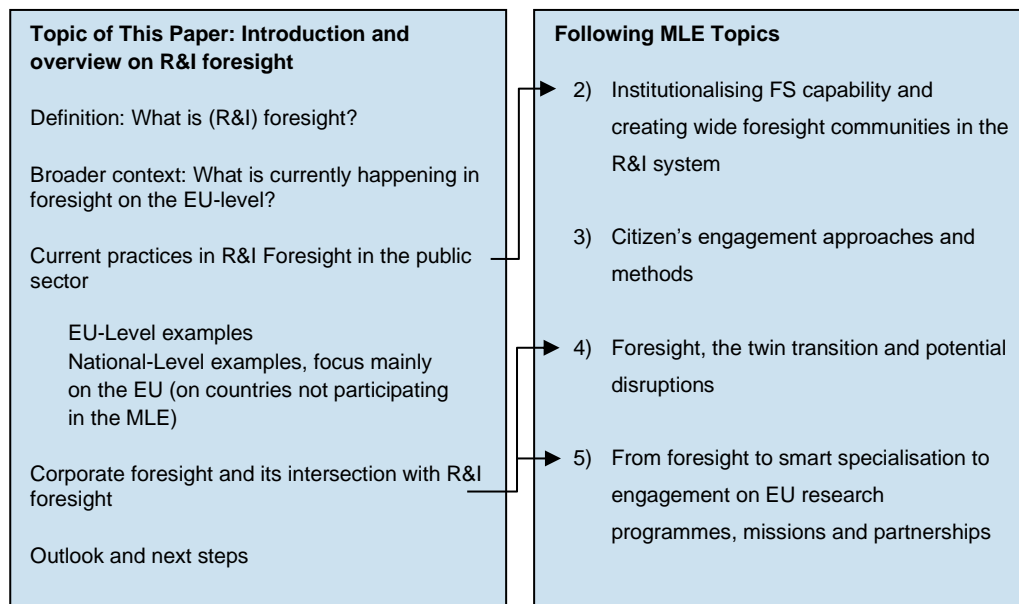


Figure 1: The topics of the MLE and this paper with its connections to other topics

1. The broader background and definitions of foresight and R&I foresight

Foresight is defined as “the disciplined analysis of alternative futures”, in a public sector and policy context aiming “to support policymakers in making better-informed decisions, having considered future eventualities, scenarios and outcomes” (EU Commission 2022c²). It is typically characterised by three aspects (based on Miles et al. 2016, p. 11-12):

- its systematic nature, which considers alternative futures (possibly including plausible, possible, and desirable futures)³,
- the action orientation, i.e., aiming at enabling, supporting, or informing present day decisions, and
- its participatory nature, aiming to involve a wider set of expertise reaching beyond “the usual suspects”.

² Another rather widely used definition frames foresight as “the application of (a) systematic, participatory, future-intelligence-gathering and medium-to long-term vision building process”, aiming at “informing present day decisions and mobilizing joint actions” (Miles and Keenan 2002, quoted from Miles et al. 2016, p.12; see also European Commission 2022c, Berloznik et al. 2002 and Martin 2010 for details on the development of the term).

³ This differentiates foresight clearly from forecasting, with its focus on prediction (Miles et al. 2016, p.11).

In earlier days foresight studies were often referred to as futures studies or futures research⁴, and their origins can be traced back to the 1960s and 1970s, with prominent examples being: the activities of the Club of Rome and the publication of “The Limits to Growth” in 1972 (Miles et al. 2016, p. 1); activities by RAND in the military field in the USA; as well as developments in Europe, with influential works by Johan Galtung, Eleonora Masini or the French “La prospective” with the work of de Jouvenel or Godet (see for more detail on historical background e.g. Dreyer et al. 2013 and Miles et al. 2016). In the last decades of the 20th century, a “revival of futures activities” was observed, as well as the launch of large-scale technology foresight activities in many countries, which were mainly government funded (Miles et al. 2016, p. 2). Since the 1990s, there has been an increasing diffusion of such technology foresight around the world, while its scope has often broadened and taken aspects outside of a narrower focus on technology development into account (Miles et al. 2016, p. 2-5)⁵. While the borders to other related practices such as technology assessment remain blurry, there is also a **lack of consistently used terminology in foresight activities**, and other terms may be used (i.e. Forward Looking Activities (FLA), Future-Oriented Technology Analysis (FTA), or Foresight dealing with Science, Technology and Innovation (ForSTI), see Miles et al. 2016, p. 2-4 for more detail). Furthermore, links to and overlaps with technology assessment (TA), which in most understandings covers activities aiming at assessing impacts of technology or potential future technology development paths⁶, also exist.

As a working definition for the purpose of this paper, we understand **research and innovation (R&I) foresight as foresight activities, i.e., a disciplined analysis of alternative futures, for and in R&I systems**⁷. It can thus cover questions of how R&I itself might develop, but also how other trends, developments or possible scenarios might influence and become relevant for R&I.

In this understanding, such activities can be technology foresight activities, but may also cover other topics. Such activities may be undertaken at different levels (e.g., at EU, national or regional levels) and by different types of organisations, e.g., by international organisations, by companies, in the public sector. Within the context of this MLE we mainly focus on activities realized in the public sector by EU and associated countries. To contextualise these activities, this paper will also set out the broader context of overall foresight. Due to interest expressed by participating countries in the MLE it also touches upon activities outside of the EU and in the corporate sector. The aim of this approach is to explore how learnings from these activities may intersect with or be beneficial for R&I foresight. More in-depth information from the countries participating in the MLE will be covered in the 2nd MLE exercise paper.

⁴ This terminology still to this day is used frequently, mostly referring to academic activities (see e.g., Martin 2010 for additional detail on terminology developments).

⁵ In the 1990s, especially activities in Europe can be regarded as a “result of policy learning”, as they drew strongly from the experiences in the Japanese technology forecasting programme. This was seen as a successful model for STI technology forecasting, which involved e.g., Delphi approaches and also considerable engagement and bottom-up elements (Miles et al. 2016, p. 14).

⁶ See Malanowski et al. 2001 for an overview of activities in different countries, Grünwald 2012 for an overview of parliamentary activities and Europe, and Sotoudeh and Gudowsky 2018 for a recent example of technology assessment and foresight integration.

⁷ Research and innovation systems here are understood as including actors such as ministries as well as “industrial and government research laboratories, research universities, research organizations, and industrial policy agencies” (Iuri 2002, p. 16). For a discussion of the development of the concepts of the systemic view of research and innovation systems also see Iurii 2022.

2. The current context of foresight in the EU (and beyond)

Considering the broader picture of foresight activities (i.e., beyond R&I foresight), foresight activities in the last years have grown considerably with increasing communication of results at EU level (European institutions, agencies and bodies) as well as in many member states and associated countries. Flagship examples of activities and respective bodies on the EU level include:

- The establishment, for the first time, of a **Vice-President for Strategic Foresight** in the College of Commissioners (held by Maroš Šefčovič since its inception; European Commission 2022a),
- The **EU-Foresight Network**, operating at two levels: a group of “Ministers for the Future” meeting at least once a year; and a supporting network of senior level officials from national administrations, which meet at least twice a year (European Commission 2022b),
- The **publication of annual EU strategic foresight reports** (EU Commission 2022b) beginning with the 2020 report focusing on “Charting the course towards a more resilient Europe“, the 2021 edition on “The EU’s capacity and freedom to act“, and the 2022 report on “Twinning the green and digital transitions in the new geopolitical context” (European Commission 2022b),
- The **EU Directorate-General for Research and Innovation (DG R&I) foresight activities** and its Horizon Europe Foresight Network working across all DGs engaged in the Research Framework Programmes (European Commission 2022d),
- The **EU JRC Foresight Competency Centre** providing the Megatrends Hub and various other tools such as the Scenario Exploration System (SES) or the megatrends workshop toolkit and a variety of studies, as well as the Foresight ON-newsletter (European Commission 2022d),
- A series of **Council Presidency workshops** in cooperation with DG R&I exploring R&I foresight, which initiated a first stocktaking of respective experiences,
- The **European Strategy and Policy Analysis System (ESPAS)**, a framework for cooperation and consultation between the European Parliament, the European Commission, the Council of the European Union, and the European External Action Service, the European Investment Bank, the Committee of the Regions, the European Economic and Social Committee, the European Union Institute for Security Studies and the European Court of Auditors as observers, to work together on medium and long-term trends facing or relating to the European Union, which also holds regular conferences (ESPAS 2022),
- A variety of **European research agencies and bodies** that are conducting foresight, such as European Environmental Agency (EEA), European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), European Foundation for the Improvement of Living and Working Conditions (Eurofound), European Agency for Safety and Health at Work (EU-OSHA), or the European Border and Coast Guard Agency (Frontex),
- Scientific foresight activities conducted at the **Panel for the Future of Science and Technology (STOA) at the European Parliament** (STOA 2022).

Looking beyond the EU, **foresight also seems to be diffusing and growing internationally**. Examples include the recent activities of the United Nations (UN) with a push towards institutionalisation of foresight at the highest level (see the report “Our common future” and ongoing activities around the implementation of respective initiatives), and the United Nations Development Programme (UNDP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) **futures literacy** activities (Neuvonen 2021; UN 2022; The Millennium Project 2022a; UNESCO 2021; UNDP 2018). Moreover, there are comparable or similar developments in various other international organisations and institutions, such as the Organisation for Economic Co-operation and Development (OECD) (OECD 2022) or the International Organisation of Standards (ISO) (ISO 2022), the non-profit futures think tank The Millennium Project (The Millennium Project, 2022a and 2002b), and prominent activities in countries outside of the EU, such as in Dubai, the UK, or Canada⁸.

3. R&I foresight in the public sector – insights into current practices

R&I foresight can serve a variety of functions and cover a range of activities. At the same time, insights on developments in and impacts of foresight, where available at all, rely on self-assessments and qualitative reviews, rather than robust scientific evaluations. Therefore, information available is more incomplete than in other fields of research supporting policy. Overviews and categorisations of existing practices are rare, and the last broad overview available is from 10 years ago (see Keenan and Garcia 2021, p. 3, referring to the European Foresight Platform as the last broader overview identifiable).

3.1. Methods and scope of activities

A recent international mapping of governmental foresight activities for science, technology and innovation (STI) policy by the OECD identified exercises and organisations with the aim of “obtaining a baseline understanding of current practices and capabilities” (Keenan and Garcia 2021, p.4)⁹. It covered 14 STI foresight exercises and 13 different organisations. In the analysis, it mapped their objectives and rationales, the time horizons used, the number of participants involved in the exercises and their breadth of engagement, as well as the main methods used. Among the insights from the results are:

- “Most exercises **engaged more than 500 people** in one way or another, including through foresight panel membership, participation in surveys and workshops.” (Keenan and Garcia 2021, p. 11.).
- “However, **only around half of the exercises surveyed engaged civil society organizations and citizens**, while the participation of researchers and the business sector is near-ubiquitous” (Keenan and Garcia 2021, p. 11).

⁸ For details on the activities in Canada, which currently features one of the most differentiated national foresight approaches, and in the UK, with one of the longest traditions of national foresight activities, see the chapter on examples. Concerning activities in Dubai, this has been a highly visible example in recent years. Features of activities in Dubai include the opening of the Museum of the Future in 2021, the strong support of foresight by the Prime Minister, research and training activities by the Dubai Future Foundation and the Dubai Future Academy (see SOIF p. 31, p. 35, p. 66-68). Dubai also hosts an annual foresight conference, described as “the world’s largest gathering of futurists” aiming to provide “an international platform for futurists” (Dubai Future Foundation 2022).

⁹ The OECD findings are preliminary, and the coverage of activities is not complete. The publication indicates “while the coverage in no way pretends to be comprehensive, it is somewhat representative of what we understand the government STI foresight landscape to look like.” (Keenan and Garcia 2021, p. 5).

- Among the **principal methods** employed (in organisations) were, first and foremost, scenarios, trend analysis and horizon scanning (but also various others).
- A recent **meta-analysis of papers on foresight for technology policy between 2015 and 2020** revealed a similar picture, with **scenario planning as the most used method** detected, followed by **expert surveys, the delphi method, trend analysis, horizon scanning, and workshops and interviews with experts** (Neels 2020, p. 8, also providing definitions per methods; see also Figure 2 below¹⁰).
- Concerning the main **outputs**, the following were most prominent according to the OECD mapping: Lists of key technologies (e.g., Korea 5th, China 2035), scenarios (e.g., Japan, Finland, Germany), emerging challenges (e.g. Canada, Russia, South Africa) (Keenan and Garcia 2021, p. 14), as well as a wide range of accompanying analysis and policy translation work (Keenan and Garcia 2021, p. 14).
- Concerning **dissemination**, reports, workshops, and policy seminars were utilised in nearly all instances, however YouTube channels, blog posts, **libraries of tools as well as trainings and toolkits** were also used (Keenan and Garcia 2021, p.14).

¹⁰ This analysis includes published academic papers only, which most probably will not fully reflect current practices. However, it does present a systematically identified and analysed review of activities within this sample, related especially to the application of technology policy (see Neels 2020 p. 5-6). Previous mappings such as in the European Foresight Monitoring Network, are based on more detailed but older data sets (see Popper 2008). From this mapping exercise, methods were categorized into the so-called “Foresight Diamond” with dimensions on the degrees of creativity, expertise, interaction, and evidence per method as well as their qualitative, semi-qualitative or quantitative nature, while also including methods not originally being foresight methods, but being adaptable to use within foresight (see Popper 2008, UNDP 2018). A respective mapping of methods used especially in the R&I context may be attempted later in the MLE process based also on survey data from respective countries.

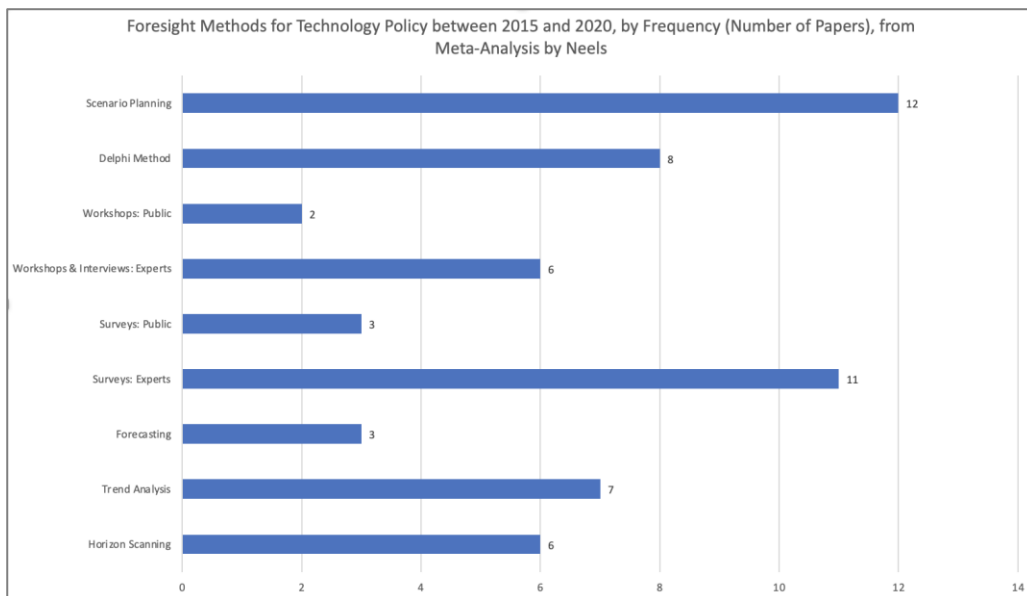


Figure 2: Foresight methods used in technology policy between 2015 and 2020, from a meta-analysis of respective papers (N=37), own visualization, all data from Neels 2020¹¹

Furthermore, the mapping by the OECD identified a **range of impacts**, as identified by organisations and from the exercises surveyed, such as direct inputs to national plans and policy planning, the stress testing of policy planning, influence on STI funding programmes, as well as “raising awareness of issues, foresight culture and continuing dialogue and motivating different areas of society to engage in future-oriented thinking and discussion” (Keenan and Garcia 2021, p. 15). These assessments, from the preliminary results available, do not draw on scientific evaluation usually regarded as “hard evidence”, but draw from “soft” and qualitative sources of insights, and rely mainly on publicly available information (see Keenan and Garcia 2021, p. 4 and 5).

3.1.1. Impacts and emerging practices

Harper 2013 (p. 10) differentiates **five generations of foresight activities**, with the **current phase categorised as ‘tailored approaches in R&I ecosystem’**. The paper stresses that “**the evidence base for innovation and related policy impacts resulting from foresight activity is limited**”, while nevertheless identifying several conclusions concerning the use and impacts of foresight (Harper 2013, p. 5). It highlights the change of evaluation criteria over time and presents a hierarchy of targeted foresight innovation impacts in order to distinguish between immediate, intermediate, and ultimate impacts (see Figure 3 below)¹².

¹¹ Numbers in the visualization refer to “counts of methods used in papers”, with 37 papers being analysed in depth (Neels 2020 p. 4-8). The visualisation does not include the category of “other methods” and “reviews”. The category “reviews” refers to “historical studies or reviews from the literature” being referenced in 11 of the papers. The category “other methods” refers to methods only covered in one paper, naming specifically “backcasting, roadmapping, online platform collaboration, foresight information system” (Neels 2020, p.8).

¹² The analysis draws upon national foresight activities in Europe and worldwide which have undergone “some form of evaluation, light evaluation and self-review” (Harper 2013, p. 5), stressing that the extent of formal evaluation is limited.

Furthermore, **emerging practices of foresight for STI policy** have been identified, drawing upon an expert survey and expert interviews. Here, an increasing use of four approaches is highlighted:

1. integrated qualitative and quantitative approaches,
2. IT-based and automated foresight,
3. experiential foresight including new forms of communication and interaction such as visualisation and gaming, and
4. open and crowd-sourced approaches (Daheim/Hirsch 2016; Daheim 2020).

The **concept of anticipatory governance has become increasingly prevalent** in recent years. It refers to the “systematic embedding and application of strategic foresight throughout the entire governance architecture, including policy analysis, engagement, and decision-making” (OECD 2021b, p. 5 and following). The concept reflects the need to move beyond foresight approaches based on singular projects, rather focusing on e.g., establishing respective units, institutions or frameworks as well working on developing a “foresight culture” based on embedding competences within organisations (OECD 2021b, p. 5 and following). This perspective also highlights that R&I foresight activities in many countries now take place in a **wider ecosystem of public sector foresight** (see. e.g., Heo et al. 2021, Warnke et al. 2022)¹³. Such wider ecosystems may consist of activities in different departments, ministries, or agencies, and can also include a central coordination of all foresight activities, which can in turn influence the scope, topics and methodological choices of R&I foresight (cp. e.g., Heo et al 2021, Warnke et al. 2022)¹⁴.

¹³ First insights also exist on to what extent cultural aspects play a role in the set-up of foresight practices in different nations, see Andersen et al. 2014.

¹⁴ From the examples outlined below, cases with relatively far-reaching and complex national public sector foresight ecosystems and at least a certain degree of central coordination are Canada, France, Germany, the Netherlands, Spain, the UK, and Singapore.

Hierarchy of Targeted Foresight Innovation Impacts, from Harper 2013



Figure 3: Hierarchy of targeted foresight innovation impacts – some examples (own visualization, all data from Harper 2013, abbreviated version, with timeline for implementation in brackets, referring to projects included in the paper Harper 2013, p. 24).

3.1.2. Snapshots into current EU-level R&I foresight activities

Several EU level R&I foresight projects have developed strategic insights, among them four exemplary flagship projects: The Futures4Europe Platform, the Bohemia project, and the RIBRI and SAFIRE projects.

The **Futures 4 Europe Platform** explores “future changes in the global and European context for EU R&I policy as well as emerging developments in science, technology and innovation, in order to capture in particular those topics that could have a disruptive impact on Europe’s ability to achieve its overarching policy goals” (Futures4Europe, 2022). Within this project, “Stories from 2050” have been developed with individuals and communities in Europe and internationally, to depict sustainability opportunities and challenges (FOD, 2022).

Previous larger projects include the **BOHEMIA project**, which aimed, using a 2038 time horizon, “to identify priorities and themes for Future European R&I policy and to provide a description of the issues that should be addressed by R&I policy and funding” (Fraunhofer ISI 2022)¹⁵. The **SAFIRE project** – (Strategic Intelligence Foresight System for European Union Research and Innovation (R&I) Framework Programmes) focused on ways to improve the state of the art in foresight use in EU policymaking (Focken et al. 2022)¹⁶. Finally, **the project RIBRI**, the Radical Innovation Breakthrough Inquirer, identified a list of feasible radical innovation breakthroughs in science and technology and determined the likelihood of their significant use by 2038 (Warnke et al. 2019)¹⁷.

Concerning the use of foresight for and in EU research projects, there are a number of activities undertaken with DG R&I coordinating. A **Horizon Europe Foresight Network** was set up, bringing together representatives from all DGs involved in Horizon Europe. A number of projects focus on or include foresight with participants from many member states; a current exemplary project output is a study on “Scenarios for Europe in a post Covid-19 world”, specifically examining impacts on R&I policy (European Commission 2022e).

3.2. Snapshots into exemplary public sector (R&I) foresight practices at the national level

On the **national level**, a variety of activities and organisations can be identified. Several publications provide an overview of recent public sector foresight approaches on the national level in a range of countries and document their practices (Harper 2013; Heo et al. 2021, Keenan and Garcia 2021, SOIF 2021, Warnke et al 2022).

The following tables map a set of examples of current public sector practices. As the second thematic paper in the context of the MLE will zoom in on insights from a survey from the countries participating in the MLE, these countries have not been included here. Instead, the overview focusses on a set of 10 additional examples, mainly from the EU (only from countries which are not participating in the MLE). In addition, some insights into select prominent international cases are included. The information provided draws primarily upon the publications identified above, complemented by other sources of information where

¹⁵ The primary result was a report based on 19 targeted scenarios, which provided recommendations for European R&I policy for Horizon Europe (European Commission, 2018).

¹⁶ The outcome was a system that was comprised of “a set of functions and a set of resources, which is flexible and modular, so that it can incorporate new functions and new resources as required during its use” (Focken et al. 2022).

¹⁷ The project was part of the preparation for Horizon Europe’s implementation, and used a “massive automated survey of recent scientific and technical literature filtered through panels of experts” as well as “reviews of important recent foresight projects worldwide” (Warnke et al. 2019).

feasible. While this overview and the information provided in it is not exhaustive and draws upon secondary sources, it demonstrates the diversity of approaches and projects in public sector foresight. It features specifically those projects with an R&I focus. Where possible, other examples are included, especially in cases where there is a connection to other focus topics of the MLE. The aim of this approach is to demonstrate the broader context of public sector foresight activities.

The overview tables summarise the available information. The information provided always starts with the most recent project examples, but also includes, where available, information on background and history to illustrate the broader context.

Examples of public sector foresight practices (EU, selection)¹⁸

Country (and underlying references)	Organisation(s) involved	Recent Projects
<p>Denmark</p> <p>References: Andersen et al. 2014; Ministry of Higher Education and Science 2018</p>	<p>Ministry of Higher Education and Science, process on “The Government’s objectives for Danish research and innovation”</p> <p>“Research2015” Programme, initiated by the Parliament, realized every 4 years, a process on the challenges for Denmark</p> <p>“Globalisation Strategy” Programme, by Committee of Ministers and Council of Globalisation</p>	<p>Process on “The Government’s objectives for Danish research and innovation” report by Ministry of Higher Education and Science, approx. 2014</p> <p>“Research2015” Programme, every 4 years a process on the challenges for Denmark; started 2007 and influenced politics strongly from 2008-2011 (last documented phase in the literature)</p> <p>“Globalisation Strategy” Programme, introduced in 2005, a programme on the future of Denmark; approach in 4 phases incl. meetings with discussions on the challenges that Denmark will face in the upcoming decades, discussions based on literature review papers; inclusion of citizens in first phase; ministries brought in topics</p> <p>Both programmes were not necessarily seen as strategic foresight processes, but foresight literature and methods were used</p>
<p>France</p> <p>References: Dreyer at al. 2013; Gouache 2022; Harper 2013, pp. 18f.; Roëls 2020</p>	<p>“The longest established foresight programme in Europe”, and the Centre d’Analyse Stratégique (CAS) working directly under the Prime Minister</p> <p>Delegation dedicated to foresight at the Senate, and a Delegation at the French Defence Department</p> <p>Various other units and entities, such as AllEnvi: Alliance nationale de recherche pour l’Environnement</p>	<p>Recent projects on improving innovation systems</p> <p>Prosper initiative, project on big and open data (2017-2018, by French public research centres & agriculture and food ministry, with informal working groups and activities dependent on members’ involvement)</p> <p>Regional process, Maroussis tomorrow/in 2038, participatory process of co-creation, with 500 participants</p>

¹⁸ Countries in the table are in alphabetical order.

Country (and underlying references)	Organisation(s) involved	Recent Projects
	<p>(National Alliance for Environmental Research); PIPAME: Pôle Interministériel de Prospective et d'Anticipation des Mutations Économiques; CIP: Comité Interministériel de la Prospective; most involved ministries in foresight: Ministry of Armed Forces and Ministry of Agriculture and Food; Ministry for an Ecological and Inclusive Transition; Prosper initiative, by French public research centres & agriculture and food ministry; also local / regional examples such as from the Village of Marcoussis</p>	
<p>Germany</p> <p>References: Nathani et al. 2021, pp. 32-39; BMBF 2022, Warnke et al. 2022, pp. 52-63</p>	<p>Various units with foresight activities: Federal Foreign Office (AA), Federal Ministry of Education and Research BMBF (with an R&I focus), German Environment Agency (under Federal Ministry for the Environment, BMU); Federal Ministry for Economic Affairs (BMWf); Federal Ministry of Defence (BMVg), with the planning office Federal Armed Forces; Chancellery (BKAmt); Federal Ministry of Labour and Social Affairs (BMAS), think tank on digitization of labour; German Environment Agency (under Fed. Min. for the Environment/BMU); Federal Ministry for Economic Affairs (BMWf); Federal Ministry of Family Affairs (BMF); Federal Ministry of the Interior and Community (BMI); Federal Academy for Security Policy (BAKS); Federal Ministry of Justice and Consumer Protection (BMJV); Federal Ministry for Economic Affairs and Energy (BMWK/E); Commission on the Future of Agriculture (ZKL); Office for Technology Assessment at the German Parliament</p>	<p>“Vorausschau”, the foresight process of the Federal Ministry of Education and Research (BMBF), a multi-year R&I foresight exercise which continues a long-standing tradition of respective processes realized by the ministry. It encompasses, for example, regular horizon scanning and scenario studies, and a variety of engagement and dissemination activities, and it works with a futures expert’s circle; the project is ongoing, with its focus currently being adapted</p> <p>Previous projects are e.g., “Technological and social developments in Germany 2030” (2019-2022, BMBF foresight cycle III)</p> <p>Economic perspectives of digitization (2019-2021, Federal Ministry for Economic Affairs BMWf)</p> <p>Productive and sustainable agriculture (2020-2021, Commission on the Future of Agriculture ZKL)</p>

Country (and underlying references)	Organisation(s) involved	Recent Projects
	<p>Long tradition, with first foresight experts under Willy Brandt, but institutionalization not fully addressed until 2013 (with strengthening of strategic foresight in coalition agreement)</p> <p>Constant collaboration between ministries and units and with external and international actors is stressed Regional (Regierungsbezirke) and federal state (Bundesländer) activities also exist</p>	
<p>Hungary</p> <p>References: Harper 2013, Havas 2000; Nemeth 2016</p>	<p>Security foresight process by the Ministry of Defence; Strategic Analysis Group (SAG) with experts from the military, the university, and the ministry of defence</p> <p>Hungarian Technology Foresight Programme, TEP (1997-2000, first programme in Hungary dealing with foresight; in general, very uncommon at this time that governments of smaller states were active in foresight)</p>	<p>Security foresight process: Literature review of military papers and foresight research from other nation states but also international organisations as well as interviews or talks with experts; since 2012 government pushes the reconceptualization of the national defence concept; development of PESTEM method (PEST & Environmental & Military)</p> <p>TEP is described as “a holistic foresight programme, based on both panel activities (scenarios, SWOT analysis, recommendations, policy proposals, etc.) and a large-scale Delphi survey”, with a duration of 3 years (Havas 2000, p. 96); and strong effects on policy (Harper 2013, p. 21f.)</p>
<p>Spain</p> <p>References: Warnke et al. 2022, pp. 41f.; National Office 2022</p>	<p>National Office of Foresight and Strategy is a “unit of the Presidency of the Government of Spain responsible for analysing the challenges and opportunities that Spain will encounter in the coming decades and helping the country prepare for them”. (National Office 2022)</p>	<p>Recent Project: “Spain 2050”, aims to counteract short-term interests of the political-administrative system, strengthen strategic interests (time frame: 30 years), enable foresight/long-term policy and anticipatory governance, and includes a visioning process for citizens, public institutions, companies, universities, think tanks, NGOs, foundations, and organisations</p>

Country (and underlying references)	Organisation(s) involved	Recent Projects
	Establishment of one of the first strategic foresight clusters as part of Ministerio de la Presidencia del Gobierno (1978-1982)	Foresight was central for the transition to democracy; focus topics after that time: economy, technology, defence
<p>Sweden</p> <p>References: Björn and Lübeck 2003, Commission on the Future of Sweden 2013; Harper 2013, IFFS 2022a; IFFS 2022b</p>	<p>Commission on the Future of Sweden, in early 2010s to develop a perspective on the future of Sweden in the coming 10 and 40 years until 2020 and 2050</p> <p>National Technology Foresight Process run by the Royal Swedish Academy of Engineering Sciences (IVA), the Swedish National Board for Industrial and Technical Development (NUTEK), the Swedish Foundation for Strategic Research and the Federation of Swedish Industries, implemented “with support from the Swedish government and in close collaboration with companies, public agencies and other interested parties” (Björn and Lübeck 2003, p. 2)</p> <p>IFFS (Institute for Future Studies), founded in 1973, then linked to the Prime Minister’s Office, from the end of the 1980s more autonomous</p>	<p>Commission on the Future of Sweden, in early 2010s to develop a perspective on the future of Sweden in the coming 10 and 40 years until 2020 and 2050, combination of qualitative and quantitative information on future challenges</p> <p>Between the end of the 20th and the beginning of the 21st century two rounds of the so called “national technology foresight process” took place; first part was driven by private companies, the state was invested in the second; research on the future of different technologies and tech-clusters, identification of six strategic national challenges and 11 technologies to be targeted by public investments</p>
<p>The Netherlands</p> <p>References: CBP 2022; Clingendael 2022; RIVM 2014; RIVM 2022, SOIF 2021;</p>	<p>Activities at the ministry and sectoral level, with “significant de-centralisation” and cross- ministerial coordination, facilitated through the Council of Ministers (SOIF 2021, p. 57)</p> <p>RIVM (National Institute for Public Health and the Environment), Foresight on Health</p> <p>Central Planning Bureau (CPB) works with a high degree of freedom for the ministry of economic affairs and climate</p>	<p>Dutch Public Health Study in the Light of Covid 19</p> <p>Research on the impacts of Machine Learning and Big Data on the future of global trading</p> <p>Recent project examples also include the use of gaming for enabling larger scale national and local citizen engagement</p> <p>Decentralized foresight approach, partly externalized, currently with attempts to increase participation; CPB: Consensus based approach; trying to bring the different opinions/ perspectives (on the</p>

Country (and underlying references)	Organisation(s) involved	Recent Projects
	<p>Institutes for foreign policies (the institutes do research for the government, but are independent from it)</p> <p>Draws upon a long tradition of foresight being embedded in governmental institutions</p>	<p>future) within the political institutions together; Foresight Tournaments</p>
<p>Countries participating in the MLE process, thus not covered here (but to be analysed in more detail in thematic report two on institutionalisation) are: Austria, Belgium, Czech Republic, Estonia, Finland, Norway, Portugal, Slovenia, and Romania</p>		

Examples of Public Sector Foresight Practices (International, Selection)¹⁹

Country (and underlying references)	Organisation(s) involved	Recent Projects
<p>Canada</p> <p>References: Government of Canada 2022; Harper 2013; p. 18; OECD 2021; Warnke et al. 2022, pp. 25-29</p>	<p>PHC (Policy Horizons Canada): federal government organization that conducts independent foresight work for all ministries; the agenda is influenced by and embedded in government through a steering committee with deputy ministers, and a clerk (leader of Privy Council Office PCO); reports through the Deputy Minister of Employment and Social Development Canada (ESDC) to the Minister of Employment, Workforce Development and Disability Inclusion</p>	<p>Project on COVID-19</p> <p>Recent projects (2021) e.g., on “The Future of Value” (ongoing) and on The Future of Sense Making (2021)</p> <p>Fulfils its mandate through the following tasks:</p>

¹⁹ Countries in the table are in alphabetical order.

Country (and underlying references)	Organisation(s) involved	Recent Projects
	<p>PRI (Policy Research Initiative): “original” institution, government think tank, research started in 1996</p>	<ul style="list-style-type: none"> • “Analyse the emerging policy landscape, the challenges that lie ahead, and the opportunities opening up. • Engage in conversations with public servants and citizens about forward-looking research to inform their understanding and decision making. • Build foresight literacy and capacity across the public service.” (Government of Canada 2022)
<p>Singapore</p> <p>References Warnke et al. 2022, pp. 42-44; CSF 2022</p>	<p>Centre for Strategic Futures (CSF)</p> <p>Since 2015, part of the new Strategy Group in the Prime Minister’s Office (focus on “whole-of-government strategic planning and prioritisation, whole-of-government coordination and development and to incubate and catalyse new capabilities in the Singapore Public Service”, CSF 2022)</p> <p>Various other government agencies have also recently “began to set up their own foresight teams, which conduct more domain-specific horizon scanning and futures research” (CSF 2022)</p> <p>Beginnings of “future planning efforts as an experiment in the Ministry of Defence in the late 1980s” (CSF 2022); in 1995, the Government set up the Scenario Planning Office in the Prime Minister’s Office, renamed the Strategic Policy Office (SPO) in 2003 “to reflect the strengthened links between foresight work and strategy formulation” (CSF 2022); Centre for Strategic Futures</p>	<p>Overview on drivers of change 2040</p> <p>Covid-19 disruptive effect on (existing) trends</p> <p>Overview of global trends and foresight work worldwide</p>

Country (and underlying references)	Organisation(s) involved	Recent Projects
	(CSF) was established in 2009 “as a futures think tank within SPO to focus on issues that may be blind-spot areas, pursue open-ended long-term futures research, and experiment with new foresight methodologies”	
<p>UK</p> <p>References: Cynnal Cymru 2015; Harper 2013, pp. 14f.; Warnke et al. 2022, pp. 38-41; Nathani et al. 2021, pp. 39-46; UK Government 2022</p>	<p>GO (Government Office) Science for Futures</p> <p>Horizon Scanning Programme Team, “a collaboration between Cabinet Office and the Government Office for Science, to coordinate futures work across government and integrate futures into decision-making” (UK Government 2022)</p> <p>Decisions on new foresight project topics are made by the Government Chief Scientific Advisor (GCSA)</p> <p>Establishment of UK Foresight Programme in 1994, with over 30 published reports²⁰</p> <p>Regional activities such as “The Future We Want” large scale futures participation process in Wales</p>	<p>“Net Zero Society” (ongoing)</p> <p>“Resilience to long-term trends and traditions” (ongoing)</p> <p>“Wireless 2030” (ongoing)</p> <p>“Genomics beyond health” (2022)</p> <p>“Future of citizen data systems (2020)</p>
<p>Other non-EU countries named as examples in the literature reviewed (Keenan et al. 2021, Dreyer et al. 2013; Harper 2013; Heo et al. 2021; OECD 2021; SOIF 2021; Warnke et al. 2022) where some degree of detail is provided are (in alphabetical order): Australia, China, Japan, Korea, Malaysia, New Zealand, Russia, UAE, and the US</p>		

²⁰ Foresight academic institutions in the UK named in the literature are Manchester Institute of Innovation Research, the University of Sheffield’s Regional Technology Foresight, Oxford Martin School (HEO 2021)

4. Corporate foresight and its intersection with R&I foresight

In parallel to public sector activities, **corporate foresight activities** have also been developing dynamically over the last decades and, in some instances intersect with governmental foresight activities (see e.g., Bereznoy 2017, Daheim and Uerz 2008, Rohrbeck 2015, Rohrbeck 2009). Examples from Europe include the activities by BASF and Evonik, both international chemical sector companies located in Germany, or the Spanish Bank BBVA, as well as Philips from The Netherlands. Other prominent examples internationally include Shell or Ford (Ford 2017, Ford 2022, Johnson 2018, Rösch 2022).

There are also examples of **public sector support for increasing corporate foresight capacity** and other intersections of R&I foresight with corporate foresight. One of those examples is a transnational project in the Visegrad countries (Czech Republic, Hungary, Poland, and Slovakia). This project aimed at “mobilising corporate foresight potential” in a range of very diverse sectors and was supported by four universities and research centres (Sacio-Szymańska et al. 2017).

Another ongoing project at the intersection of R&I and corporate foresight is “Strategic foresight for sustainable innovation and growth”, a pioneer project realised by VTT together with 12 companies and Tampere University (VTT 2022). It aims at “developing strategic foresight methods, tools, and practices in cooperation with companies”, while also sharing research in a network in the project (VTT 2022). It also aims at “significant opportunities for innovations and new business” and an “understanding of the sources of sustainable growth to support strategic management” (VTT 2022).

A third example is the set-up of the German foresight process by the Federal Ministry for Education and Research BMBF, which features an expert group supporting the process, including foresight experts from companies such as Evonik and Volkswagen (BMBF 2022).

Exploring respective insights from recent developments in corporate foresight concerning their relevance for public-sector R&I foresight could also feed the thematic papers on topic four (on the twin transition and disruptions) and five (on smart specialisation, missions and partnerships) in the framework of this MLE.

5. Conclusions and first insights on challenges and future directions

This paper and its literature review provide insights into success factors as well as challenges and barriers to successful foresight practices in the public sector. It also identifies some pointers for future directions of development of foresight activities that draw upon the examples provided in the previous sections, including:

- In France, despite a long tradition in foresight in the public sector, foresight units often suffer from “a difficult standing”, and of a lack of continuity, with units often lasting for only three to four years. Furthermore, a lack of capacity and teams being too small to generate impact is being reported, as well as a weak link to policy and the parliament (Roëls 2020, p. 69).
- In the Netherlands, in terms of future directions, attempts to increase participation are reported, as well as a stronger influence of the courts in requiring policy to take long-term considerations into account (Heo et al. 2021, p. 7-8; SOIF 2021, p.58; RIVM 2014)

- In Hungary, an influential large scale holistic foresight project was carried out relatively early on for a smaller EU country (Nemeth 2016). However, efforts to institutionalise foresight after the end of this project have not been successful, even though foresight studies keep being carried out at Hungarian universities (Nemeth 2016).
- In Germany, bureaucratic processes are identified as a challenge, as they do not allow for “flexible” foresight and hinder more effective foresight thinking with a focus on action or implementation. Moreover, there is a risk of foresight being perceived at higher levels as “nice to have” if no immediate benefits are visible (Warnke et al 2022, pp. 59).
- For Canada, deemed as “one of the most well-established government foresight ecosystems in the world” (OECD 2021, p. 5), the integration in administration and close contact with and among ministries are regarded as conditions for success.
- In spite of a long tradition of institutionalised foresight (Heo et al. 2021, p. 8), the challenge of a loss of relevance of foresight has been observed in the UK since 2010. In addition, horizon scanning has become “fairly fragmented” with non-systemic approaches in “strong department silos”, which is another challenge (Heo et al. 2021, p. 8). At the same time, the devolved governments’ foresight has become more important, for instance, the large-scale citizen engagement processes undertaken in Wales in the form of a national conversation between policy-makers and citizens, “The Wales We Want” (SOIF, 2021, p. 34, and Cynnal Cymru, 2022).

Considering the various examples, it is obvious that there is wide diversity of national public sector foresight set-ups and approaches. Furthermore, despite successful or large-scale projects being realised, the risk remains that the importance of foresight activities may decrease again, as was the case in Hungary and the UK. In parallel, there seems to be a tendency for **increasing institutionalisation of foresight and dispersion across units and departments**. This may or may not, and to different degrees, be centrally coordinated. Moreover, a more central coordination may possibly influence the specific mandate, set-up, and conditions of R&I foresight (see e.g., Warnke et al. 2022 for a mapping of alternatives for possible cross-governmental set-ups in Germany).

The MLE paper on the institutionalisation of foresight will dive more deeply into questions on the respective challenges and success factors for R&I foresight. In addition to the insights summarised above from the national cases, this paper has provided insights into, and examples for, the increasing use and differentiation of R&I foresight and foresight. How, and with which approaches and methodologies, this can be leveraged to increase the impact of R&I foresight at the national level in the EU will be explored further in the upcoming activities and papers of this MLE.

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This paper has been prepared in the context of the Mutual Learning Exercise (MLE) on research and innovation foresight (R&I foresight), a process led by the European Commission DG RTD. The paper's aim is to serve as an introductory overview in the context of this process. It highlights current and past practice examples in the form of exemplary EU-level and especially national initiatives and provides first conclusions on success factors and challenges.

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