



How to stress-test EU policies

Building a more resilient Europe for tomorrow

STUDY

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How to stress-test EU policies: Building a more resilient Europe for tomorrow

Policy-makers are seeking to 'future proof' policies in order to be better prepared for disruptive and unanticipated events. The application of foresight methods such as stress-testing can help achieve this goal. This study introduces a methodology for the European Parliament to stress-test legislation. The method can be integrated into existing law-making and scrutiny processes in the European Parliament. It draws on lessons learnt and recommendations stemming from independent research that encompassed a comprehensive review of reports and research studies, and in-depth research on four countries (Finland, the Netherlands, New Zealand and the United Kingdom), as well as a pilot-test for three policy areas (robotics and artificial intelligence, information and consultation of workers, and competition policy – State aid).

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The annexed study was prepared by a research team led by Dr Tine Andersen of the Danish Technological Institute at the request of the European Added Value Unit (EPRS).

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Executive summary

Why this study?

Recent years have witnessed a number of **disruptive events and developments** that have generated significant and sometimes transformational impacts on society. Examples include the global financial crisis in 2008, the Brexit referendum results in 2016 and the outbreak of the coronavirus pandemic in 2020. Current policy design and assessment tools seem to be ill-equipped to deal with the risks such events may entail. Moreover, Better Regulation tools such as ex-ante impact assessment and stakeholder consultation have often been sidelined due to the urgency to act.

Policy-makers are increasingly seeking to '**future proof** policies.¹ In October 2021, the Organisation for Economic Co-operation and Development (OECD) called on governments to enable the development of agile and future-proof regulation.² In November 2021, the European Commission issued a **revised Better Regulation Guidelines and Toolbox** that promotes the integration of strategic foresight into EU policy-making.³ Stress-testing is a strategic foresight method that appears particularly suitable for reinforcing the resilience and robustness of policies and legislation in view of unexpected shocks that could plausibly occur in the future. In a nutshell, stress-testing involves a critical assessment of a piece of legislation's preparedness for the advent of disruptive events and developments. For example, would EU legislation concerning legal migration continue to function as intended if the internet failed? What elements in the legislation would support its resilience in the face of such an event? What additional elements could promote the legislation's resilience to the event?

This study presents a practical methodology to stress-test EU legislation. This methodology can be applied to different policy areas and for different types of EU legislation (e.g. directives, regulations and recommendations). It draws on the lessons learnt and recommendations made following independent research led by Dr Tine Andersen of the Danish Technological Institute (see Annex – DTI Study). The research encompassed a comprehensive literature review, in-depth research in four countries with advanced foresight practices (Finland, the Netherlands, New Zealand and the United Kingdom), and a pilot-test for three policy areas (robotics and artificial intelligence (AI), information and consultation of workers, and competition policy – State aid).

Key findings

Stress-testing policies against a small number of disruptive events is achievable in a limited timeframe and **can generate added value** for the EU law-making process. Stress-testing can help to identify weak points or gaps for closer scrutiny in EU legislation, which could be addressed via proposed amendments or new legislation.

In combination with **strategic foresight**, stress-testing can be applied most notably in the agenda-setting phase, but also in other phases of the legislative cycle. It requires dedicated effort to carry out exercises and to maintain ties and communication with relevant institutions and networks. Stress-testing exercises should **engage policy-makers and stakeholders** at key points in the process. Following these guidelines could promote the relevance of the stress-testing exercise and its outcomes for EU law-making.

¹ Fernandes M and Heflich A. '[Future proofing](#)' EU policies – The why, what and how of stress-testing, European Parliament, July 2021.

² OECD, Recommendation of the Council for Agile Regulatory Governance to Harness Innovation, C/MIN(2021)23/Final, 2021.

³ European Commission, [Better Regulation Guidelines](#), SWD(2021) 305 final, 3 November 2021.

This study presents a step-by-step approach to carrying out stress-testing on EU policies. This approach draws on a range of expertise, tools and methods, including legal analysis, strategic foresight, regulatory policy analysis, narrative storytelling, online stakeholder engagement and SWOT (strength/weakness/opportunity/threat) analysis.

Recommendations

The **European Parliament should consider the use of stress-testing** to support its law-making and scrutiny activities and bolster its role as co-legislator. The organisational arrangements to facilitate the uptake of stress-testing could be inspired by examples from national parliaments. This study highlights the example of Finland, where the national Parliament includes a Committee for the Future.

Stress-testing in the European Parliament should ensure a **participatory and transparent approach** with other EU institutions and stakeholders.

The stress-testing methodology, presented and discussed in this study, will be extended to other policy areas⁴ and legislation at different stages of its policy life-cycle. For this reason and to assist the European Parliament in using the methodology, the European Parliamentary Research Service (EPRS), will continue the stress-testing project in the second half of the ninth parliamentary term.

⁴ In this study, the stress-testing methodology was pilot-tested in three policy areas: robotics and AI, information and consultation of workers, and competition policy – State aid. For more information, please see Annex – DTI Study.

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1. Context and objectives

1.1. Is EU legislation fit for the future?

The EU is a **global leader and 'standard-setter'** in its approach to designing policies and legislation.⁵ This approach, which is governed by the EU's **Better Regulation agenda**, seeks to create 'legislation that achieves its objectives while being targeted, effective, easy to comply with and with the least burden possible'.⁶ In the 2016 Interinstitutional Agreement on Better Law-Making, the European Commission, the Council of the European Union and the European Parliament committed to the pursuit of better law-making across the legislative cycle.⁷ The procedures and tools employed in EU law-making pay considerable attention to **evidence-based input and stakeholder opinions**, with a view to promoting transparency and trust in the EU's public institutions and underpinning the foundations of democracy and good governance.

Weaknesses in the Better Regulation approach have however, been revealed by the increasing complexity and transboundary nature of **crises and disruptive events**, such as the outbreak of the

Box 1 –OECD countries' regulatory response to disruptive events

- Some 15 out of 34 OECD countries do not require impact assessments of regulations introduced during a crisis.
- About 60 % of OECD countries do not have a body overseeing the decision not to carry out an impact assessment, made by government officials.
- Only 4 OECD countries require ex-post evaluations to be undertaken for regulatory proposals which bypass ex-ante impact assessments during crises.
- Of 190 regulations issued in response to the Covid-19 pandemic, only about half included a sunset clause. Review clauses were used to a lesser extent.

Source: OECD, [Regulatory Policy Outlook 2021](#).

Covid-19 pandemic.⁸ Member States have reacted by asking the EU and international bodies to 'do more'.⁹ While the powers of the European Parliament have grown since the Treaty of Lisbon, responses to crisis situations have primarily been shaped by the European Council and the European Commission, due to the urgency to act.¹⁰ Fast-track procedures, which have little parliamentary oversight, have become more common.¹¹ The OECD highlights the **limited scrutiny of regulatory responses especially during crises** such as the coronavirus pandemic (see Box 1).

⁵ OECD, [Better Regulation Practices across the European Union - Highlights](#), 2019.

⁶ European Commission, [Better Regulation Guidelines](#), SWD(2021) 305 final, 3 November 2021. The guidelines were introduced in 2015 and revised subsequently in 2017 and 2021.

⁷ [Interinstitutional agreement between the European Parliament, the Council of the European Union and the European Commission on Better Law-Making](#), 13 April 2016.

⁸ Borges de Castro, R., Anticipatory democracy: Harness the power of people and strategic foresight. European Policy Centre, 10 May 2021.

⁹ Rhinard M., [The crisisification of policy-making in the European Union](#). *Journal of Common Market Studies* 2019 57(3), 616-633.

¹⁰ von Ondarza, N., [The European Parliament's involvement in the EU response to the corona pandemic - A spectator in times of crisis](#), *Stiftung Wissenschaft und Politik (SWP) Comment*, 2020.

¹¹ The introduction of fast-track procedures for crisis situations and early warning systems through administrative decrees has increased over time in the EU. The estimated number of horizon scanning and early warning systems grew from less than 10 in the year 2000 to more than 70 in the year 2015. Backman, S. and Rhinard, M., [The European Union's capacities for managing crises](#). *Journal of Contingencies & Crisis Management* 2017, 26(2), 261-271.

In recognition of the challenges facing society today, the OECD has called on governments to embark on a 'regulatory reboot' and take a more **agile and forward-looking approach** to law-making 'to ensure they can absorb future systemic shocks'.¹² The European Commission has taken some steps forward in this respect.¹³ The recently revised Better Regulation Guidelines call for the systematic integration of strategic foresight in the Better Regulation agenda.¹⁴ Specifically, impact assessments and evaluations should account for megatrends, which are defined as 'long-term global driving forces that are observable in the present and are likely to continue to have a significant influence for a few decades'.¹⁵ However, the revised Better Regulation guidelines do not mention **low-probability, high-impact events** – which are also known as '**black swans**' and '**wild cards**'.

Risk management and contingency planning should be integrated into the legislative procedure. Doing so could help preserve the principles of Better Regulation and ensure that **policies designed today are more robust and resilient to the conditions and challenges of tomorrow**. Stress-testing is a practical method that can support the design of better policies (see Box 2).

The **European Parliament could stress-test existing and newly proposed EU legislation to generate European Added Value**.¹⁶ Its scrutiny of the European Commission's proposals and actions could consider the possible materialisation of disruptive events and developments. Moreover, the European Parliament's own-legislative initiatives could address weak points or gaps in EU legislation. In practical terms, the European Parliament could stress-test EU legislation in any policy area.

A stress-testing capacity in the European Parliament should be embedded within a **broader approach to anticipatory governance**. This is because stress-testing is not a sole solution to future-proof policies and should rather be used 'among a range of methodological and organisational approaches'.¹⁷

Box 2 – How do we define stress-testing EU legislation?

This study defines stress-testing as a method to check if legislation is sufficiently **robust, resilient and reactive** to deal with future scenarios stemming from disruption, in particular extreme events, and to identify possible ways to reinforce the legislation.

It does not serve to predict the future but to **prepare and equip policy-makers** to address disruptive events.

In practice, it means checking if a proposed or existing policy/law is robust and resilient under a future disruptive scenario. While quantitative data can support policy stress-testing exercises, it is not a requirement in the approach we propose.

¹² OECD, [Recommendation of the Council for Agile Regulatory Governance to Harness Innovation](#), 6 October 2021 and OECD, [Government at a Glance 2021](#), 9 July 2021.

¹³ The von der Leyen Commission has prioritised the streamlining of foresight across its activities. For more information, please visit the European Commission's [website on strategic foresight](#).

¹⁴ European Commission, [Better Regulation Guidelines](#), SWD(2021) 305 final, 3 November 2021.

¹⁵ European Commission, [Better Regulation Guidelines](#), SWD(2021) 305 final, 3 November 2021. The Toolbox includes a dedicated tool for strategic foresight – Tool #20 Strategic Foresight for Impact Assessments and Evaluations. The European Commission identifies megatrends to consider in its [Megatrends Hub](#). Horizon scanning looks at phenomena that can be classified into three categories: trends, drivers of change and megatrends. Trends are triggered by drivers of change, some of which provoke change at global level. The latter can be considered to be megatrends.

¹⁶ Fernandes M. and Heflich A., '[Future proofing](#)' EU policies – [The why, what and how of stress testing](#), European Parliament Research Service, 2021.

¹⁷ Please see Annex – DTI Study, Section 2.4.

1.2. Stress-testing could support future-proof EU legislation

This study introduces a practical methodology to stress-test EU legislation – that is, to consider how EU legislation could be adapted and better prepared to face future disruptive events and developments. It takes the European Commission's Better Regulation Guidelines on strategic foresight as its point of departure and is tailored to the role and mandate of the European Parliament as co-legislator and scrutiny body. Stress-testing exercises can be carried out by the European Parliament in the following contexts:

- Scrutiny of new or amending legislative proposals prepared by the European Commission;
- Scrutiny of the operation of existing legislation; and
- Development of own-legislative initiatives in accordance with Article 225 TFEU.¹⁸

Section 2 presents the key findings from our research while Section 3 presents a step-by-step approach for how to stress-test legislation in the European Parliament.

The study is supported by research carried out by the Danish Technological Institute (see Annex – DTI Study). This research is grounded in a comprehensive review of the literature and experiences of several countries that are advanced in institutionalising foresight methods that include stress-testing (Finland, the Netherlands, the United Kingdom and New Zealand).

Subsequent studies are envisaged to build on this research and extend the stress-testing methodology to a larger number of policy fields.

¹⁸ In accordance with Article 225 TFEU, the European Parliament has a right to request the European Commission to take legislative action in a particular area by adopting a legislative own-initiative report.

2. Key findings

Our research generated four key findings, which are described below. These findings draw to a large extent on the supporting research study (see Annex – DTI study).

2.1. Key finding 1 – Stress-testing has direct application to legislation

Stress-testing has direct application to specific policies or laws. Stress-testing can help to pinpoint areas in which policy-makers may suffer from a lack of information and facilitate reflection on the basic assumptions of a policy or law. 'Weak points' identified by a stress-testing exercise can be translated into proposals for amendments and new legislative initiatives. Stress-testing can thus be understood as a **practical method to integrate strategic foresight into regulatory law-making**.

Stress-testing could be carried out in a 'light' manner to identify the extent to which a policy or law performs well across a small selection of future scenarios stemming from disruptive events.¹⁹ Such a 'light' exercise could offer added-value and would be more practical than 'trying to future-proof policies against the entire range of possible futures.'²⁰

2.2. Key finding 2 – Stress-testing is not a common foresight practice

While there are abundant sources that highlight possible disruptive events and alternative futures, there is far less consideration about their practical consideration in law-making.²¹

As noted in the external study (see Annex – DTI study), information about **practical approaches to stress-testing is sparse** outside the financial sector. Stress-testing in the banking sector and a selection of other examples identified in the research are highlighted in Box 3. Several examples are linked to the European Commission Joint Research Centre.

The Covid-19 crisis has incited a new wave of interest among EU policy-makers regarding the importance of anticipatory governance.²² Most recently, EU leaders have named the EU's preparedness, resilience and response systems as a 'cross-cutting political priority for the Union'.²³

¹⁹ As noted in the Annex – DTI Study, stress-testing should ideally be focused on plausible disruptive events for which there are some signals.

²⁰ The external study reached this conclusion following a pilot-test in three policy areas. For more information, please refer to Annex – DTI Study, Section 3. The term 'possible future' follows the taxonomy of four types of future depending on their level of uncertainty (from least to highly uncertain) 1) projected future, 2) probable future, 3) plausible future, 4) possible future, developed by van Dorsser, C., Taneja, P., Walker, W., Marchau, V., 2020, [An integrated framework for anticipating the future and dealing with uncertainty in policymaking](#), *Futures*, vol. 124.

²¹ Please see Annex – DTI study for more information. The study included an in-depth review in four countries: Finland, the Netherlands, the United Kingdom and New Zealand. The country reviews can be found in Appendix 1.

²² European Parliamentary Technology Assessment (EPTA), [Technology assessment and decision making under scientific uncertainty – lessons from the COVID-19 pandemic](#), November 2021, page 13.

²³ The [European Council endorsed](#) the Council conclusions of 23 November 2021 calling to strengthen the EU's crisis response and resilience building approach, General Secretariat of the Council, [Council conclusions on enhancing preparedness, response capability and resilience to future crises](#), 14276/21, 23 November 2021.

Box 3 – Examples of development of futures scenarios and stress-testing

Since the 2008 financial crisis, the European Banking Authority carries out regular **stress-testing of banks** to ensure they have sufficient capital to withstand a negative shock. These tests draw on quantitative forecast models in different stress scenarios (Kupiec, 2020).

- An EU funded project, called IMPRESSIONS, stress-tested selected **EU agriculture and environmental policies measures** against four scenarios that were paired with an extreme and a moderately high climate change scenario (Carlsen, et al., 2017).
- In the Netherlands, local and regional authorities carry out a form of stress-testing as a way to implement the Delta Plan on Spatial Adaptation to **mitigate climate-related risks** (Delta Programme, 2017).
- The European Commission's Joint Research Centre (JRC) developed alternative future scenarios for **rural areas** in the EU to support the development of a long-term vision of a policy response to the issues identified (Bock, 2021).
- The JRC also developed scenarios to explore future challenges for **food safety and nutrition** in the EU and to assess the resilience of current food policies and regulatory frameworks (Mylona, et al., 2016).
- Qualitative scenarios were constructed to assess impacts of disruptive events for **European agriculture** (Mitter et al, 2020). The scenarios were adapted to the Finnish national context (Lehtonen, 2021).

Sources: Mitter H, et al., [Shared socio-economic pathways for European agriculture and food systems: the Eur-Agri-SSPs](#), *Global Environmental Change*, 2020; Lehtonen H. S., et al., [Shared socioeconomic pathways for climate change research in Finland: co-developing extended SSP narratives for agriculture](#), *Regional Economic Change* 21(7), 2021; Kupiec, P. H., Policy uncertainty and bank stress testing, *Journal of Financial Stability*, Volume 51, pp. 1-26, 2020; Carlsen, H., Jäger, J. & Juhasz-Horvath, L., [Assessment of current policies and strategies using stress-testing methods](#), 2017; Delta Programme, [Delta Programme 2018](#), 2017; Bock, A. & Bontoux, L. Food safety and nutrition – how to prepare for a challenging future? New approaches for using scenarios for policy-making, *European Journal of Futures Research*, 5(10), 2017; Bock A et al., [Scenarios for EU Rural Areas 2040](#), 2021.

There is also interest in national parliaments in carrying out policy stress-testing. A survey of national parliaments identified a **lack of established methodologies as the key obstacle** (see Box 4). Time constraints and a lack of appropriate human resources would present challenges, even if such a methodology were available. Nevertheless, some parliaments are actively using other future-proofing methodologies such as horizon scanning and scenario analysis, which could be complementary to and support stress-testing exercises. A link between foresight and policy-making is either assured in parliaments through in-house analytical departments,²⁴ or by parliamentary committees dedicated to long-term future challenges.²⁵

Box 4 – National parliament use of stress-testing

In November 2021, the European Parliamentary Research Service launched a survey in the [European Centre for Parliamentary Research and Documentation \(ECPRD\) network](#). Some 28 replies were received from member parliamentary chambers, of which 20 were from EU Member States. The replies highlighted a variety of foresight and anticipatory practices experiences, but none reported systematic stress-testing of national policies.

²⁴ For example the UK's [Parliamentary Office of Science and Technology](#) and [Estonia's Foresight Centre](#).

²⁵ Seven parliaments around the world have dedicated committees that focus on the future: Brazil, Chile, Iceland, Finland, Lithuania, the Philippines and Uruguay. However, other committees in many countries – not named 'for the future' – have long-term future considerations in their remit (Austria, Canada, Estonia, France, Japan, Poland, Thailand and Vietnam). This information was obtained from an interview with the secretariat of the Finnish parliament's Committee for the Future.

2.3. Key finding 3 – While some sectors are more amenable to stress-testing, it could offer value in all policy areas

Some policy areas – such as the environment, transport and fiscal policy – are considered to be more amenable to stress-testing, due to the availability of data and the possibility to quantitatively model future scenarios. However, quantitative analysis alone without qualitative considerations may not be sufficient.²⁶ Moreover, the pilot tests carried out for this study find that **qualitative analysis can be appropriate** and yield useful findings.²⁷

In the examples of stress-testing identified (see Box 3), the selection of the disruptive event and its impacts have typically been limited to a specific policy area. However, **considering disruptive events and impacts outside the policy area of the legislation during a stress-testing exercise could reveal other important vulnerabilities**. Stress-testing – as with other foresight activities – should be open, inclusive and account for interconnections between different policies and sectors. Nonetheless, a stress-testing exercise should consider adaptations to the specificities of the policy area of focus and draw on the most relevant methods (see Annex – DTI Study).

2.4. Key finding 4 – Policy-makers should be involved and engaged in stress-testing exercises

As with other foresight exercises, stress-testing exercises are typically prepared for policy-makers rather than with them. The research found that policy-makers tend to be sceptical of anticipatory exercises and are more focused on shorter-term objectives. Nonetheless, the **links between independent agencies or bodies carrying out such exercises and policy-makers appear to facilitate policy impact**.²⁸

To ensure the added value of stress-testing exercises, processes could thus be put into place to involve and engage policy-makers. The use of appropriate communication methods and facilitators could support policy-makers in considering 'how long-range issues have near-term manifestations that connect to their immediate needs and priorities'.²⁹ Ensuring adequate resources would be key for the success of stress-testing (this includes both time and staffing). However, stress-testing exercises can be adapted to the time and resources available.³⁰

²⁶ Please see Annex – DTI Study for more information. This issue was also highlighted in a workshop on 'Strategic foresight and quantification link for better future-oriented policymaking' during the 2021 EU Conference on modelling for policy support organised by the JRC.

²⁷ Please see Annex – DTI Study, Section 3 for more information. Pilot-tests were carried out in three policy areas: robotics and artificial intelligence, information and consultation of workers, and competition policy – State aid.

²⁸ Please see Annex – DTI Study, Section 4.

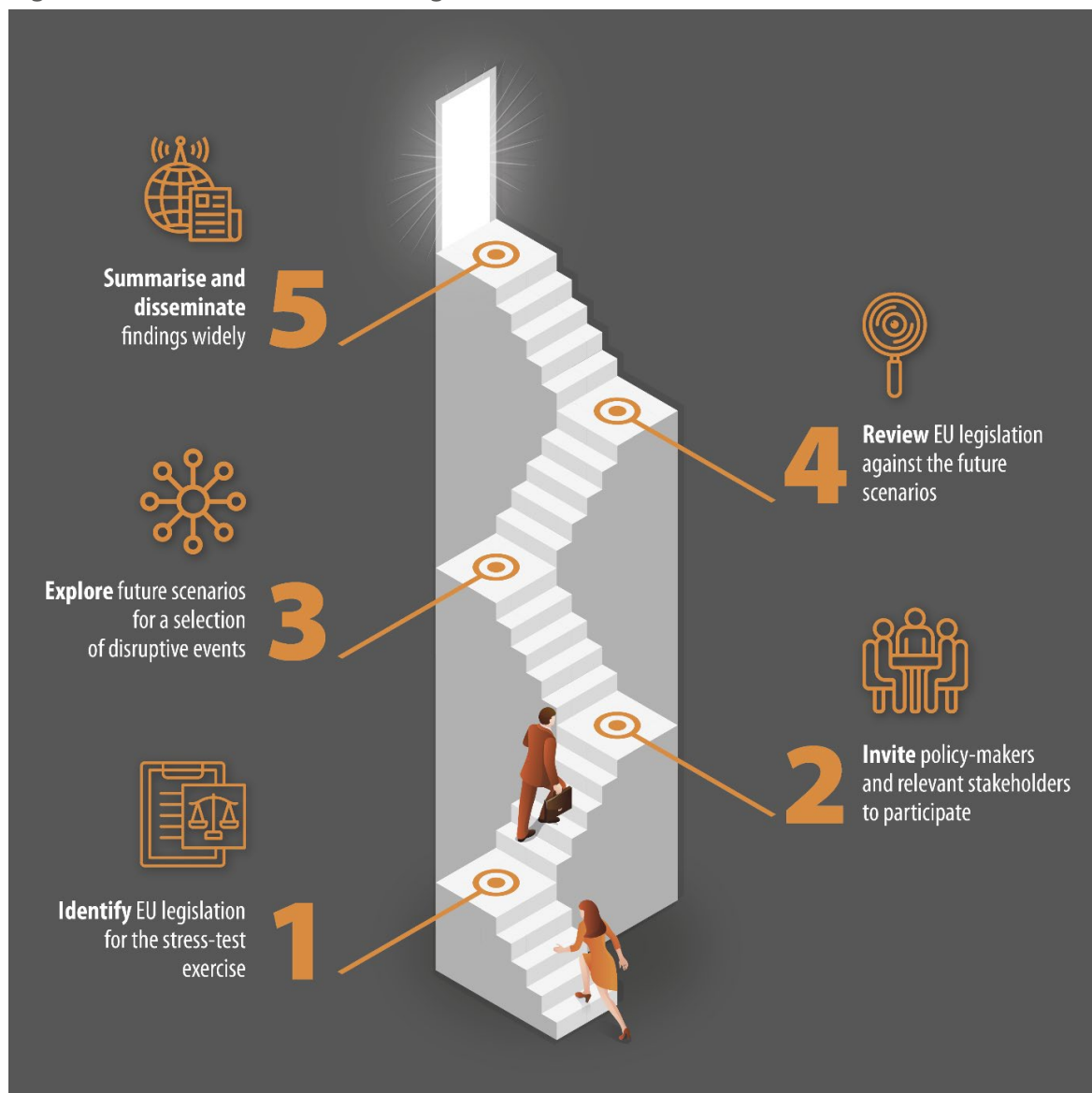
²⁹ Please see Annex – DTI study, Section 4.1.1 and Fuerth (2012), op.cit.

³⁰ Please see Annex – DTI Study, Section 4. The three pilot-tests were carried out in two to three months.

3. A methodology to stress-test legislation in the European Parliament

This study introduces a five-step methodology to stress-test EU legislation in a policy area (see Figure 1). This methodology will be further tested through subsequent studies during the second half of the 9th legislature of the European Parliament.

Figure 1 – How to stress-test EU legislation



Source: Authors' elaboration, graphics: Samy Chahri, EPRS.

Note: These steps draw on the research presented in Annex – DTI Study.

Stress-testing exercises require methodological expertise in legal analysis, strategic foresight, regulatory policy analysis, narrative storytelling, crowd-sourcing and SWOT analysis. Additional expertise may be relevant, depending on the policy area in focus and the selected methods for analysis.

Regarding the resources dedicated to stress-testing and its organisation within the European Parliament, the approach could be inspired by examples from national contexts. One notable example is Finland, where the national parliament has a standing Committee for the Future.³¹

3.1. Step 1 – Identify EU legislation for the stress-test exercise

The first step is to identify the central piece of EU legislation that will be subject to the stress-testing exercise. **Any type of EU legislation can be considered.**

The selection of the EU legislation should consider the following questions:

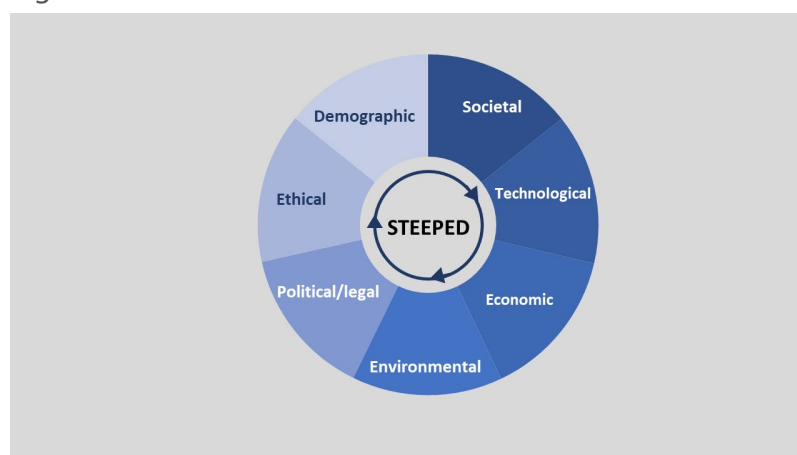
- Which EU legislation is being reviewed and/or proposed in the European Commission's work programme?
- Are there plans for a European Parliament legislative own-initiative report?³² What is the relevant EU legislation in consideration?
- In which policy areas have stakeholders called for a stronger EU role?

Policy challenges are increasingly complex and do not fall strictly within one policy area. For this reason, stress-testing exercises should take into account interdependencies with legislation in other policy areas or cross-policy impacts.³³

3.2. Step 2 – Invite policy-makers and relevant stakeholders to participate

A successful stress-testing exercise requires input from a **broad and diverse set of policy-makers and stakeholders**. These persons should not be limited to well-known experts as is typical, but also include citizens and business representatives that reflect all the dimensions of STEEPED (see Figure 2). Wider stakeholder engagement could be facilitated through surveys, workshops and crowd rating, which was explored in this study.³⁴ **Online engagement methods and tools** can help ensure a comprehensive coverage of opinions from all

Figure 2 – The STEEPED scheme



Source: van Woensel L., [Guidelines for foresight-based policy analysis](#), European Parliament, July 2021.

³¹ The Committee for the Future in Finland's national parliament prepares future reports that may include legally binding resolutions that can carry over to the subsequent legislature. The Committee does not discuss legislative proposals, but issues future-oriented binding recommendations in relation to the Government Report on the Future. (see Appendix 1 – Country studies).

³² In accordance with Article 225 TFEU, the European Parliament has a right to request the European Commission to take legislative action in a particular area by adopting a legislative own-initiative reports.

³³ van Woensel L., [Guidelines for foresight-based policy analysis](#), European Parliament, July 2021.

³⁴ Crowd rating is a method that can gather opinions from a 'crowd'. It was applied in Annex – DTI Study.

stakeholder groups.³⁵ This broader outreach can strengthen stakeholders' involvement in law-making, society's futures literacy, and support the key principles of Better Regulation. Policy-makers can be engaged throughout, from the early stages of the stress-testing exercise to the communication and implementation of the findings.

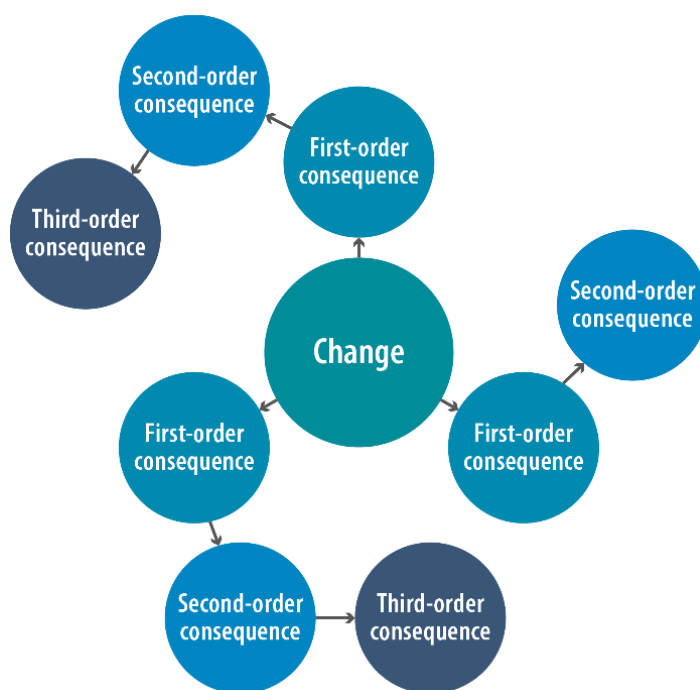
3.3. Step 3 – Explore future scenarios for a selection of disruptive events

In this step, future scenarios should be developed for a selection of possible future disruptive events. This selection can be made from the Risk & Capabilities Monitor developed by the European Parliament,³⁶ as well as collections of 'wild card' events, such as that produced in the *iKnow Project*.³⁷ The pilot stress-tests carried out as part of this research considered the following disruptive events: a large-scale cyber-attack, prolonged drought and wildfires in the Mediterranean and an outburst of the black economy.³⁸

The selection of disruptive events could draw on input from policy-makers and stakeholders and should not attempt to be comprehensive, but rather to reflect the spectrum of the types of shock.

The potential consequences of each selected disruptive event should then be considered. This can be done in a visual manner, using a **Futures Wheel** (see Figure 3). To the extent possible, the linkages between change and consequences should be substantiated by available

Figure 3 – Future Wheel illustration



Source: Fernandes M and Heflich A., '[Future proofing' EU policies - The why, what and how of stress-testing](#), European Parliament, July 2021.

³⁵ Scientific Foresight Unit (STOA), [A framework for foresight intelligence: Part 2: Online stakeholder engagement](#), November 2021.

³⁶ The monitor is based on a series of 'resilience and capabilities' studies led by the European Parliament that include: Towards a more resilient Europe post-coronavirus: Bassot, E., et al, [An initial mapping of structural risks facing the EU](#), European Parliament, 2020; Bassot, E., et al, [Towards a more resilient Europe post-coronavirus: Capabilities and gaps in the EU's capacity to address structural risks](#), European Parliament, 2020; Bassot, E., et al, [Towards a more resilient Europe post-coronavirus: Options to enhance the EU's resilience to structural risks](#), European Parliament, 2021.

³⁷ Miles, I. et al., 2011. Wild Cards – Policy Alerts from [iKnow Project](#).

³⁸ Please see Annex – DTI Study, Section 3 for more information. Pilot stress-tests were carried out in three policy areas: robotics and AI, information and consultation of workers, and competition policy – State aid.

evidence and data.³⁹ A **qualitative assessment of all the consequences** may strike the right balance and serve the needs of the stress-testing exercise.

The results of the Future Wheel exercise could be summarised in a **narrative storytelling format** for policy-makers and relevant stakeholders, who may suggest the addition or removal of consequences and/or a re-ordering of consequences.⁴⁰ This approach can help **overcome cognitive biases** and promote the serious consideration of what the potential consequences of a disruptive event could entail.⁴¹

3.4. Step 4 – Review EU legislation against the future scenarios

The EU legislation should then be analysed to identify its **main objectives and the measures envisaged to deliver these objectives**. The review should also detect **elements of flexibility**, which may include articles or clauses that allow for a modified application of the legislation due to changing circumstances and/or conditions.⁴²

For a selection of consequences identified in the Future Wheel exercise, any potentially relevant provision/measure of the EU legislation under consideration should be noted, as well as how it might apply in relation to the consequence. This assessment may consider whether Member States would have discretion to act, if financing could be made available and if other relevant legislation (including national legislation) might apply. Possible gaps in the EU legislation with respect to a consequence should also be identified. This assessment may draw on a wide range of research and analysis as well as expert and stakeholder opinion.

3.5. Step 5 – Summarise and disseminate findings widely

The findings of the stress-testing exercise should be summarised in a short report that addresses the following questions:

1. Which EU legislation was the focus of the stress-testing exercise and why was it selected?
2. What strengths and opportunities were identified in the EU legislation? What weaknesses and threats were identified? What are the key provisions/measures?
3. What are the possible legislative 'solutions'? What is their potential legal basis and EU added value?
4. What are the recommendations for the European Parliament?

These reports could serve as a **call to action** and could contribute to and/or provide the basis for the European Parliament to take an own and/or legislative initiative, or provide input for amendments in an ongoing legislative process.

³⁹ An in-depth quantitative analysis may not be feasible due to the limited timeframe. It may also be undesirable, due to the need to maintain a broad scope in the consideration of the possible consequences.

⁴⁰ A useful example to communicate future scenarios is: European Union Institute for Security Studies (EUISS), [What if... not? The cost of inaction](#), Chaillot Paper 163, 22 January 2021.

⁴¹ For more information, please see: Denning S., *The Leader's Guide to Storytelling*, Wiley Publishing, 2005; McCall, B., Shallcross, L., Wilson, M., Fuller, C. and Hayward, A., *Storytelling as a research tool and intervention around public health perceptions and behaviour: a protocol for a systematic narrative review*, British Medical Journal, Vol 9 Issue 12, 2019; Ramos J., Linking Foresight and Action: Toward a Futures Action Research, *The Palgrave International Handbook of Action Research*, 2017, pages 823-842.

⁴² Potential elements of flexibility include: sunset clauses, review clauses, emergency exceptions/clauses, discretion, sandboxes and the precautionary principle. For more information please refer to Annex – DTI Study.

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Stress-testing EU policies

Research paper

Our legislation is not currently prepared for events like a shutdown of the internet or a pandemic. In this respect, policy stress-testing can serve as a simulation exercise, in which the provisions in a piece of legislation are subjected to theoretical stress, much like industrial products are stress-tested to ensure that they are durable and do not present dangers to consumers. This is an attractive idea that is gaining followers in a time of turbulence, where even advanced forecasts fall short of providing assurance that policies designed today will be effective tomorrow. The overall aim of this study is to identify possible methodologies and approaches that the European Parliament could apply to stress-test policies, and to analyse the benefits and challenges associated with these approaches. The study involved an in-depth literature review, an investigation of practices in four country examples, development of a methodology for stress-testing, and a pilot stress-test of legislation within three EU policy areas: robotics and artificial intelligence; information and consultation of workers; and competition policy – State aid. The study finds that while no model for policy stress-testing exists that could be applied to EU policies as a ready-to-use system, there is value to testing legislation against a small, but carefully selected, number of high-impact, low-probability events. The study provides recommendations to the European Parliament, should it decide to adopt stress-testing as a means to increase the resilience of EU policies.

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Executive summary

Policies are often ill-equipped to deal with events with low probability but significant impact (high-impact, low-probability events, or HILPs). Stress-testing policies is an attractive idea that is gaining followers in a time of turbulence, where even advanced forecasts fall short of providing assurance that policies designed today will be effective tomorrow. Hence, the idea of stress-testing policies resonates with the *bon mot* of many foresight professionals: *'The future cannot be known'*.

Stress-testing policies is essentially a simulation exercise, in which policies or concrete legislation is subjected to theoretical stress, much like industrial products are stress-tested to ensure that they are durable and do not present dangers to consumers.

The overall aim of this study is to **identify possible methodologies and approaches that the European Parliament could apply to stress-test policies** and to analyse the benefits and challenges associated with these approaches. A central hypothesis of the study is that policies that have been stress-tested may perform more robustly and generate more value in a world increasingly characterised by uncertainty and complexity. The study aims at testing this hypothesis and drawing out lessons for policy-making in the European Parliament.

Approach and methodology

The study involved an in-depth literature review, four country studies, development of a methodology for testing, and a pilot stress-test. **The literature review** focused on establishing the prevalence of stress-testing policies as well as gathering information about methods used. **Country studies** involving desk research and interviews with relevant stakeholders (for example, the secretariat of the Committee for the Future in the Finnish national parliament), were carried out in four countries: Finland, the Netherlands, New Zealand, and the United Kingdom. The country studies addressed research questions concerning the role, purpose, organisation, and impact of stress-testing at the national level.

Based on findings from these initial research tasks, a methodology for a **pilot stress-testing exercise** was developed. The methodology included three separate but linked analytical tasks:

- Identifying indicators of flexibility in the selected pieces of EU legislation;
- Retrospective analysis: Assessing how the EU legislation has performed during the Covid-19 pandemic;
- Prospective analysis: Developing and validating scenarios based on plausible high-impact events and gauging the resilience of the EU legislation, should the scenario materialise.

Subsequently, **this method was applied to pieces of legislation within three EU policy areas**: robotics and artificial intelligence (AI); information and consultation of workers; and competition policy – State aid. The table below gives an overview of the selected pieces of legislation within the three policy areas and the scenarios used in the pilot stress-test of each piece of legislation.

Overview of pilot test to develop a stress-testing methodology

Policy area	EU legislation subjected to stress-testing	Disruptive events considered
Robotics and artificial intelligence	<ul style="list-style-type: none"> ➤ The proposed AI Act (COM(2021) 206 final) 	<ul style="list-style-type: none"> ➤ Large-scale cyber-attack ➤ Europe (and the world) flooded
Better information for and consultation of workers	<ul style="list-style-type: none"> ➤ The Directive on mass redundancies (Council Directive 98/59/EC of 20 July 1998 on the approximation of the laws of the Member States relating to collective redundancies) ➤ The Directive on safeguarding employees' rights in case of transfers of undertakings (Council Directive 2001/23) ➤ The Directive on a general framework for workers' consultation (Council Directive 2002/14) 	<ul style="list-style-type: none"> ➤ Prolonged drought and wildfires in the Mediterranean ➤ Global economic crisis.
Competition Policy - State aid	<ul style="list-style-type: none"> ➤ State aid rules (Articles 107 (2) (b) and 107 (3) (b) TFEU) in conjunction with the temporary frameworks put in place through various EU Commission Communications (Soft Law) 	<ul style="list-style-type: none"> ➤ New pro-war US president ➤ An outburst of the black economy

Source: Authors.

Lessons learnt

The research clearly indicates that no model for stress-testing policies exists that could be applied to EU policies as a ready-to-use system. Stress-testing, as conceptualised in the study is found to be used in some sectors and in some policy areas across countries. Stress-testing policy elements against quantitative scenarios using statistical modelling of sector-specific indicators is relatively common in e.g., environmental policy, transport policy, or fiscal policy.

The research has not found examples of policies or legislation being stress-tested against events that originate or whose main impact is felt outside the policy domain. **However, policies are vulnerable to all sorts of events, including such that originate in other domains**, as the example of Covid-19 clearly illustrates, and stress-testing should reflect this.

Overall, stress-testing policies does not eliminate a need for continuously reviewing policies, and it may be of little value if exclusively conducted at the end of the policy process to assess robustness against a limited selection of possible futures. **Stress-testing policies should ideally be accompanied by adaptive approaches to policy design.**

Overall, the methodology developed in the study worked well. The pilot test demonstrated that value can be got from testing only against a small, but carefully selected, number of HILPs, and that approaches are available that allow for a systematic selection of HILPs; that access to an updated catalogue of HILPs is vital for selecting relevant events; that drawing out consequences of HILPs is best done by mixed groups; that online facilitation tools work well for brainstorming scenarios; and that time and resources can be adapted flexibly.

However, it is crucial that **the objective(s) of stress-testing policies are made clear, and that the exercise itself carefully scoped and planned in order to achieve its objectives.** If stress-testing is to be of value, it must be repeated regularly to ensure that a policy remains capable of

withstanding a wider range of adverse events and developments, including those that may only be anticipated when reviewing a policy again at a later point in time. Challenges to consider include:

- **The selection of hypothetical future HILPs**, which requires both knowledge and the ability to envision the future.
- **Scoping of the stress-test**, which requires that a process is put in place that will allow policy-makers to select the most relevant stressors from a catalogue of HILPs.

Concerning the organisation of policy stress-testing, the research found that, in all four case countries as well as in the EU, **independent, but publicly funded, agencies/bodies are tasked with foresight and developing policy-relevant scenarios**. The closer the link between such bodies and parliament or ministries, the more visible the impact on policy-making. For example, in Finland, a parliamentary Committee for the Future has been set up to discuss and validate foresight carried out by the Finnish Government and by foresight experts.

It is a priority to address the right level of uncertainty and specificity to ensure that resources spent on stress-testing against HILPs do not exceed resources set aside for general preparedness for contingencies. A desire to create robust policies requires resources that increase with the number of events or scenarios that is considered. In this perspective, resilience through anticipation, adaptability of policies, and an agile implementation system seems to be preferred by the case countries.

Recommendations – on methodology

The research team recommends to **carefully consider the policies and legislation that should be subjected to stress-testing, and at which stages of the policy cycle stress-testing should take place**. One model could be to require that all proposals for legislation must undergo a 'light' stress-test much like the one carried out in the pilot exercise, while the review of legislation which has been in place for a certain number of years could include a more thorough stress-test against more carefully elaborated scenarios.

The study recommends limiting the number of scenarios in stress-testing. Increasing the number of scenarios requires resources, and also makes the scenarios more difficult to communicate to the stakeholders. **The time horizon to consider in a stress-test should be decided with a view of the nature of the policy area and legislation in focus**. Some policy environments may be characterised by less or a somewhat lower pace of change over time, while others may be linked to more frequent disruptive developments or events.

While knowledge and data are at the root of scenario-building, the pilot exercise indicates that **stress-testing does not have to involve large amounts of quantitative data nor statistical modelling**. Stress-testing against qualitative scenarios can reveal significant vulnerabilities and strengths in the legislation tested.

It is recommended to make as much use as possible of existing foresight knowledge or existing scenarios, since time for stress-testing is likely to be a limited resource in the policy cycle. In particular, the 'four generic alternative futures' (business as usual; adaptation to limits to growth; collapse; and transformation (Dator, 2009)) represent a framework for effective development of distinct scenarios, which can be adapted as necessary to a specific policy area.

Stress-testing focuses on ensuring that policies are capable of withstanding or adapting to adverse future events or developments. To avoid that policy focus becomes concentrated on negative expectations to the future and less on improvement and innovation, **it is recommended to also examine how policies contribute to desired futures**.

Recommendations – on organisation

It is recommended to **make the best use of available structures, networks, resources, and knowledge rather than building an organisational unit for stress-testing from scratch**. Significant resources do not only exist within the EU system itself. It is recommended to **map foresight resources in Member States** to create a network that can contribute to gathering intelligence. Member States' governments and parliaments are responsible for the implementation of EU policies and should therefore be involved in stress-testing. **It is recommended to support stress-testing at the decentralised level with know-how and training**. For example, in the Netherlands, the regions and municipalities are required to stress-test infrastructure policies against climate scenarios.

It is strongly recommended that stress-testing processes involve policy-makers. This can ensure commitment from policy-makers and also encourage them to consider alternative options. Involvement can take place e.g., in the form of a parliamentary committee, but other models could be considered.

It is recommended to always involve stakeholders from a variety of stakeholder groups or positions, representing different perspectives on the future and the plausibility of future events, since this will contribute to the robustness of the conclusions of a stress-testing exercise.

To carry out stress-testing in an organisation requires dedicated resources as well as links to other policy institutions and academic institutions. Sufficient resources and organisational capacity is required to facilitate systemic uptake of stress-testing.

However, as the pilot test clearly indicated, **the scope and the methods used in a stress-testing process can be scaled to the time and resources available**. The number and level of detail of scenarios to use in stress-testing should be kept at a feasible level, just as stakeholder involvement should be planned with a view to resource requirements. The services of external experts may be enlisted to support stress-testing exercises, as is common practice across government departments in the country case studies.

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1. Introduction

1.1. Context and objectives

This report sums up the findings of a study on 'Enhancing the design and performance of EU policies through 'stress-testing' – methodological considerations and approaches' carried out under the Framework Contract EPRS/DIRC/SER/19/002/LOT 1. The study was carried out by a team led by the Danish Technological Institute at the request of the European Parliamentary Research Services, European Added Value (EAVA) Unit.

The European Parliament Research Service has highlighted the need for stress-testing at the EU level and has taken first steps to strengthen the Parliament's anticipatory capacity (Fernandes & Heflich, 2021). In this context, the overall aim of the study is to identify possible methodologies and approaches that the European Parliament could apply to 'stress-test' policies and to analyse the benefits and challenges associated with these approaches. The unfolding event of the Covid-19 pandemic and the observation that its impacts have been serious far beyond the area of public health and the health sector has highlighted the timeliness of the study.

Text box 1-1: Examples of real and hypothetical events challenging the robustness of policies

- The Fukushima nuclear power plant disaster (due to a tsunami caused by an earthquake)
- A coup d'état in China
- The earth being struck by a meteorite
- A pandemic rapidly killing more than 500 000 people in a country
- The total collapse of the internet

Source: (Mendonça, et al., 2004; Heinonen, 2013)

The pandemic is, however, only one among many disruptive events that potentially challenge the assumptions underpinning national and European policies. While megatrends like climate change,

Text box 1-2: Definition of policy stress-testing used in the study

Stress-testing checks the stability, strength, and 'health' of a particular policy in the context of shocks (i.e., high-impact, low-probability events) beyond regular or operational norms and provides guidance on areas in need of improvement, restructuring, or rebuilding.

Source: Authors

or the digital transformation of society, as well as the potential associated risks, are widely acknowledged, risks of disruptive events are rarely considered in a systematic manner when designing policies and drafting legislation. Hence, policies are often ill-equipped to deal with events with low probability but significant impact (*high-impact, low-probability events, or HILPs*). In this context, policy stress-testing can be seen as a *simulation*

exercise, where policies or concrete legislation is subjected to theoretical stress, much like industrial products are stress-tested to ensure that they are durable and do not present dangers to consumers.

A central hypothesis of the study, then, is that policies that have been stress-tested may perform more robustly and generate more value in a world increasingly characterised by uncertainty and complexity. The study aims at testing this hypothesis and drawing out lessons for policy-making in the European Parliament.

1.2. Overall study methodology

The study draws on an in-depth literature review and country studies. Based on findings from this study, a pilot stress-testing exercise was carried out.

To enable the research to serve as the basis for recommendations on stress-testing, a series of research questions have guided the research.

1.2.1. Research questions

The research questions are listed below according to type.

Questions concerning the prevalence of policy stress-testing

- Which OECD countries have carried out stress-testing and in what policy areas and stages in the policy cycle?

Questions concerning the role and impact of stress-testing in policy formation

- What is the purpose of stress-testing at a national level?
- To what extent do outcomes and lessons learnt from stress-testing (and other foresight activities) influence the final policy design?
- Has stress-testing led to improved performance and robustness of policies?

Questions concerning methodological approaches

- What are the key elements in stress-testing activities at a national level (e.g., stakeholder consultation, survey)?
- How do stress-testing activities interlink with and support other activities, e.g., foresight and scenario analysis?
- Which time horizons are applied?
- To what extent do activities focus on high-impact, low-probability events (HILPs)?
- Are specific types of HILPs considered?
- Is the focus on HILPs dependent on sector or policy area?
- Is the performance of policies that have been stress-tested monitored during implementation?
- What are the key elements in stress-testing methodologies across countries and policy areas?

Questions concerning the potential role of stress-testing in EU policy-making

- Which lessons and recommendations can be taken from national examples for the development of a stress-testing methodology for EU policies?
- To what extent did the EU legal framework provide tools and measures to respond to the Covid-19 pandemic? To what extent were new measures and instruments introduced in response to the Covid-19 pandemic? To what extent were these new measures and instruments due to an absence of provisions in the legislative framework?
- Considering a range of high-impact events, what are the key tipping or breaking points in the EU legislative framework? To what extent could these weak points be reinforced through legislative amendments and non-legislative action at the EU level?
- Are there drawbacks or trade-offs to 'future-proofing' the legislation?

1.2.2. Literature review

The detailed methodology for the literature review is described in Section 2. The literature search initially identified 1 900 sources of which 125 were deemed relevant for the study. The research team reviewed these sources, as well as additional sources that were quoted by websites visited in connection with the country studies or suggested by interviewed stakeholders. The review comprised academic literature, accounts and documents describing the application of foresight and stress-testing methodologies in policy contexts at national and EU levels, country studies, policy documents, and legislative sources.

1.2.3. Country studies

Country studies were carried out in four countries. Based on a preliminary scanning responding to the first research question above, the following four countries were selected for an in-depth analysis of their use of policy stress-testing:

- Finland,
- the Netherlands,
- New Zealand, and
- the United Kingdom.

The country studies involved desk research and interviews with key stakeholders. They addressed the research questions concerning the role, purpose, and impact of stress-testing in national policy formation. Section 2.6 presents how stress-testing is organised in those four countries. Details of country studies can be found in Appendix 1.

1.2.4. Pilot stress-testing

To examine how stress-testing can be used in an EU policy context, a pilot stress-test was carried out. It involved selecting concrete pieces of legislation in three EU policy areas (AI and robotics, information and consultation of workers, and competition policy), retrospectively assessing the performance of the EU legislation during the Covid-19 pandemic and testing them against scenarios developed from hypothesised high-impact, low-probability events. The methodology for the pilot test is described in detail in Section 3.

2. How to stress-test policies? Findings from a literature review and country studies

This section presents the outcomes of an in-depth literature review and four country case studies consisting of two EU Member States and two non-EU Member States. Both tasks were conducted to examine the nature of policy stress-testing as well as explore current forms of its application.

2.1. Methodological notes

The *literature review* covered a wide range of sources on stress-testing and related strategic foresight activities, including books, journal articles, reports, and policy toolkits. The *country case studies* examined how policy stress-testing is understood and used in Finland, the Netherlands, New Zealand, and the United Kingdom, which all had previously been identified by our research team as having made significant progress towards integrating strategic foresight in their policy process.

Insights from the country studies are used throughout this section to supplement findings from the literature review, for example to compare the concept of stress-testing as defined in the foresight literature with the understandings of it in different national contexts. All four case studies are based on in-depth interviews with national foresight and policy experts as well as additional desk research. Country fiches separately summarising the results of each case study can be found in Appendix 1.

The sources screened for the literature review were identified through a combination of methods. Initially, a systematic search of the full-text database Scopus was conducted, using a combination of search terms, including 'policy stress-test(ing)', 'policy risk assessment' and 'anticipatory legislation'. As mentioned, the search yielded more than 1 900 search results. A preliminary screening of the abstracts however showed that a substantial amount was irrelevant for this study. The research team, therefore, augmented its approach using snowball referencing and the gathering of recommendations from interviewed stakeholders. The sources were assessed according to their relevance and value for this study and partly cover literature that refers to the concept of stress-testing by other terms, such as 'wind tunnelling' and 'red teaming'.

This led to a total of 125 relevant sources, of which 95 sources were subjected to further analysis for the literature review. The literature base is mainly composed of academic journal articles and papers (47 %), studies and reports from various EU institutions and organisations (17 %), and the OECD (5 %). Government documents (14 %) and sources from private organisations, projects, and other types of publishers (17 %) make up the remainder of the analysed literature.

The following sub-sections are structured according to specific topics, starting with an examination of the concept of stress-testing and moving on to describe why and how policy stress-testing is conducted. The two last sections focus on how stress-testing is organised, and its results used in the four countries examined closer for this study.

2.2. The concept of stress-testing

From a historical perspective, **stress-testing can be traced back to military and security studies**. War games, also referred to as simulations or exercises, have been used since the middle of the 19th century in a military context to explore diverging battlefield scenarios and their consequences. Originally, this encompassed the use of table-top war games with figurines representing armies, or the staging of field exercises using real troops and equipment. Following their dispersion, computer systems were also used for the simulation of different scenarios and the assessment of their outcomes (Milne & Longworth, 2020).

As an approach to testing the performance of different strategic options against adverse future developments, wargaming is closely related to stress-testing and has been applied in both corporate and policy contexts (Kubarych, 2001; Orišek & Schwarz, 2008). The relationship between the two methods is not clearly defined, but nonetheless evident in the foresight literature. Tönurist & Hanson (2020), for example, describe 'gaming' as a structured exercise with the purpose of stress-testing decisions in a complex environment that is based on the simulation of different

Text box 2-1: Stress-testing and strategic foresight

Stress-testing is one among a range of different, but interrelated, strategic applications of foresight methods. Regardless of the concrete purpose, strategic foresight aims to anticipate possible future developments and allow policy-makers to take these into consideration when designing and developing policies. These methods include a range of different future-oriented approaches, such as horizon scanning, back-casting, gaming, road mapping and scenario planning

Sources: UNDP Global Centre for Public Service Excellence (2018); OECD (2019); Leitner et al. (2020).

scenarios. In a similar manner, Fiott (2019) likens stress-tests to the wargaming or simulation of crisis situations. Finally, the British Ministry of Defence (2013) relates wargaming to the concept of stress-testing in its handbook on 'red teaming', which involves the application of different techniques to enhance the robustness of decisions in the face of challenging and adverse situations.

In line with these findings, stress-testing is described by British policy advisers interviewed for this study as a way of planning for disruptive future events that may have an impact on, or even derail, specific policies that are being assessed. It is understood as a deliberate process whereby proposed or existing policies are subjected to stresses that could possibly emerge, to identify vulnerabilities and help with the development of contingency measures. Likewise, foresight practitioners and policy experts interviewed for the New Zealand case study relate stress-testing to risk analysis, stating that it involves the testing of policies against a set of scenarios based on identified risks and their possible future impact. In Finland, the main focus is not on stress-testing, but on anticipatory policy-making. However, a form of stress-testing takes place in the National Emergency Supply Agency, where contingency plans are developed to ensure the supply of strategic resources (energy, food, healthcare, defence) in different risk scenarios (source: expert interviews).

There is a heightened interest among policy-makers in using stress-testing to enhance the resilience and robustness of policies in the face of an uncertain future. It is the hope that stress-testing methods can be applied to future-proof proposed or existing policies against potentially disruptive trajectories of known trends as well as sudden events or shocks that can have significant impacts on society (OECD, 2019; Fernandes & Heflich, 2021).

Following the 2008 Global Financial Crisis, **mandatory stress-testing was introduced in the financial sector to assess whether banks and other financial institutions have enough capital to withstand a negative shock**, in Europe in the shape of the EBA Europe-wide stress test.¹ Fiscal stress-tests use econometric models to forecast how financial institutions can be expected to fare in hypothetical multi-year economic stress scenarios (Kupiec, 2020). Since stress-tests have been common practice in the financial sector for some time, a significant amount of the literature on stress-testing relates to fiscal stress-tests, see for example Magnus et al. (2019), Chattta and Alhabshi

¹ For more information, please see the website of the European Banking Authority: <https://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing>.

(2020), Luu and Vo (2021). However, Kupiec (2020) concluded that several of the methodologies used for stress-testing the regulatory capital of financial institutions are unreliable.

Kupiec examined the accuracy of three different econometric models in predicting the performance of a number of American banks during the 2008 financial crisis and following the recession. His study uses two types of data sources to create different stress-testing models, namely representative (or 'pooled') bank data and pre-2008 historical data from individual banks. The outcomes show that representative bank model forecasts differed significantly from the forecasts based on bank-specific models, as well as from the actual outcomes. Depending on the econometric model used, the number of banks that was forecast to fail varied dramatically, and there was little overlap between the group of banks forecast to fail and those that ended up failing in the real turn of events (Kupiec, 2020). Given this analysis, and assuming that the structure and scope of EU policies and legislation is of considerably higher complexity than banking, **a direct transfer of this type of quantitative methodologies alone seems inadequate.**

Hence, to address and answer the study's research questions as best as possible, this section focuses on the growing body of literature describing and discussing stress-testing and related methods to enhance policy design and performance in a wider sense.

The United Kingdom's Government Office for Science (2017) has developed *the Futures Toolkit*, which offers a catalogue of strategic foresight methods and guidance on how these can be applied in the policy process. *The Futures Toolkit* emphasises that stress-testing as a policy tool builds on other foresight methods. These include horizon scanning, which seeks to gather information on emerging trends and developments, as well as scenario development, where outcomes of horizon scanning activities are used to create different scenarios of possible futures (see section 2.4.1). On this background, the Government Office for Science offers the following definition:

Policy stress-testing is a method for testing policy, strategy, or project objectives against a set of scenarios to see how well the objectives stand up to a range of external conditions.

(Government Office for Science, 2017, p. 64)

In a similar manner, the *Foresight Manual* of the UNDP Global Centre for Public Service Excellence (2018) describes 'wind tunnelling' as a foresight method to test a set of strategic objectives against different scenarios. This approach involves the creation of a 'Scenario-Strategy-Matrix', where strategy options and their performance are evaluated in a range of scenarios with the help of four criteria, namely Strategic Fit, Cultural Fit, Economic Performance and Risk Performance (UNDP Global Centre for Public Service Excellence, 2018).

The Centre for Strategic Futures (CSF) in Singapore emphasises the value of stress-testing as an assessment tool in its foresight glossary. It defines stress-testing as a method to increase the robustness of existing policies '...by identifying potential breaking points and instances of failure along possible policy trajectories' (CSF & Civil Service College Singapore, 2012). Although not referring to scenarios in its definition, the CSF describes stress-testing as involving the assessment of policies in the face of different futures. Among its outlined approaches to identifying tipping and breaking points of policies is 'sensitivity analysis', which focuses on studying how changes in individual factors in the external world may affect policy performance. Another mentioned approach is 'pre-morteming', where it is assumed that a policy already has failed in order to analyse the causal factors that would have caused this to happen (CSF & Civil Service College Singapore, 2012).

2.3. Why stress-test?

Policy-makers are increasingly challenged by complexity and uncertainty in their work since some of today's most pressing issues, such as automation, climate change or the deployment of artificial intelligence, are likely to have unintended and unexpected consequences (Tönurist & Hanson, 2020). Another contributing factor is sudden and disruptive events that cause great and reverberating impacts across sectors and geographies. These high-impact, low-probability events (HILPs) are within strategic foresight typically referred to as 'black swans' or 'wild cards' (Mendonça, et al., 2004; Heinonen, 2013; UNDP Global Centre for Public Service Excellence, 2018). Wild cards have been defined as sudden and unique incidents, which may cause significant changes in the evolution of specific trends or social systems. They have the potential to challenge and transform our existing knowledge because we previously were unaware of the risk for their occurrence, which is why they are also referred to as 'unknown unknowns' (Tönurist & Hanson, 2020).

In the past decade, European policies were stressed by a number of such shocks, including the influx of migrants from Europe through Turkey in 2015, the Brexit referendum result in 2016 as well as the Covid-19 pandemic.

2.3.1. The benefits of stress-testing

Stress-testing can help policy-makers address the increasing uncertainty they are faced with. When assessing the performance of existing or proposed policies against a range of scenarios, policymakers are taking a proactive approach to enhancing policy performance (OECD, 2019). Policies stress-tested in this manner can be expected to be more robust and have a greater capacity to remain functional in the face of shocks. They may also be more resilient and capable of adapting to the situation following a disruptive event (Capano & Woo, 2017).

There are several reasons why stress-testing can add value to the policy process. As emphasised by the OECD, governments often fail to prepare for unexpected or unprecedented developments and events (2019). Given the high stakes involved, there is wide agreement in the foresight community that policy-makers must take multiple future trajectories into account, rather than just planning for the future deemed most likely (Marchau, et al., 2019; Tönurist & Hanson, 2020; Government Office for Science, 2021a). This includes planning for disruptive events and shocks, which are particularly challenging to anticipate.

Findings from the country case studies show in a more detailed manner how experts in different national contexts perceive stress-testing to be enhancing the policy process. Interviewed foresight experts and policy advisers generally agree that the method can be used to raise awareness of possible future risks and identify those that should be addressed urgently. Furthermore, these experts emphasise the value of testing existing policies against a set of scenarios to assess whether given policy objectives remain relevant, and the devised mechanisms to reach them remain effective, across a range of different futures. As stated by a foresight practitioner in New Zealand:

'This leads typically to a much more nuanced conversation, as opposed to simply asking 'will that policy still work in the future?'. Instead, we are examining whether an examined policy option is the approach we want to take, whether its objective is still where we want to get, and if the vehicle we are using to get there still is the most appropriate. If the answer is yes to all of these questions, we ask whether we can do better.' (Source: expert interview).

At the same time, the interviewed experts underline that stress-testing cannot be applied to predict the future, but rather to raise awareness among those involved that the future could unfold in different ways than expected. On this background, foresight practitioners from Great Britain, New Zealand, and Finland all describe how stress-testing activities can enhance policy resilience by

leading to more adaptive policies. This is, for instance, the case when outcomes showing that policies fail in specific scenarios are used to decide when and how to amend a stress-tested policy should the future unfold towards these scenarios (source: expert interviews).

According to the foresight literature, stress-testing can be used to illuminate how policies may fare in extreme scenarios and times of crisis, including those caused by significant shocks. This can, at least in theory, contribute to a more robust policy design, since many policies are likely to be affected by unpredictable or even catastrophic events and futures in the long term (Howlett, et al., 2018; Fiott, 2019). The Covid-19 pandemic has clearly demonstrated that the capacity and time to apply standard regulatory policy tools is limited in times of crisis. Policy-makers were faced with situations where they had to act as a matter of urgency without the possibility to carry out impact assessments or stakeholder consultations (European Commission, 2021). The integration of stress-testing in the policy process may contribute to greater readiness for such situations.

2.4. Stress-testing as a response to uncertainty

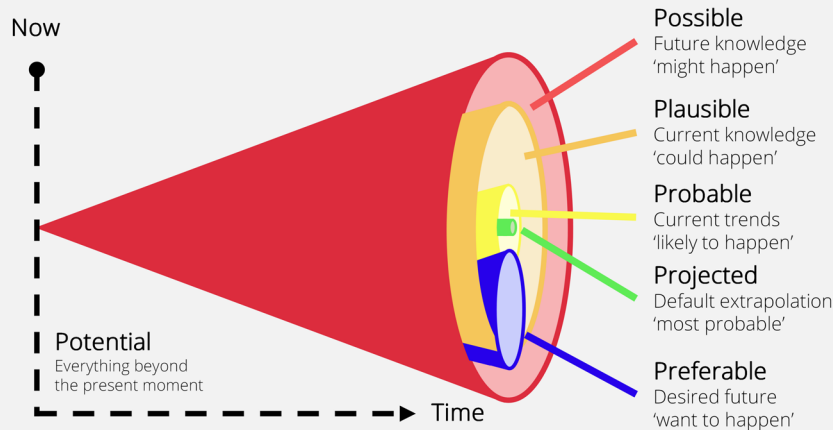
When long-term thinking in the policy process is limited to addressing expected future developments, policy-makers may be blind to opportunities and risks related to less likely futures.

Meaningful attempts to future-proof policies thus require explorations of the entire spectrum of alternative futures (UNDP Global Centre for Public Service Excellence, 2018).

Foresight experts from all the case countries point out that it can be difficult for those participating in stress-testing to let go of their assumptions and imagine futures that are radically different from the future they are expecting to emerge. Nonetheless, doing so is emphasised as being essential to enhancing policy resilience in the face of uncertainty, bearing in mind that unexpected future developments and disruptions may quickly and significantly change policy environments (source: expert interviews). In order to discuss what levels of future uncertainty should be addressed by stress-testing, it is necessary to introduce some approaches to distinguishing between these levels.

One of the most common tools to determine whether foresight activities consider a wider range of alternative futures is the Future Cone as presented by van Dorsser et al. (2018). In its most basic form, it is a taxonomy distinguishing between six types of futures that mainly differ in terms of their likelihood. Starting out with the entire realm of potential futures, the Future Cone gradually zooms into more likely or desired future types, as illustrated in figure 2-1.

Figure 2-1: The Future Cone



The *Future Cone* distinguishes between different types of alternative futures. Although it exists in various iterations, the model basically defines the following future types:

Potential futures - everything that possibly can happen beyond the present moment. This underlines the assumption that the future is undetermined and open.

Possible futures – those futures we think 'might happen', based on some future knowledge we do not currently possess, but possibly may possess one day.

Plausible futures – referring to the futures we think 'could happen', based on our current knowledge and understanding of how the world works.

Probable futures – those futures we deem 'likely to happen', typically based on current trends.

Projected futures – encompassing the futures we consider the most likely of the 'probable futures' to occur, usually an extrapolated continuation of past developments.

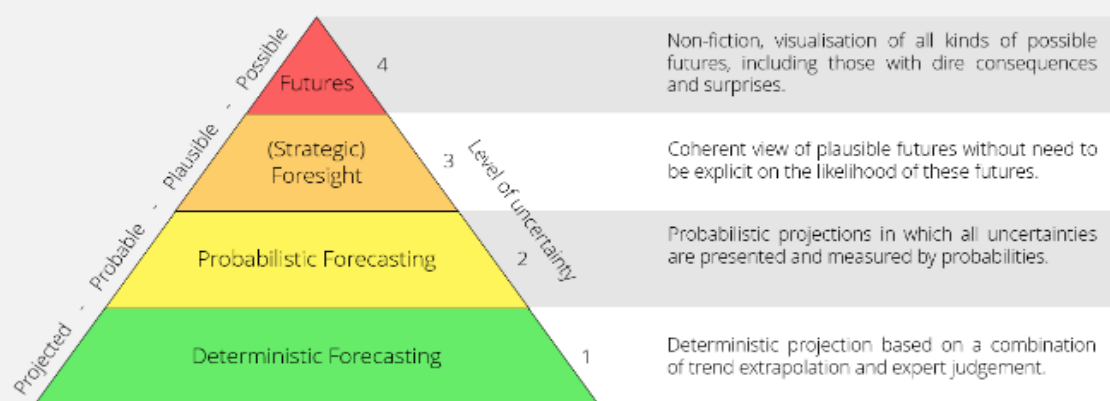
Preferable futures – those futures we 'want to happen'. These are based on normative values and may overlap with other future types.

Source: (Voros, 2017; van Dorsser, et al., 2018)

In an effort to improve the link between futures research and policy-making, van Dorsser et al. (2018) make use of the Futures Cone to create a conceptual model relating different forward-looking disciplines to levels of uncertainty about the future. As illustrated in figure 2-2, the Futures Pyramid distinguishes between four broader fields of anticipating the future by linking them to different future types and related levels of uncertainty. The model underlines the difficulty of anticipating the whole range of possible futures, since the insights into the future diminish in size and detail, the greater the level of uncertainty that is being addressed (van Dorsser, et al., 2018).

Figure 2-2: The Futures Pyramid

In their conceptual model of the *Futures Pyramid*, van Dorsser et al. have incorporated the future types presented in the *Future Cone*, as adapted from Voros (2017), and the four levels of uncertainty about the future defined by Walker et al. (2010). The model represents a hierarchy of four broader disciplines in futures research. It is shaped like a pyramid to visualise how the extent and detail of insights into the future decreases when moving up the hierarchy. Definitions for each layer of the pyramid are part of the original model and are as follows:



Source: (van Dorsser, et al., 2018)

Both the Futures Cone and the Futures Pyramid distinguish between different types of futures that can be envisaged and considered in anticipatory policy-making. They can therefore be used as a point of departure, for example, when wanting to decide what types of futures a policy should be stress-tested against. However, there are also significant differences between the two models. Whilst the Future Cone uses the axis of time to illustrate different future trajectories, the Futures Pyramid takes these future types and relates them to levels of uncertainty. In a further step, the different future types and their corresponding level of uncertainty are linked to specific disciplines within the entire field of anticipatory approaches. Van Dorsser et al. (2018) use the Futures Pyramid to establish what level of uncertainty the various disciplines concerned with anticipating the future address. They argue, for example, that deterministic forecasting is linked to the lowest level of uncertainty, as it uses trend extrapolation and expert judgement to reach a single reliable forecast of the future. Deterministic forecasting is thus related to exploring the future most likely to occur, defined as the projected future in the Futures Cone.

It must be pointed out that the *Futures Pyramid* is structured by layers representing disciplines building on each other. Those disciplines higher up in the hierarchy of the futures field may use methods and approaches related to lower layers and levels of uncertainty. For this study, it is particularly relevant that the *Futures Pyramid* links the field of strategic foresight to the exploration of plausible futures. Corresponding to the second-highest level of uncertainty in the model, these futures lie within the range of normal expectations as to what could happen. Whilst this includes projected and probable futures, it excludes wild card events or 'unknown unknowns', which are discussed further below and represent the highest level of uncertainty. Van Dorsser et al. (2018) place futures studies on top of their pyramid to illustrate that the field as a whole aims to provide systematic views of the entire spectrum of possible futures, including those with adverse impacts and surprises.

As previously mentioned, policy stress-testing is typically described as a method based on strategic foresight and aiming to future-proof policies against a wider range of disruptive developments and events that may occur in the future. The linking of strategic foresight to the exploration of plausible futures in the Futures Pyramid lays the ground for a discussion about what level of uncertainty stress-testing can and should address. Stress-testing activities addressing plausible futures can at least to some extent be based on evidence, such as extrapolations of future impacts stemming from observations of relevant ongoing developments. The same does not apply when the aim of stress-testing is to future-proof policies against wild card events and similar shocks that lie within the realm of possibility but are not expected to occur. Although stress-testing can be used to simulate how policies perform in scenarios based on unexpected and extreme events the value of such stress-tests can be questioned. Assumptions about the future that do not build on evidence can lack credibility. Indeed, several of the experts interviewed for the conducted country studies point out that all stress-testing activities should be rooted in the best available evidence about systemic interactions and feedback loops to the greatest possible extent, both to increase the quality of outcomes and to assure policy-makers that stress-testing is a deliberate and systematic method that can enhance the policy process (source: expert interviews).

Additionally, in terms of testing policies against possible, yet unlikely events, it may be considered impossible to prepare for the eventuality of all HILPs or wild card events that can be imagined. In support of this perspective, the OECD (2019) underlines that attempts to predict or forecast the future are not very useful in the face of high uncertainty. A more valuable approach is to develop a number of different plausible future scenarios, explore their potential impacts and assess related implications for policies. As highlighted by a policy adviser from New Zealand, this allows for the development of policy options that work well across a range of scenarios deemed somewhat likely, instead of trying to future-proof policies against the entire range of possible futures. At the same time, other interviewed experts point out that stress-testing can address the highest level of future uncertainty, for example when the engagement with selected future scenarios leads to the development of flexible strategies capable of being adjusted at certain thresholds and while the future unfolds (source: expert interview).

Confirming some of the findings above, the reviewed literature emphasises that strategic foresight methods typically focus on anticipating plausible future developments (Lempert, 2019; Tönurist & Hanson, 2020). However, different sources also underline the importance for policy-makers to consider the possibility and potential impacts of unexpected events with significant consequences (HILPs, wild cards or black swans).

Although wild cards are essentially not predictable, attempts to anticipate their impacts can be a valuable exercise for policy-makers, helping them to identify and better understand risks and opportunities that they are currently unaware of (Mendonça, et al., 2004; Heinonen, 2013; Government Office for Science, 2021a). The purpose of crisis simulations, for example, is to broaden the mind of decision-makers by rendering strengths and weaknesses in the crisis response visible with the help of scenarios based on critical events (Fiott, 2019). Even though it is described as quite challenging, the foresight literature offers an approach to the anticipation of wild card events. This approach entails scanning for *weak signals*, which are described as early signs of possibly arising issues, which have yet to be confirmed. They are initial symptoms of significant discontinuities or new possibilities that are different to interpret and may be connected to specific events, new practices, and novel technologies, among others (UNDP Global Centre for Public Service Excellence, 2018; Government Office for Science, 2021a).

When considering differences between wild cards and HILPs, it is helpful to distinguish first between *absolute probability* and *perceived probability*. The concept of a HILP, in underlining 'low probability', appears to assume that the absolute probability of the event is low. The concept of wild cards does

not consider the probability, but rather the extent of the surprise caused by the event. A wild card may be quite probable if one analyses current trends and weak signals carefully but may not be perceived as such by policy-makers or by the public.

Another distinction that should be considered is the difference between a certain type of event and a concrete event. For example, meteorological science has repeatedly pointed out that Europe can expect a trend towards more unstable weather resulting from climate changes. The meteorologists have also singled out certain types of events likely to become more frequent, like heavy rainfalls resulting in the risk of flooding; or droughts leading to risks of crop failure and forest fires. They have, however, not foreseen concrete events like mud-slides in Norway, flash floods in Germany, or drought in Italy.

From a stress-testing perspective, it is clearly infeasible to test EU policies against all conceivable concrete events, whereas it is possible to consider certain types of events that can be expected to occur. On the other hand, as one moves towards the national, regional, or local level, the scope for stress-testing against concrete events increases, as contextual factors co-determining the risk (like, for example, the geological characteristics, the uptake of digital technologies, or the travel patterns of the population) can be more easily quantified, and perhaps even modelled.

Finally, a major study of wild cards and weak signals funded by the European Commission has pointed out that the understanding and manageability of wild cards events can be improved if one distinguishes between three types of wild cards:

- Nature-related 'surprises' (example: The recent tornados in the Czech Republic)
- Unintentional 'surprises' resulting from human actions (example: Covid-19 pandemic)
- Intentional 'surprises' resulting from human actions (example: Wealthy people invest in space technology to get a ticket into space) (Popper, 2011)

2.5. Foresight methods and their use in stress-testing

The foresight literature is unanimous that policy stress-testing entails subjecting policies to theoretical future scenarios, which can be based on sudden disruptive events or HILPs. These shocks do not occur in a vacuum but amplify or counteract more long-term trends in society. If stress-testing activities are meant to address probabilistic or plausible risks, they must involve the use of scenarios based on evidence suggesting that some future developments are more likely than others. With this background, the following sub-sections focus on approaches that are closely linked to policy stress-testing, including horizon scanning and scenario development.

2.5.1. Brief description of key methods

Horizon scanning

The foresight literature contains a range of methods that can be applied to anticipate future developments and their potential impacts. The most prominent example is *horizon scanning*, a method to analyse the future, which is described by the OECD (2019) as the 'foundation of any strategic foresight process'. **Horizon scanning entails the systematic monitoring and examining of different data sources to detect and research drivers of change**, meaning key trends and factors as well as the potential future risks and opportunities related to them. Information on these drivers can be gathered through a range of methods, including interviews and workshops allowing for the consultation of stakeholders and experts in a given policy area. A further input to scanning activities is the review of relevant sources, such as reports, articles, and existing foresight literature, related to the policy environment that is being examined (Government Office for Science, 2017; OECD, 2019; Tönurist & Hanson, 2020).

Insights from the conducted country studies confirm that scanning for signals of change is an essential part of strategic foresight activities. Foresight experts from the United Kingdom, for example, emphasise the importance of persistent horizon scanning. According to them, the assessment of how trends linked to uncertain outcomes may disrupt different policy environments requires the continuous gathering of knowledge on what is happening and emerging in the broadest range of areas (source: expert interviews). Such efforts have been formally integrated into government in New Zealand, where recent legislation² has placed a statutory obligation on the chief executives of all government departments to regularly publish *Long-term Insights Briefings*. The briefings are meant to provide the public domain with information on medium- and long-term trends, risks and opportunities that may affect New Zealand's society in the future (Department of the Prime Minister and Cabinet (New Zealand), 2021). Similarly, the Finnish bi-annual Government Report on the Future serves to inform all stakeholders about possible future developments and consequences for policy-making.³

Due to the wealth of information that may be collected when exploring possible futures, it is helpful to work with pre-determined categories to structure and assess this data in a meaningful way. **A common approach is the STEEP method, where collected information is organised according to Social, Technological, Economic, Environmental and Political domains.** The framework has recently been extended by van Woensel (2020), who has developed the STEEPED scheme by adding two additional dimensions allowing for the targeted mapping of ethical and demographic aspects, respectively. Other methods include PESTLE and PESTLE+V, using the categories Politics, Environment, Society, Technology, Legislation, and Values (Government Office for Science, 2017; Tönurist & Hanson, 2020).

Addressing different signals of change

Scanning exercises aiming to anticipate future developments can address different signals of change and levels of uncertainty. *Megatrends analysis*, for example, is a specific scanning approach that focuses on the examination of large-scale changes that are expected to have complex and multidimensional long-term impacts. They can typically be identified by looking at general tendencies resulting from past events that may increase or decrease in strength over time (OECD, 2019; Tönurist & Hanson, 2020). At the other end of the scale, it is possible to address higher levels of future uncertainty by scanning for weak signals, as mentioned previously in section 2.3.

Identifying weak signals is a rather difficult endeavour, as there is typically no robust evidence associated with them. **Weak signals are early signs of issues that will probably arise, but which are yet to be confirmed.** They are the first symptoms of significant discontinuities or emerging possibilities and may forewarn specific events and changes that could more fully reveal themselves in the long-term future (UNDP Global Centre for Public Service Excellence, 2018; Government Office for Science, 2021a).

As opposed to trends, which are characterised by lower uncertainty and a somewhat clear direction, weak signals can usually be found in isolation, making it easy to overlook them and particularly challenging to interpret their potential meaning or importance. Nonetheless, the scanning for weak signals represents an essential tool for efforts to anticipate changes, risks, and opportunities to policy environments over longer time horizons (Government Office for Science, 2017; Tönurist & Hanson, 2020).

² [Public Service Act 2020](#)

³ For more information, please see the website of Finland's government with regards to foresight: <https://vnk.fi/en/foresight/government-report-on-the-future>.

Scenarios

Since policy stress-testing entails an assessment of how policies can be expected to fare in a range of different futures, **the development of scenarios describing a range of futures is an essential part of the stress-testing process.** The foresight literature distinguishes between different types of scenarios and offers several approaches to developing them.

Börjeson et al. (2005) differentiate between three general scenario types, of which explorative scenarios are most relevant for policy stress-testing. As opposed to predictive scenarios (what will happen?) and normative scenarios (describing a desired future), explorative scenarios are defined by the question 'what can happen?'

Explorative scenarios are usually developed by analysing the interaction between a wide range of trends and other change drivers to arrive at a limited number of different futures – the scenarios. **The scenarios should be sufficiently removed from the present in time for emerging issues to develop, and they should be somewhat plausible.** The purpose of explorative scenarios is to allow for an examination of different future trajectories and what they mean in terms of possible structural changes and related impacts. Different methods can be combined to inform explorative scenarios for policy stress-testing, such as interviews, surveys, and workshops with relevant stakeholders, including citizens affected by a given policy as well as experts, researchers, and analysts with particular insights into the relevant policy area.

An additional scenario development technique is the Delphi method, which was originally developed in the late 1950s. Whilst different versions of this approach have been elaborated since, **a typical Delphi study aims to gather and harmonise opinions from a panel of experts** on the strategic importance of issues raised. This usually involves an iterative consultation process, where participating experts reflect on each other's opinions and judgements to reach a consensus, for example, in regard to how the future is likely to unfold (Börjeson, et al., 2005).

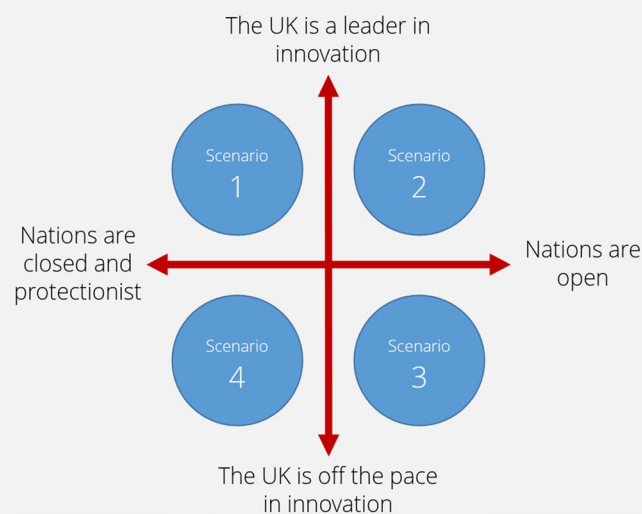
Depending on the scope of foresight activities involving the use of scenarios, the methods mentioned above can span time periods of different lengths. It is possible to generate scenarios based on the outcomes of a single workshop with experts, or to use insights from different stakeholder groups and a combination of generation techniques over time (Börjeson, et al., 2005; Government Office for Science, 2017; UNDP Global Centre for Public Service Excellence, 2018).

Scenarios often take the form of narratives describing how one or more futures may unfold. They are neither meant to be 'wrong' or 'right' but aim to offer informative images of the future that are based on qualitative insights by different stakeholders and/or the extrapolation of existing quantitative data. In the foresight literature, there is little indication as to how many scenarios should be generated when trying to anticipate future developments (Government Office for Science, 2017). Whilst acknowledging that some foresight activities may involve a greater number, the *Foresight Manual* of the UNDP Global Centre for Public Service Excellence (2018) suggests limiting the number of scenarios to no more than five, as it may otherwise be difficult to compare and draw lessons from scenario exercises. It can be added that working with a greater number may also be less feasible since time and other resources for foresight initiatives are likely to be limited. Given that the future may unfold in a myriad of different ways, one could object that five scenarios are not enough to explore the future sufficiently. However, **it is not the aim of scenarios to predict the future, but rather to illustrate that it may unfold in different ways than expected, which in turn is meant to lead to a greater awareness of future risks and opportunities as well as reflections on how to address them.** Since the focus of strategic foresight is on exploring plausible futures, it may therefore be more relevant to concentrate scenario development on a few narratives of likely futures, rather than a wider range of random 'what-if-scenarios'.

Among the most prominent methods for qualitative scenario development is the *2x2 matrix approach*, also referred to as *Axes of Uncertainty*, which is presented in Figure 2-3 (Government Office for Science, 2017).

Figure 2-3: Axes of uncertainty

For the relatively swift development of four scenarios that policy options may be stress-tested against, a 2x2 matrix is designed using two axes of uncertainty. These axes are comprised of two distinct, critical uncertainties in a given policy environment, which represent drivers of change that may develop in opposite directions over time. The British *Futures Toolkit* offers an example of a 2x2 matrix that is the result of discussing and prioritising drivers related to global security and the UK's innovative capacities:



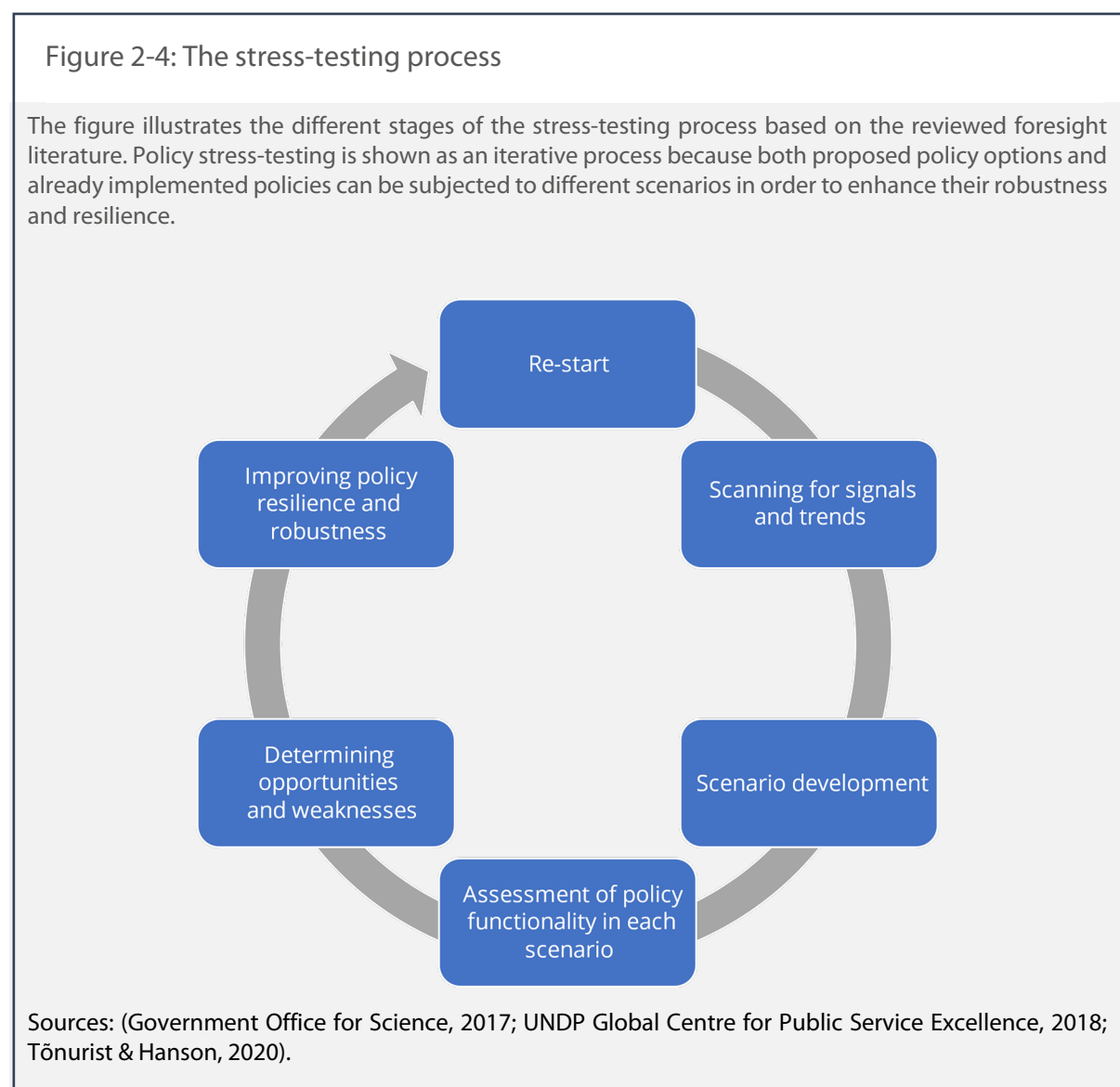
Source: (Government Office for Science, 2017)

Briefly described, the approach entails the development of four distinct scenarios structured around two drivers of change that are considered to be of essential importance for a specific policy area, whilst also being linked to highly uncertain and possibly opposing outcomes.

An alternative approach to scenario development is the use of generic future images. Following a comparative analysis of scenarios created for various foresight activities, **Dator (2009) identified four archetypal alternative futures, which he named 'continuation', 'collapse', 'discipline' and 'transformation'**. The first of the generic futures is characterised by a view of the future as being defined by continued or renewed growth, often in an economic sense. The second category of archetypal future images explores the impact of environmental, economic, or technological collapse. 'Discipline-scenarios' are images of a future, where stakeholders have recognised that ongoing developments are not sustainable and have chosen to adjust their actions and behaviours to bring about change. Finally, the last category of archetypal future images encompasses scenarios focussing on the transformative power of technological developments and the impacts they can have (Dator, 2009). The scenario archetypes can serve as a framework for the formulation of four distinct scenarios in virtually all policy areas and are increasingly used within governmental foresight (UNDP Global Centre for Public Service Excellence, 2018).

2.5.2. The role of stress-testing in the policy process

There is wide agreement in the foresight literature that the aim of policy stress-testing is to ensure that policies fulfil their objectives in a greater range of plausible futures (Government Office for Science, 2017; UNDP Global Centre for Public Service Excellence, 2018; OECD, 2019; Tönurist & Hanson, 2020). Figure 2-4 summarises the individual steps involved in policy stress-testing, which build towards increased policy robustness and resilience. The figure synthesises findings from this literature review and is based on several sources.



2.5.3. Sectoral applications

Whilst there is no shortage of guides and other resources describing strategic foresight methods and promoting their use, the literature on practical applications of policy stress-testing is sparse, at least outside of the financial sector. This section presents some of the few documented stress-testing activities in different sectors that were identified during this study.

Financial stress-testing activities

New Zealand regularly conducts fiscal stress-tests due to a legal requirement for the New Zealand Treasury to submit an Investment Statement to the parliament at least once every four years (SOIF, 2021). The most recent Statement from 2018 (The Treasury, 2018) presents the national government's long-term fiscal position and examines potential fiscal challenges. It contains results of stress-testing activities conducted to assess the impact of plausible adverse shocks to the national debt over a five-year horizon.

Three exploratory scenarios were generated and used to achieve this. They were based on the impacts of a major earthquake, the outbreak of a widespread agricultural disease and an international economic downturn, respectively. The 2018 Investment Statement states that the scenarios were not developed to accurately reflect the nature of any future shock but to illustrate how the New Zealand economy would react to shocks with a significant magnitude. Two of the three scenarios were informed by previous foresight efforts, such as the comprehensive scenario developed for a paper on the economic impact of Foot-and-Mouth Disease by the Ministry for Primary Industries (Forbes & van Halderen, 2014).

To stress-test New Zealand's fiscal resilience, the scenarios were used to examine the initial impacts of the simulated shocks and how these could evolve through the economy. **Quantitative economic modelling was applied to forecast various costs to the government, namely balance sheet revaluations and direct as well as indirect fiscal costs.** In this manner, the impact on national debt five years after a given shock and the total financial impact on the government's balance sheet over a fifteen-year period was mapped. According to the 2018 Investment Statement, this time horizon was chosen because the applied fiscal forecasting model showed that the growth effects of the examined shocks are unlikely to last longer than fifteen years (The Treasury, 2018).

Another example of fiscal stress-testing are **efforts by the American Federal Reserve to promote a safer banking and financial system following the financial crisis** starting in 2007 and the subsequent national recession. Having first introduced them in 2009 to assess the resilience of the largest American bank holding companies, the Federal Reserve continues to conduct and publish results of supervisory stress-tests on an annual basis. Today, US federal banking supervisors use econometric models to examine how an extended group of financial institutions, including US intermediate holding companies, subsidiaries of foreign banking organisations as well as savings and loan holding companies, would fare in adverse and severely adverse scenarios (Board of Governors of the Federal Reserve System, 2009; 2020).

Results of the supervisory exercises in 2020 show that large banks were generally well capitalised, enabling them to cope with a range of critical hypothetical events. However, due to the uncertainty from the Covid-19 pandemic, the Federal Reserve chose to place restrictions on bank pay-outs to maintain the strength of the banking sector. In the past, the Federal Reserve has released detailed information on its hypothetical scenarios for its stress-test exercises. The scenarios for 2021 exercises, for example, used a three-year time horizon and included 28 variables, such as economic activity and prices, interest rates as well as international economic developments (Board of Governors of the Federal Reserve System, 2021).

Finally, **the EBA Regulation gives the European Banking Authority powers to initiate and coordinate annual EU-wide stress-tests.** The aim of the tests is to assess the resilience of financial institutions to adverse market developments and to contribute to the overall assessment of systemic risk in the EU financial system. The stress-tests use consistent methodologies, scenarios and key assumptions developed in cooperation with the European Systemic Risk Board (ESRB), the European Central Bank (ECB) and the European Commission. (European Banking Authority, 2021).

Mitigating climate-related risks through stress-testing

In the Netherlands, stress-testing activities are conducted at a local level to mitigate climate-related risks. In a collective effort, local and regional authorities work together with the central government to implement the Delta Plan on Spatial Adaptation 2018 (Delta Programme, 2017). Structured around seven ambitions, of which one is the mapping of vulnerabilities, the plan is meant to support efforts to render the spatial design of the Netherlands climate-proof and water-resilient by 2050. With this background, mandatory stress-tests are conducted to gain insights into vulnerabilities related to four climate themes, namely drought, heat, 'water over-load' (due to extreme precipitation) and flooding (due to rising water levels of canals, rivers, and the sea). (Kennisportaal Klimaatadaptatie, n.d. (a); Delta Programme, 2017)

Stress-tests are to be conducted by all municipalities, local water authorities, provinces, and the central government. To enable local and regional authorities as well as citizens to react to future climate-related risks, the impact of such risks are gathered and combined with data on the sensitivity of local infrastructure. Data is available in a knowledge portal⁴ focusing on climate change provided by the Climate Adaptation Services (CAS), an independent institute funded through the national Delta Programme. The portal includes an interactive Climate Effect Atlas⁵ developed by a range of partners, including the Ministry of Infrastructure and Water Management, the Dutch Meteorological Institute, and several universities as well as instructions for standardised stress-tests⁶ to be conducted by local authorities.⁶ The guidelines prompt the public authorities responsible for stress-tests to use the data provided to map vulnerabilities in their area, seeking input from stakeholders in the form of area knowledge and expertise.

Results of the individual stress-testing activities are published by local authorities on a knowledge platform dedicated to climate adaptation in the Netherlands. Although they differ significantly in terms of scope and quality, they represent an example of how anticipatory practice can be embedded nationwide (Kennisportaal Klimaatadaptatie, n.d. (b); n.d. (c); n.d. (d); 2021).

The reviewed literature contains further case studies of stress-tests to mitigate climate-related risks. Some of these are only mentioned briefly here, as they entail rather complex processes and more fully describing them would put too much emphasis on stress-testing in relation to environmental policies. A number of case studies reviewed focus on the use of a variety of model-based approaches belonging to *Decision Making Under Deep Uncertainty* (DMDU), a set of methods and tools that can help decision-makers navigate in situations characterised by a high level of future uncertainty (Marchau, et al., 2019).

Groves et al. (2019), for instance, describe how *Robust Decision-Making* (RDM) was applied to ensure long-term water planning by the American Bureau of Reclamation in the Colorado River Basin. RDM combines different concepts and processes, including decision analysis, scenarios, and exploratory modelling to stress-test strategy options over a multitude of different future trajectories (Lempert, 2019). In the case study on water planning, the RDM approach led to the development of an adaptive strategy, encompassing both near-term decisions and plans for adjustments to be made when external developments, such as future water demand and climate conditions, reach defined trigger points (Groves, et al., 2019).

Additional case studies involve the use of *Dynamic Adaptive Policy Pathways* (DAPP) in the context of long-term flood risk management (Haasnoot, et al., 2013; Lawrence, et al., 2019). In a similar

⁴ <https://klimaatadaptatienederland.nl/en/>.

⁵ <https://www.klimaateffectatlas.nl/en/>.

⁶ <https://klimaatadaptatienederland.nl/en/policy-programmes/delta-plan-sa/stress-test/>.

manner to the RDM-approach, DAPP makes use of computer-based modelling to facilitate the development of strategies that are adaptive and robust in the face of different future scenarios.

In New Zealand, the dynamic method was used by regional flood managers who were faced with increasing future uncertainty due to climate change and the increasing exposure of humans to natural hazards. The Greater Wellington Regional Council (GWRC) chose to address this uncertainty by applying a DAPP approach, as it allowed for dynamic planning over a time frame of at least 100 years (which is a statutory benchmark for climate change planning in New Zealand). As part of the approach, proposed strategy options were stress-tested against 48 quantitative scenarios based on existing data from the Intergovernmental Panel on Climate Change. Together with input and expertise from researchers, technical advisors and community stakeholders, outcomes led to the development of an adaptive plan consisting of specific policy options and adaptation thresholds (Lawrence, et al., 2019).

2.5.4. The use of foresight in the European Union

In the European Union, strategic foresight is playing an increasingly important part in the policy process. Although evidence of policy stress-testing by European institutions is limited, a lot of work is being done that could help set the foundations for such activities.

Strategic foresight initiatives by the European Commission

In September 2021, the European Commission published its second Strategic Foresight Report (European Commission, 2021). In the first Strategic Foresight Report, published in September 2020, **the Commission presents initial lessons from the Covid-19 pandemic and examines the resilience of the EU and its Member States in regard to four inter-related dimensions, namely the socio-economic, geopolitical, green, and digital dimensions.** The report also outlines the Commission's agenda for embedding strategic foresight in EU policy-making. Part of this agenda is the ongoing development of 'resilience dashboards', a new tool for assessing the vulnerabilities and capacities of the EU and its Member States in each of the mentioned dimensions (European Commission, 2020).

The European Commission's Joint Research Centre (JRC) has published a number of foresight studies applying anticipatory methods to different policy areas. One example is a study focussing on industries contributing to greater resource efficiency and/or eco-innovation. It explores different pathways for the transition to a sustainable EU economy with the help of four exploratory scenarios, representing alternative and distinct narratives of social values and fiscal policy in the EU in 2035. The comprehensive, qualitative scenarios were developed using a 2x2 matrix approach (see Figure 2-3) and with the help of expert panels participating in dedicated workshops. Panel members represented a wide range of stakeholders, including industry representatives, academia, the Commission, NGOs, and private consultants (Bontoux & Bengtsson, 2015).

Another foresight initiative, carried out by the JRC in close collaboration with the Commission's Directorate General for Food Safety and Health (DG SANTE), chose to take a similar approach. It employed the methodology of scenario development to examine possible future challenges for food safety and nutrition in the EU. The aim of the initiative was to support policymakers in assessing the resilience of existing food policies and regulatory frameworks. Outcomes of the initiative were four exploratory scenarios describing alternative futures of the food system in 2050 (Mylona, et al., 2016).

A third example of the JRC's foresight work is a study focussing on the future of migration in the EU (Szczepanikova & Van Criekinge, 2018). It adapted results from a previous background study commissioned by the JRC (De Haas, 2018) as well as findings of studies by other institutions that had

examined past and recent migration trends, their drivers as well as the impacts of existing migration policies on them. This approach, complemented with insights from workshops with academic and policy experts, allowed for an efficient development of four exploratory migration scenarios for 2030. The finalised scenarios were used as starting points for discussions in focus groups with representatives from the Commission, the OECD and academia, among others, leading to written contributions by participants examining what the different scenarios would mean for EU policy-making and how they could evolve in different geographical regions (Szczepanikova & Van Criekinge, 2018).

Finally, the foresight work by **the Commission's Standing Committee on Agricultural Research (SCAR)** can be mentioned. SCAR currently represents 37 countries, including ministries from all Member States as well as candidate and associated countries as observers. The Committee's dedicated 'Foresight Group' has coordinated five extensive foresight exercises and hosted several foresight conferences to examine the future of European agriculture and the wider bioeconomy. Results of activities initiated by the foresight group are typically disseminated in study reports. The most recent (European Commission, 2020) summarises the outcomes of the 5th SCAR Foresight Exercise, which was conducted by a group of 14 independent experts (6 foresight specialists and 8 experts within agriculture and food systems). They used horizon scanning, scenarios, and road mapping to explore possible pathways to more sustainable use of natural food resources in the EU.

Strategic foresight initiatives by the European Parliament

The European Parliament has done significant work towards promoting strategic foresight and anticipatory practices. It has, for instance, set up a **Strategic Foresight and Capabilities Unit within the European Parliamentary Research Service (EPRS)**. The unit carries out a range of foresight activities, including the regular publishing of the Global Trendometer since 2016 (Noonan, 2019). Taking a forward-looking approach, it maps global trends across a range of economic, social, and political subjects and identifies related risks and opportunities. The Trendometer thus helps in fostering a strategic foresight culture within the European Parliament by exploring how identified trends may evolve in the medium- to long-term and what implications the anticipated developments may have (EPRS, 2019; EPRS Strategic Foresight and Capabilities Unit, 2021).

Another relevant body within the European Parliament is the **Panel for the Future of Science and Technology (STOA)**. Its main responsibility is to assess the impact of new and emerging technologies in order to inform committees and other bodies of the Parliament on the opportunities and risks scientific and technological advancements may entail (STOA, n.d.).

Finally, **the European Parliament is part of the European Strategy and Policy Analysis System (ESPAS)**, a voluntary framework for cooperation and consultation at the EU administrative level. ESPAS is an inter-institutional collaboration between the European Parliament, the European Commission, the Council of the EU, and the European External Action Service. With help from several observing bodies, it aims to strengthen the administrative foresight capacities in the EU, for example by applying foresight methods to discussions on key trends relevant to Europe's security and strategic outlook. ESPAS also provides EU officials with training opportunities allowing them to develop their skills in foresight methods, such as horizon scanning and scenario planning (ESPAS, n.d.; ESPAS, 2018).

More specific evidence of anticipatory activities in the European Parliament is provided by some more recent publications with a clear foresight perspective. Among these are three related papers produced by EPRS in collaboration with the Directorates-General for Internal Policies (IPOL) and External Policies (EXPO) (EPRS, DG IPOL & DG EXPO, 2020a; EPRS, DG IPOL & DG EXPO, 2020b; EPRS, DG IPOL & DG EXPO, 2021). By examining potential structural risks faced by Europe, the papers aim

to promote anticipatory governance at the EU level and are part of the Parliament's contribution to discussions about the implications of the Covid-19 pandemic for EU policy-making.

The first of these papers contains **an initial mapping of 66 structural risks, including environmental, digital, political, and social risks** that Europe may be confronted with within the next 15 years. By structuring the risks in terms of their likelihood to occur and the potential scope of their impact, the paper identifies 18 risks that demand the immediate attention of EU policy-makers, whilst also suggesting possible policy responses to address them (EPRS, DG IPOL & DG EXPO, 2020a).

A follow-up paper by the Parliament takes **a closer look at 33 risks that are considered to be more likely or to potentially have a greater impact**. The paper examines the existing capabilities in the EU and Member States to address these risks, whilst also identifying policy gaps and suggesting possible approaches to solutions in the short- and medium-term (EPRS, DG IPOL & DG EXPO, 2020b).

Finally, and published more recently, a third paper **delves deeper into 25 key policy areas that could be severely affected by some of the 33 potential structural risks previously examined**. The paper aims to identify priorities for enhancing resilience within the EU system. It suggests concrete initiatives that EU institutions could take to strengthen the resilience of the EU in the examined policy areas, which are inspired by the Parliament's own resolutions, proposals by other EU institutions as well as inputs from external stakeholders and experts (EPRS, DG IPOL & DG EXPO, 2021).

Also, relevant here is **the first comprehensive foresight study by STOA** (Scientific Foresight Unit, EPRS, 2016). The project 'Ethical aspects of cyber-physical systems' was carried out to explore the unintended impacts and related ethical concerns linked to the possible evolution of intelligent robotics systems by 2050. It used a well-defined foresight approach, employing different anticipatory methods in three distinct phases. Initially, a technical horizon scan was conducted in collaboration with external academic experts and consultants to anticipate how short- and long-term developments in the field of intelligent robotics systems may affect different domains. The STEEP scheme (see section 2.4.1) was used to categorise information from conducted scanning exercises.

The second phase of the study involved an envisioning exercise and the development of scenarios to anticipate future public concerns that may arise in line with possible advancements of intelligent robotic systems. With expert participation at workshops, a total of four exploratory scenarios were developed offering alternative narratives of the future of cyber-physical systems. In the study's final stage, experts from STOA and EPRS conducted legal back-casting to identify possibilities for future-proofing relevant legislation. Legal back-casting entails envisioning a desired future or set of outcomes and then identifying needs for new laws or adjustments to existing laws needed to move in the direction of the desired future state.

The outcome of the study was a forward-looking briefing to support the European Parliament in the anticipation of future impacts that advances in intelligent robotics systems may have. The briefing highlighted EU legislative acts in relevant policy areas that may need to be reviewed, whilst also informing a European Parliament resolution with recommendations to the commission on civil law rules on robotics (European Parliament, 2017).

Other strategic foresight activities at the EU level

Strategic foresight activities have also been conducted at the EU level outside of the Commission and the Parliament in recent years. **In the context of the EU-funded project IMPRESSIONS, for instance, a stress-testing study was conducted which aimed to examine policy vulnerabilities in the face of high-end climate change scenarios** and to promote more robust actions in response

to identified risks. Part of the study were four cases assessing specific environmental strategies and policies in the EU, Scotland, Hungary, and Iberia respectively. For all four case studies, stakeholders (e.g., from academia, public authorities, and consultancies) were consulted at workshops and participated in qualitative assessments of selected environmental policies using stress-testing methods (Carlsen, et al., 2017).

The two Horizon2020 projects **Bringing Innovation to Ongoing Water Management (BINGO)** and **Co-Designing the Assessment of Climate Change Costs (COACCH)**, developed and used foresight methods to examine how socio-economic parameters may evolve due to possible future impacts of climate change. BINGO focussed on developing solutions for climate-related risks to the water cycle and water management, such as droughts and floods. The project used scenarios based on pre-existing climate data to explore how six different European areas may be affected by average and extreme conditions of climate change (BINGO, 2019; BINGO, n.d.). Focussing to a greater degree on stakeholder engagement, the project COACCH used co-design and co-production as key principles for the development of its research activities. Representatives from different industries, research institutions, public authorities and civil society collaborated to produce methods and tools for assessing the risks and costs of climate change at the regional level in Europe. Part of this process was the participatory development of scenarios with stakeholders, using pre-existing data and projections related to climate change as points of departure (Hof, et al., 2018; Ščasný, et al., 2020; van der Wijst, et al., 2021).

Finally, the European Union Institute for Security Studies (EUISS) has applied anticipatory methods in the field of foreign security and defence policy. Next to papers on the use of strategic foresight in various countries, EUISS has also produced briefs exploring possible future developments in different geopolitical regions based on horizon scanning and scenario development (EUISS, n.d.). One of its more recent publications presents 12 scenarios examining the cost of inaction by the EU in response to risks relating to digitalisation, environmental matters, and foreign policy, among others (EUISS, 2021).

2.6. Organising stress-testing

As demonstrated by the examples presented in the previous sections, the stress-testing of policies typically involves the application of different foresight methods and the collaboration with different experts and stakeholders. This section presents findings from the four country cases describing to what extent policy stress-testing is organised and the necessary foresight capabilities established in Finland, the Netherlands, New Zealand, and the United Kingdom.

2.6.1. The state of policy stress-testing in Finland

Finland has a well-integrated approach to applying long-term thinking to the policy process with strong institutions of foresight across government as well as publicly funded non-departmental public bodies (SOIF, 2021). National foresight efforts are characterised by well-established cooperation between policy-makers and experts from various fields and disciplines. In Finland, both parliament, through the Parliamentary Committee for the Future⁷, the Government, the Prime Minister's Office, and ministries are involved in foresight work together with academic experts.

⁷ <https://www.eduskunta.fi/EN/valiokunnat/tulevaisuusvaliokunta/Pages/default.aspx>.

Foresight methods have been integrated into the decision-making processes of all 12 Finnish ministries and the strategies of multiple ministries are, at least in part, based on the development and exploration of possible future scenarios (OECD, 2019b). Once during each electoral period, the Government is legally required to submit to Parliament a report on the future focusing on long-term perspectives (i.e., 10-20 years) within a specific theme. The Government Report on the Future⁸ examines Finland's future challenges and opportunities, as well as outlining the government's vision of what a desirable future should be. It has been published every 4-5 years since 1993 with the two latest reports focussing on well-being through sustainable growth and the transformation of work (Prime Minister's Office, 2013; 2017).

Ministries are, likewise, required, once every term of government, to produce a Futures Review for their own branch of government (Prime Minister's Office (Finland), n.d. (2)). These activities may, in Finland, be supported by a range of public bodies with foresight capacities, including the inter-ministerial government working group for the coordination of research, foresight, and assessment activities (TEA working group) and the Government Foresight Group.

Hence, the resilience of public policies in a volatile physical and economic environment is sought through what is described by interviewees as knowledge-based decision making or simply national foresight work, and **ministries are expected to take the outcome of foresight activities into account when drafting legislation.**

Whilst foresight capacities are strongly embedded and well-organised across government institutions, **policy stress-testing is not systematically applied in Finland.** There is no legal requirement to stress-test policies and efforts to enhance policy resilience tend to focus on other – albeit related – foresight methods, such as horizon scanning and scenario development.

In general, the Finnish approach to policy-making prioritises the design phase over the subsequent phases in the legislative cycle, and forward-looking design of policies over stress-testing of legislation against high-impact, low-probability events. This is why **some emphasis is given to defining a desirable future**, as exemplified by the Government Report on the Future, and working towards it. For the same purpose, national foresight initiatives make use of 'futures dialogues', where small groups of citizens (young people are given preference) are consulted through structured, but exploratory dialogues on their views on the future (Lahtinen, 2021; Timeout-Foundation, n.d.).

Indeed, desk research and interviews for the country study on Finland indicate **a certain disjoint between the futures-oriented approach in the design and drafting of legislation and the impact assessment of draft legislation.** It can be added that currently, ex-post evaluation of legislation is not applied systematically. With this being said, foresight does play a part in both the initial and later stages of the policy process. Currently, the ministries are informed by their own and other national foresight initiatives when proposing legislation and conducting an initial impact analysis. Subsequently, the Finnish Council on Regulatory Impact Analysis⁹ in the Prime Minister's Office is responsible for improving the quality of impact assessments of government proposals, although there is no specific emphasis on the time horizon of impact, or whether the impact analysis considers different scenarios (Prime Minister's Office, 2019). Finally, the National Audit Office of Finland (NAOF)¹⁰ carries out assessments of governance and steering mechanisms on the background of foresight information. Whilst it does not carry out stress-testing against HILPs, the

⁸ <https://vnk.fi/en/foresight/government-report-on-the-future>.

⁹ <https://vnk.fi/en/council-of-regulatory-impact-analysis>.

¹⁰ <https://www.vtv.fi/en/>.

NAOF contributes to enhancing policy resilience by analysing legislation against trends and scenarios (source: expert interviews).

2.6.2. The state of policy stress-testing in the Netherlands

Foresight has a long history in the Netherlands, with Royal Dutch Shell carrying out its first horizon scan exercise in 1967 (Andersson, 2021). The use of stress-testing in the national policy process is currently most pronounced in the field of environmental policy.

A major flood in 1953¹¹, which killed 2 551 people, 1 835 of them in the Netherlands, led to the foundation of the Delta Programme¹², a framework to ensure that physical protective measures (i.e., dikes, dams, sluices) were in place and could withstand this type of event in the future and that critical infrastructure could function during flooding. The scope of the Delta programme, now in its second phase, has widened to include not only resilience against direct impacts of climate-related events, including flooding, but also in regard to water quality, urban development, and health issues (source: expert interviews). The programme unites the central government, provinces, municipalities, as well as water boards and entails the testing of strategic options against climate scenarios, whilst also applying other foresight methods. National policies aiming to make the Netherlands more climate-proof and water-resilient are directly based on assessments and decisions made as part of the Delta Programme (National Delta Programme, n.d.).

In 2019, the Dutch government published a National Strategy on Spatial Planning and the Environment (Government of the Netherlands, 2019). The strategy was 'stress-tested' by the Netherlands Environment Assessment Agency (PBL), one of three national Planning Agencies providing short- and long-term insights with respect to their specific policy domain. As part of the stress-test, the government's environmental strategy was assessed in the face of two scenarios, a high economic growth scenario and a stagnation scenario (source: expert interviews).

On a more general level, **there is no fixed procedure in place regarding the organisation and structure of stress-testing** in the Netherlands. Despite a relatively strong integration of foresight across ministries and sectors (see, for example, SOIF, 2021), the use of stress-testing is more sporadic outside of environmental and spatial planning. Interviewed experts state that politicians need some convincing to use scenarios, as there is a tendency to focus only on expected future developments and a reluctance to explore alternative futures (source: expert interviews).

Despite the uneven use of stress-testing in the Netherlands, **there are structures in place that would allow for a more integrated approach to stress-testing in the national policy process**. A specific example is the statutory obligation for all proposed policies to be subjected to an impact analysis using an integrated assessment framework for policy and regulations (Integraal Afwegingskader - IAK)¹³ developed in the Netherlands. This includes a requirement to accompany draft regulations with a note specifying 'the costs to citizens, businesses and institutions and the costs to the government' (Kenniscentrum Wetgeving en Juridische zaken/The Knowledge Centre for Legislation and Legal Affairs (the Netherlands), 2017), whilst no references are made to assessing impacts associated with possible future events. It can be pointed out though, that a guideline to cost-benefit analyses issued in 2013 by two of the national planning bureaus recommended considering costs related to uncertainty and risk, and that scenarios be used to evaluate relevant exogenous developments (Romijn & Renes, 2013).

¹¹ <https://www.rijkswaterstaat.nl/en/water/water-safety/the-flood-of-1953>.

¹² <https://english.deltaprogramma.nl/delta-programme>.

¹³ <https://www.cilc.nl/cms/wp-content/uploads/2018/02/IAK-English-02-11-2017.pdf>.

At the same time, **an OECD review** (OECD, 2020) **of ex ante policy evaluations in the Netherlands finds little evidence of their impact on decision making within government** and states that they typically are characterised by a limited uptake of research outputs from the otherwise strong analytical capacities situated throughout government. This holds true for knowledge produced by the National Planning Agencies, despite their main task of providing the Dutch government with insights into the present and future state of the country as well as how it may be affected by government policies (Halffman, 2009; OECD, 2020d).

Although the research made for the present study indicates a growing interest in strategic foresight at the national level following the Covid-19 pandemic, it has apparently not led to a significant increase in stress-testing activities, at least when it comes to policy issues unrelated to climate change or other environmental issues.

2.6.3. The state of policy stress-testing in New Zealand

As is the case in Finland and the Netherlands, **stress-testing is also not widely applied in New Zealand's policy process**. Among the most significant reasons for this are the absence of systematic integration of strategic foresight in government and difficulties in engaging decision-makers in using outcomes of foresight initiatives (SOIF, 2021; expert interviews).

Nonetheless, the stress-testing of policies against a set of possible future scenarios is considered to be good policy practice. **Government agencies have a legal responsibility to monitor and ensure that regulatory systems remain functional over the long term** due to the statutory obligation of *regulatory stewardship*. Introduced with the Public Service Act 2020 (Parliamentary Counsel Office, 2020), the obligation renders all chief executives of government departments (where most of New Zealand's legislation is administered) responsible for taking a proactive and collaborative approach to monitoring and securing the performance of the legislation administered by them. This entails responding to change over time in order to secure the functioning of policies in the medium- and long-term. The Public Service Act does not define these time horizons any further, nor does it state a legal requirement to employ stress-testing as such. However, it obliges all departmental chief executives to regularly publish Long-term Insights Briefings on trends, risks and opportunities that may affect New Zealand and its society in the future (Department of the Prime Minister and Cabinet, 2021a; 2021b; Ministry of Justice, n.d.).

In the absence of a centralised public unit for this purpose, the responsibility for coordinating national foresight efforts is currently held by the semi-formal Strategic Futures Group, which began to form in 2016. It is a network of around 140 foresight practitioners, mostly strategists, planners, and policy practitioners in various government departments. They promote the development of foresight capabilities in government and offer peer reviews to interested departments having conducted foresight activities. According to an interviewed member, the Strategic Futures Group has not done much foresight work together as a unit. Members generally share what they are doing within their agencies, but it has been difficult to get traction on joint initiatives. The group has trialled the use of foresight methods among a number of agencies and carried out some foresight discussions on the basis of these activities, but in a rather informal manner (source: expert interviews).

As the description of the Strategic Futures Group indicates, **foresight activities, including stress-testing, are typically orchestrated within government departments**. An example of fiscal stress-testing by the New Zealand Treasury was already mentioned in greater detail in section 2.4.2. Documented foresight efforts also include work by the Ministry of Transport, which consulted experts as well as the public to identify key drivers and generate scenarios describing how society and demand for travel may look like in 2042. Impacts of the scenarios on possible future investment

needs in the land transport system were calculated using a quantification model (Lyons, et al., 2014). Since 2019, the Ministry of Environment is legally required to regularly produce climate change risk assessments. They make use of scenarios based on existing climate change data to examine possible vulnerabilities in different sectors, such as the environment, infrastructure, and the financial system (Ministry for the Environment, 2020; 2021).

According to interviewed policy advisors, **stress-testing tends to be done on an ad hoc basis at the very end of the policy process following mandatory assessments, such as cost and benefit analysis.** Among the stated explanations for this are a lack of time and resources in some cases, whilst thinking about the probability of future risks and potential impacts is simply not prioritised in others.

Further, interviewees state that the outcomes and results of stress-testing activities rarely feed directly into final policies. One of the reasons for this is a lack of commitment devices ensuring that policy-makers, to a greater extent, engage in and implement outcomes of stress-testing and related foresight activities. Although the value of anticipatory governance is widely recognised in New Zealand, stress-testing only plays a marginal role in the national policy process (source: expert interviews). This may in part be due to the fact that the Public Service Act 2020 does not define how exactly outcomes of foresight research, such as the Long-term Insights Briefings, should be used or adapted by policy-makers.

2.6.4. The state of policy stress-testing in the United Kingdom

Among the key developments leading to a strong integration of foresight into the British government was the launch of the UK Foresight Programme in 1994 (Parliamentary Office of Science and Technology, 2009). It was introduced on the basis of a UK government White Paper published the year before, which set out a series of reforms to enhance the UK's existing strengths in science, engineering, and technology to improve the nation's competitiveness and quality of life. Among the initiatives outlined in the paper were a programme to promote technological foresight activities and a new foresight fund (UK Parliament, 2001).

The UK Foresight Programme is currently based in the Government Office for Science (GOS)¹⁴, which supports the Prime Minister and members of the Cabinet in developing policies based on scientific evidence and strategic long-term thinking. To promote the use of foresight by British policy professionals, the GOS has, for instance, developed the UK Futures Toolkit¹⁵ introduced earlier in section 2.1. It contains guidance on how to apply a range of foresight methods, including horizon scanning and stress-testing, in the policy process. A unit within the GOS, known as the Futures Team, is dedicated to advising government agencies on their foresight initiatives and to supporting foresight capability building by developing and disseminating relevant resources aimed at policy-makers, such as the recently published Trend Deck (Government Office for Science, 2021b) for possible use in scenario development or stress-testing.

It can be added that **the British government recently has introduced additional measures to support government agencies and other public bodies in using strategic foresight.** Since February 2020, these entities can use the Futures Procurement Framework¹⁶ to request foresight

¹⁴ <https://www.gov.uk/government/organisations/government-office-for-science>.

¹⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/674209/futures-toolkit-edition-1.pdf.

¹⁶ <https://www.gov.uk/guidance/futures-procurement-framework>.

services, including guidance and support on horizon scanning and scenario exercises as well as capability building, from 27 external suppliers (UK Government, 2020).

The focus on anticipatory policy-making in the UK is reflected in foresight initiatives across a range of sectors or cross-sectoral topics. Horizon scanning and scenario development are prevalent methods, which in the past have been used to explore the future of food and farming, urban development as well as transport, among others (Government Office for Science, 2011; 2016; 2019). To get external perspectives on policy-related issues and possible responses, foresight activities in the UK tend to engage a range of different stakeholders. Different projects related to a foresight initiative on the future of British cities, for instance, involved the use of workshops, interviews, and the Delphi method to consult urban development experts, researchers from academia, city/local governments, and local businesses (Government Office for Science, 2016).

Policy stress-testing is applied to a lesser extent in the British policy process. Publicly documented efforts include a study by the GOS exploring the future of obesity in the UK, which used four scenarios and quantitative modelling to stress-test possible policy responses (Government Office for Science, 2007). The Department for Environment, Food & Rural Affairs (DEFRA) is currently stress-testing the environmental targets set out in the UK Government's 25 Year Environment Plan¹⁷ against a range of scenarios. As part of its long-term strategy, DEFRA has previously declared to work towards better monitoring and evaluation of the Plan as well as proposing that it should be amended at least every five years following progress reviews (source: expert interviews).

The status is however that there is neither a legal obligation nor a common approach to policy stress-testing across government agencies. Whether stress-testing is adopted in the design process of a specific policy tends to depend on the existing foresight capabilities in the responsible government department. When used as a policy tool, stress-testing is usually conducted at the end of the policy process for assessment purposes. Further, this study finds that **the uptake of stress-testing results by British policy-makers is limited.** Among the explanations for this given by interviewed policy advisers is a mismatch between the time required to conduct stress-tests, including the development of comprehensive scenarios, and the limited window of opportunity for influencing the design of proposed policies (source: expert interviews).

¹⁷ <https://www.gov.uk/government/publications/25-year-environment-plan>.

3. Pilot testing a methodology for policy stress-testing

Building on the evidence base gathered through literature review and country research, this study now proceeds with a pilot test. The objective of the pilot has been to test, in practice, how European policies can be stress-tested, and evaluate the feasibility of carrying out policy stress-testing at a larger scale, as a systemic element of the EU policy process.

Rather than approaching this in a theoretical manner, it was decided to carry out a pilot exercise, in which a methodology was developed, drawing on the findings of the literature review and the country studies. The initial idea was to develop a methodology that should be 'policy-agnostic', i.e., it should not be tailored to a specific policy area. Instead, it should allow the study team to subject concrete legislation within three EU policy areas to low-probability, high-impact events with the aim of identifying weak spots in the legislation and suggesting possible legislative adjustments. One of the findings is that some tailoring depending on the type of policy instrument used (not the policy area itself) might be necessary. The pilot test entailed a *retrospective* analysis, where it was assessed how the policies were affected by the shocks of the Covid-19 pandemic as well as a *prospective* analysis, assessing how the policies would potentially perform if subjected to a small selection of theoretically possible (but still plausible) high-impact events.

Below, the method that was developed for this pilot test is described followed by the findings of the pilot.

3.1. Methodology for the pilot test

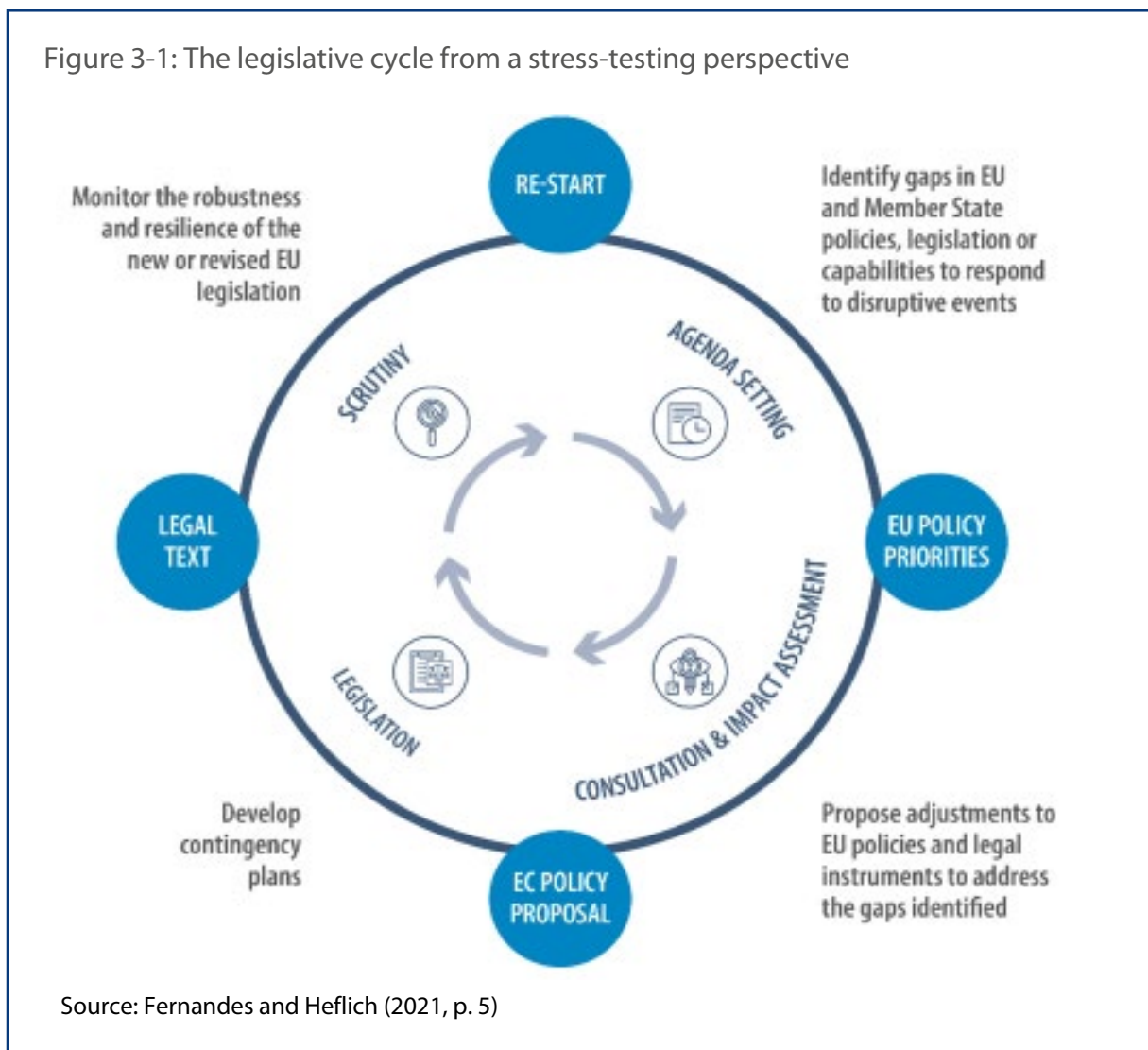
3.1.1. Step 1: Selection of three EU policy areas

The study focused on three policy areas – two established policy areas in which the EU law and policy is relatively consolidated and has been in force for some time, and one, which is rather new. This enabled an assessment of how these well-established policies had performed during the Covid-19 pandemic, as well as a 'stress-test' against future scenarios with a focus on HILPs. In the end, two such well-established policies at the heart of the Treaty on the Functioning of the European Union (TFEU) were selected, and a policy area gaining importance at the European level (robotics and artificial intelligence) was added. The resulting selection is as follows:

- 1 Robotics and artificial intelligence
- 2 Better information for and consultation of workers
- 3 Competition policy - State aid

This selection had the added advantage that it allowed for an assessment of the relative merits of conducting stress-testing at different stages in the EU legislative cycle illustrated in Figure 3-1.

Figure 3-1: The legislative cycle from a stress-testing perspective



3.1.2. Step 2: Selection of concrete pieces of EU legislation

Following these considerations, and in collaboration with EPRS, concrete pieces of legislation were selected within each of the three policy areas, see Table 3-1.

Table 3-1: Legislation to be stress-tested

EU policy area	Legislation
Robotics and artificial intelligence	The proposed AI Act (COM(2021) 206 final) ¹⁸
Better information for and consultation of workers	The Directive on mass redundancies (Council Directive 98/59/EC of 20 July 1998 on the approximation of the laws of the Member States relating to collective redundancies);

¹⁸ At the time of writing, the legislative act is still not in force: legislative procedure no: [2021/0106 \(COD\)](#)

	The Directive on safeguarding employees' rights in case of transfers of undertakings (Council Directive 2001/23); and The Directive on a general framework for workers' consultation (Council Directive 2002/14) - the three Directives are discussed together as they all address information and consultation (I&C) of workers.
Competition Policy - State aid	State Aid rules (Articles 107 (2) (b) and 107 (3) (b) TFEU) in conjunction with the temporary frameworks put in place through various EU Commission Communications (Soft Law), focusing on a limited number of sectors.

Source: EUR-Lex, compiled by Authors

The selection was made with a view to represent different types of legislation (two TFEU provisions, a set of directives, and a proposed regulation).

In the literature, there are very few sources addressing the scope for stress-testing different types of legislation. One source (Ranchordás & van't Schip, 2020) however refers specifically to EU directives as goal-oriented pieces of legislation 'that allow for more leeway and experimentation by Member States and thus more flexibility and involvement of stakeholders at the national level in a way that could be considered a form of law-making that ends up in more stakeholder involvement, and could allow for more scenarios being developed at the national level'.

3.1.3. Step 3: Developing a standardised approach to the review of EU policies

The approach that was selected for the review of the EU legislation includes three separate but linked strands of activity:

- 1 Identifying indicators of flexibility in the selected pieces of EU legislation;
- 2 Retrospective analysis: Assessing how the EU legislation has performed during the Covid-19 pandemic;
- 3 Prospective analysis: Developing and validating scenarios based on plausible high-impact events and gauging the resilience of the EU legislation should the scenario materialise.

Identifying flexibilities in the legislation

The purpose of this analysis was to be able to assess the general resilience of the selected legislation by looking for types of flexibility that will allow for quick responses in case of crisis or ensure an ongoing future-proofing exercise. The following types of flexibilities were sought for in the legislative texts:

- *Sunset clauses*: Deadlines included in the legislation, at which the legislator must either amend or re-confirm the legislation or policy.
- *Review clauses*: Deadlines included in the legislation for when the legislation should be reviewed and, if needed, amended.
- *Emergency exceptions/clauses*: Provisions that come into force only in exceptional cases, e.g., Article 107 (2) TFEU: 'The following [forms of State aid] shall be compatible with the internal market: [...] (b) aid to make good the damage caused by natural disasters or exceptional occurrences.'
- *Discretion*: Discretion given to agencies (or lower levels of governance, e.g., Member States, regional authorities) administering the framework.
- *Sandboxes*: Closely monitored experiments, where certain actors (usually businesses) are allowed to test innovative products, services, or business models whose risks are uncertain and not accounted for in existing legislation but potentially hold benefits for society.

- *The precautionary principle:* The 'better safe than sorry'-principle, which supports a protective or cautious approach to products, processes or policies that have the potential to cause harm to the public or the environment before completed scientific evidence can demonstrate the actual risk level.¹⁹

While sunset clauses are rarely found in EU policies, review, evaluation, and reporting provisions are frequently included. The latter can be helpful in the process of future-proofing legislation by requiring periodic reconsideration of the framework. An example of a sunset clause is found in the temporary framework for Coronavirus-related State Aid, which expired on 21 December 2020. It was prolonged and now is set to expire on 31 December 2021. Sunset clauses are not very prevalent in EU legislation and are more short-term than review clauses. They are also likely more used in emergency-type legislation that establish temporary/extraordinary frameworks and policies (e.g., post 9/11 or in the context of the financial crisis), while review clauses are included in the vast majority of more recent EU legislation (Krišto & Poutouroudi, 2018).²⁰

Retrospective analysis

This analysis sought to draw lessons from the recent past concerning a shock that has reverberated through geographies and sectors with expected as well as unexpected impacts: the Covid-19 pandemic. The analysis has addressed the selected EU policies as well as national responses within these policy areas. Due to the limited scope of the pilot exercise, the analysis sought examples only from two Member States, Germany, and Italy. By describing and analysing the political response at EU and national levels, and the extent to which it was necessary to suspend legislative provisions and/or put in place emergency provisions, this analysis enabled the team to pinpoint specific strengths and weaknesses in the selected legislation that have already come to be recognised. In that sense, the Covid-19 pandemic has provided a recent and ongoing real-life stress-test for the EU as well as for national policies.

Prospective analysis

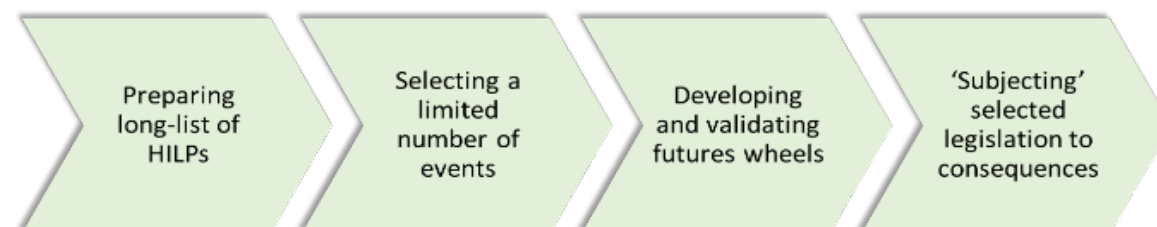
This is the part of the study that has addressed the question of stress-testing policies against future high-impact events. As described earlier (section 2.4), there is widespread consensus among scholars and international organisations engaged in futures studies about the merits of considering alternative future scenarios in policy-making. In addition, however, there is a dearth of studies that have considered the feasibility of testing concrete legislation against high-impact, low-probability events, and some studies even consider such testing as not very useful, the argument being that it is not possible anyway to prepare for all such events (OECD, 2019). Therefore, the methodology involved in the pilot test, and in particular, the selection of the events against which the legislation should be tested needed careful consideration.

The steps in the analysis are shown in Figure 3-2 and described below.

¹⁹ As put by the EU Commission: 'Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty' (COM(2000) 1 final)

²⁰ [https://www.europarl.europa.eu/RegData/etudes/STUD/2018/621821/EPRS_STU\(2018\)621821_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2018/621821/EPRS_STU(2018)621821_EN.pdf)

Figure 3-2: Steps in the prospective analysis



Source: Elaborated by authors.

Source: Authors

A major consideration in preparing a longlist of HILPs was that they should carry a certain plausibility, i.e., they should be based on horizon scanning and/or be possible outcomes of already known trends. The choice fell on considering collections of HILPs/wild cards already available in the public domain. Due to the limited scope of the pilot test, we focused on two sources: the mapping of risks to Europe post-Covid (EPRS, DG IPOL & DG EXPO, 2020a), and the collection of wild cards that was one of the outputs from the *iKnow Project* (Miles, et al., 2011).²¹ The project represented the first collective effort to translate research on wild cards and weak signals into well-structured policy briefs. It offered practical recommendations for further research on a wide range of issues (Mendonca, et al., 2009; Kaivo-oja & Lauraéus, 2017).

From these collections, ten HILPs were selected for each of the three policy areas that are already, or may conceivably be, stress factors creating pressures for the European legislation in the field. The HILPs were subsequently categorised according to the STEEPV domains (Social, Technological, Environmental, Economic, and Value-oriented) to assess whether events were well distributed across the domains. Following this exercise, the research team found too few HILPs in the environmental and economic domains and suggested a few extra items based on the literature consulted for the study. The result is shown in Table 3-2.

²¹ The iKnow Project was one of six 'Blue Sky foresight research' projects funded by the European Commission's Seventh Framework Programme for Research and Technology Development (FP7). The project brought together an active foresight community. The website of the community is still active and can be accessed at [iKnow Community: The innovation, Foresight & Horizon scanning community \(iknowfutures.org\)](https://www.iknowfutures.org/).

Table 3-2: Longlist of potential HILPs per analysed EU policy area

Robotics and artificial intelligence	Better information for and consultation of workers	Competition policy - State aid
BS Policy Alert 22 7: Total rejection of the 'Internet of Things'	BS Policy Alert 1: Killer virus	BS Policy Alert 09: Invisibility spray
BS Policy Alert 8: Universal electronic systems breakdown	BS Policy Alert 2: Body parts on Demand	BS Policy Alert 13: Outburst of the black economy
BS Policy Alert 23: Total control by Big Brother technologies	BS Policy Alert 10: Pervasive self-diagnosis and self-treatment	BS Policy Alert 16: Inner cities are closed to private cars
BS Policy Alert 24: Robots and iCare for the ageing population	BS Policy Alert 11: Reduction in human diversity?	BS Policy Alert 17: Towards the utopia? – global tech-enhanced government
BS Policy Alert 25: iBrain vs Brain point	BS Policy 14: Floods in Europe cause mass migration	BS Policy Alert 9: New pro-war president elected in the US
BS Policy Alert 26: 3D media trust-worthily copying reality	BS Policy Alert 15: Minimum Flight Distance Introduced	BS Policy Alert 20: Critical Information Infrastructure Collapsed: Back to the 80s!
BS Policy 29 Alert: Cyber crusade: e-sabotage by political 'hacktivists'	BS Policy 18 Alert: Empowerment of women – emergence of a matriarchal society	BS Policy Alert 21: The Rise of a new world
BS Policy Alert 33: Europe (and the world) flooded	BS Policy Alert 22: Collapse of social and health systems due to rapidly increased old-age poverty	BS Policy Alert 28: European Commission scraps research support projects
BS Policy Alert 20: Critical Information Infrastructure Collapsed: Back to the 80s!	BS Policy Alert 27: Free Time Society in Europe	BS Policy Alert 30: Israel and Palestine are admitted to the EU
BS Policy Alert 37: Transhumanism becomes a significant force	BS Policy Alert 31: Nano-lab inside your body	BS Policy Alert 32: A lottery is introduced where people can save their life or have death sentences – to halt over-population
BS Policy Alert 38: First contact with extra-terrestrial Intelligence	EPRS mapping: Global economic depression	Extra Policy Alert: Stronger merger control in dynamic markets
Extra Policy Alert: Blockchain technology legislation requirements increase in the global policy	Extra policy alert: Crop failure in the entire Mediterranean region due to drought and wildfires	
Extra Policy Alert: Digital twin revolution and disruption	Extra policy alert: Stronger Digital Privacy Requirements and Privacy Security Protocols	
BS Policy Alert 10: Pervasive self-diagnosis and self-treatment		
EPRS mapping: Large-scale cyber-attacks against critical EU infrastructure		

Sources: (Miles, et al., 2011; EPRS, DG IPOL & DG EXPO, 2020b), authors' elaboration

²² The 'BS'-numbers refer to 'Blue Sky Policy Alerts' – each of these is described in detail in Miles et al. (2011). Some are renamed for the sake of understandability. The policy alerts are ten years old, and hence, today some of them appear to be no more than trends rather than wild cards or HILPs.

For the pilot test, it was decided to select two items (HILPs) per policy area for the test. To ensure that the selection was undertaken in a manner that was systematic rather than random and that the selection was carried out using a methodology that could potentially be replicated by policy-makers and at a larger scale, it was decided to carry out the selection using *crowd rating* (also known as crowd voting or crowd opinion) (Santonen & Kaivo-oja, 2020). This method has the purpose of gathering opinions on a topic from a 'crowd'. In the context of wild card/HILP analysis, crowd rating can be used to gather opinions on which HILPs should be given the most attention. In such a situation, it would be relevant to invite a crowd of informed stakeholders, policy-makers, and futurists to give their opinion. In the current pilot study, the four team members served as an informed – albeit very small – crowd.

An Excel-based tool was developed by the team for the crowd rating. This tool allowed each member - independently and without prior discussion – to rank the shortlisted HILPs according to their plausibility and impact on a range of dimensions. All members of the research team participated in the final selection process by subjectively evaluating, on a scale from one to ten, the *perceived likelihood* of each HILP to occur; the *potential strength of its impact* in each of the STEEPV domains, for instance on the economy; and the *perceived need for EU intervention*, should the event happen.

The final selection of six HILPs was based on the results from this crowd rating exercise. The HILPs with the highest scores underwent a final assessment of their plausibility (low, but still plausible), impact (high and pervasive), and the combined breadth of origin and impact (covering as many STEEPV domains as possible). Finally, the team considered the relevance of the HILPs for the policy areas to be stress-tested. In this step, it was decided to test the policies not only against HILPs that appeared immediately related to the policy area but to also include in the test such HILPs that did not immediately appear relevant to the policy area. This decision was based on the observation of the impacts of the Covid-19 pandemic, which have extended far beyond public health and the health and care sectors.

Following these considerations, the crowd rating process led to the matching of two HILPs to each policy area.

Table 3-3: HILPs matched to the analysed EU policy areas

EU policy area	Event	Brief description
Robotics and AI	Europe (and the world) flooded	With rising sea levels, seawater has overflowed the continents and reshaped geographical maps. Humanity is forced to start a new era, with new economic patterns and changing lifestyles. A background of advanced technologies is still present but very often scientific achievements and materials are destroyed or located under the sea. Large shares of the population must resort to more traditional lifestyles based on agriculture or traditional crafts. Only some new islands or regions are technologically advanced and new geopolitical equilibriums arise.
	Large-scale cyber-attacks against critical EU infrastructure	Sophisticated cyber-attacks succeed and wreak havoc. Large-scale attacks on critical infrastructure include a long preparatory phase, during which targets are spied on and secretly breached, and an attack phase, with targeted or cascading attacks that cripple or sabotage the target. Targets can include neuralgic nodes in governance (e.g., people, buildings, networks, processes such as elections; energy infrastructure (e.g., electric grids, pipelines, dams,

EU policy area	Event	Brief description
		nuclear power plants); transport (e.g., air, rail, traffic management); financial infrastructure (e.g., banks); communication (e.g., 5G, satellites, internet); and health care and food supply systems.
Better information for workers	Crop failures in the entire Mediterranean region due to drought and wildfires	Due to the failure of the global community to reduce carbon emissions, the climate in the Mediterranean basin has changed substantially. The region is plagued by severe drought, and wildfires are the order of the day rather than localized and intermittent incidents. The traditional agricultural basis is severely challenged.
	Global economic crisis	The coronavirus pandemic has generated an unprecedented shift in the very nature of the global economic cycle, combining shocks on both the supply and demand sides. A severe pandemic-induced economic crisis has followed.
Competition policy - State aid	New pro-war US president elected	US policies have become more aggressive and intolerant with respect to other world powers. This happened when China's rise in power was felt more strongly. Struggles also emerged in commercial markets. The world was split into three main blocks: Asia, the US-UK, and the Middle East; in these blocks independence and protectionism suddenly gained prominence. The rest of Europe remained divided and uncommitted in its support and allegiance to any one block and followed several different paths. The result is a tendency towards chaos across large parts of Europe.
	Outburst of the 'black' (i.e., illegal) economy	National economies are increasingly relying on 'black' (i.e., illegal) economies of including cybercrime, illegal financial transactions, and trading in crypto-currencies and carbon credits. This has left society vulnerable to the development of a 'black' cyber-economy including identity theft, software piracy, hacking/scams, and counterfeiting.

Source: Authors

For each of the HILPs, *future wheels* were then developed by the team. This exercise involves drawing out the expected first, second, and third order consequences of the event, and categorizing these consequences according to the STEEPV dimensions. The future wheels were then validated through discussions with external experts²³ and with the EPRS, using the collaborative platform Miro, which allows participants to collaborate online using a virtual whiteboard and virtual sticky notes that participants can write on, edit, and rearrange until reaching a consensus. The revised wheels were subsequently used for the stress-test proper. One example of a futures wheel is shown in Figure 3-3. All the six future wheels are enclosed as Appendix 2.

²³ Two experts were involved: Dr Philip Tovey, Head of Futures at DEFRA, UK; and Dr Benedikt Dengler, Policy Officer Federal Ministry for Economic Affairs and Energy, Germany.

Figure 3-3: Futures wheel. Policy area: Robotics and AI. HILP: Europe and the world flooded



- Social dimension
- Technological dimension
- Economic dimension
- Environmental dimension
- Political dimension
- Values dimension

Source: Elaborated by authors.

The stress-test of the legislation

After the development and validation of the future wheels, the proper stress-testing involved going through each of the pieces of EU legislation selected for each EU policy area and assessing, for each of the first and second order events/consequences, if and how the legislation and its objectives could possibly be impacted by that event. Considerations of the impact of events on selected

relevant provisions of the various pieces of EU legislation are listed in tables, which can be found in Appendix 3: Stress-test – impact tables.

3.2. Findings from the pilot test: Robotics and AI

As a general note, the retrospective analysis was not carried out for Robotics and AI, since the proposed AI Act (2021/0106 (COD)) that has been selected for this pilot stress-test is not yet in force.

3.2.1. The legislation selected for testing

The concrete legislation that underwent the pilot test was the proposed AI Act.²⁴ The legal basis for the proposal is Article 114 TFEU, which provides for the adoption of measures to ensure the establishment and functioning of the internal market. **The purpose of the proposed AI Act is to lay down harmonized rules on the EU internal market to ensure a coordinated European approach to the human, ethical, and safety implications of AI.** It has the objectives of promoting the development and uptake of AI and providing legal certainty to promote investment and innovation in AI, while addressing the safety and ethical risks with certain uses of AI technology and ensuring that fundamental rights (e.g., the right to non-discrimination, right to privacy, right to human dignity) are enforced and respected in the development and deployment of AI.

3.2.2. Flexibilities in the legislation

The following forms of flexibility were identified in the proposed AI Act. These flexibilities serve to enable the Act to serve its purpose under different and changing circumstances.

Regulatory sandboxes

'To ensure a legal framework that is innovation-friendly, future-proof and resilient to disruption', Recital 71 calls on Member States to establish artificial intelligence regulatory sandboxes 'to facilitate the development and testing of innovative AI systems under strict regulatory oversight before these systems are placed on the market or otherwise put into service.'²⁵

Articles 53-55 provide for the setting up of regulatory sandboxes by national authorities. Particular attention is given to data protection concerns, and SMEs (small-scale providers and start-ups) who should be given priority access to sandboxes. Article 53 (5) requires national authorities to report to the EU AI Board annually on sandboxes' activities, progress, good practices, lessons learnt and recommendations.

The precautionary principle

The precautionary principle is applied in the AI Act to the extent that AI-applications have been classified as unacceptable (social scoring, forms of facial recognition), high-risk, and low or minimum risk. While unacceptable risk practices are prohibited, high-risk applications will have heavier regulatory burdens than low/minimum-risk applications.²⁶

²⁴ [COM\(2021\) 206 final](#).

²⁵ Ibid., p. 34.

²⁶ Recitals 27, 28, Article 5 (prohibited/unacceptable AI practices), Article 6 (classification rules for high-risk AI systems), Title III (high-risk AI systems), Article 51 (transparency obligations for certain AI systems).

Review clauses

Article 84 is entitled 'evaluation and review' and requires the Commission to produce a report reviewing the implementation of the AI Act to the Parliament and Council after five years following the entry in to force of the AI Act and every four years thereafter.

3.2.3. Findings from testing the legislation against the consequences of HILPs

The provisions of the proposed AI Act was tested against two HILP-scenarios in light of the objectives of the Act: A large-scale cyberattack and a scenario in which Europe (and the world) is flooded.

Event 1: Large scale cyberattack

Cyberattacks, including attacks on public authorities and private enterprises, happen every day. In this HILP scenario, it is envisaged that one or more large-scale cyberattacks take a whole new level of sophistication and harm than ever before. It presupposes that the attackers had a long preparatory phase and were able to breach all existing cybersecurity measures and tools applied by government entities and companies around the world, so that **the ultimate attack was extremely effective, took all targets completely by surprise, and wreaked havoc due to uncontrollable cascading effects**, crippling a significant share of critical IT systems in the EU.

Article 15 of the proposed AI Act requires that high-risk AI systems possess an appropriate level of accuracy, robustness, and cybersecurity. The provision specifies in paragraph 4 that high-risk AI systems shall be 'resilient as regards attempts by unauthorized third parties to alter their use or performance by exploiting the system vulnerabilities' and that the 'technical solutions aimed at ensuring the cybersecurity of high-risk AI systems shall be appropriate to the relevant circumstances and the risks'.

In this HILP scenario, it is assumed that while high-risk AI providers and users complied with Article 15, the level and sophistication of the attack were so high that conventional cybersecurity measures could not shield the high-risk AI systems from malfunctioning and loss of control over the operations, data theft, data poisoning, and other malicious acts. Similarly, it is assumed that cybersecurity measures put in place by high-risk AI system providers in conformity with the scheme under Regulation 2019/811 have proved insufficient to fend off the attack (Article 42 of the proposed AI Act).

Considering the objectives and provisions of the proposed AI Act, the following first-order effects of the attack were identified as relevant:²⁷

- Irrevocable loss of data in some or all sectors;
- Increased awareness of specific vulnerabilities to cyberattacks;
- Facilities not heavily connected to and relying on the internet manage better than those that are connected;
- Consumers and other users unable to use crucial digital services based on AI-systems (e.g., IoT devices linked to critical infrastructure).²⁸

²⁷ A mapping of first, second and third order effects identified in the future wheel exercise against the relevant provisions of the AI Act is provided in Appendix 3.

²⁸ The link to consumer protection might not be obvious. See, however, EPRS Brief on the AI Act from 17 November 2021, for example, where BEUC argued that consumer protection is insufficiently addressed by the AI Act: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698792/EPRS_BRI\(2021\)698792_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698792/EPRS_BRI(2021)698792_EN.pdf) In this vein, it should also be noted that a high level of consumer protection should be ensured in Union policies according to Article 38 of the Charter of Fundamental Rights of the EU.

The AI Act defines AI systems as *'software that is developed with one or more of the techniques and approaches listed in Appendix I, and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with'* (Article 3(1)). Appendix I specifies various techniques to develop AI systems, including data-intensive techniques such as machine learning and statistical approaches, and techniques that do not necessarily rely on vast amounts of data for learning, such as logic- and knowledge-based approaches. Nonetheless, all providers of high-risk AI systems,²⁹ irrespective of their technique, are required to keep considerable amounts of data about the functioning of the AI system. For example,

- Article 11 in conjunction with Article 18 requires the drawing up of technical documentation to show that an AI system complies with the AI Act requirements.
- Article 12 in conjunction with Article 20 requires automatic logging during the operation of high-risk AI systems to allow for post-market monitoring and traceability of the AI system's functioning throughout its lifecycle.
- Article 17 requires quality management programmes in place, e.g., systems and procedures for record keeping of all relevant documentation and information, data management plans, post-market monitoring systems, etc.

Similarly, users of high-risk AI systems are required to keep logs (i.e., data) about the functioning of high-risk AI systems automatically generated by the AI system (Article 29).

In case of an unforeseen large-scale cyberattack causing data losses across all sectors, the providers, distributors, and users of high-risk AI systems would no longer conform to the requirements of the AI Act, as they would have lost the logs, records, and relevant documentation about the AI system's functioning. In addition, the effects of the malicious attack on the functioning of the AI systems might not be clear. **Taken together, this might lead to high-risk AI systems posing unforeseen new risks to their environments, fundamental rights, public health, and safety, thus failing to fulfil one of the objectives of the AI Act.** Article 65 provides a procedure for dealing with AI systems presenting a risk at national level, but it is concerned with case-by-case evaluations of AI systems, not with a sudden collective risk by many high-risk AI systems.

In a similar vein, there are requirements pertaining to national and EU authorities' registers/databases of high-risk AI systems (Articles 51 and 60). These provisions aim at increasing public transparency and oversight and strengthening ex-post supervision by competent authorities. A large-scale cyberattack as envisioned in this HILP would likely impair the established register systems, again hampering external oversight of high-risk AI systems by competent authorities, thus again raising risks for public health, safety, and the protection of fundamental rights.

Next to the guarantee of having a human in the loop (Article 14) and good data governance for training, validation, and testing data sets (Article 10), one of the core logics of the AI Act to ensure that the risks from high-risk AI systems for safety, health, and fundamental rights are mitigated rests on the whole monitoring, documenting, and certification system. A total collapse of documenting, monitoring, certification and register data is not foreseen by the Act. There are also no explicit requirements that documentation needs to be kept in a paper trail or a disconnected digital data storage to provide additional safeguards. **As it is not foreseen, there is also no provision for what**

²⁹ According to article 6, an AI system shall be considered high-risk if (a) the AI system is intended to be used as a safety component of a product, or is itself a product covered by the Union harmonisation legislation listed in Appendix II; and (b) the product whose safety component is the AI system, or the AI system itself as a product, is required to undergo a third-party conformity assessment with a view to the placing on the market or putting into service of that product pursuant to the Union harmonisation legislation listed in Appendix II. Furthermore, the Commission provides a list of systems it considers to be high-risk in Appendix III to the proposal.

would happen if the whole system of documenting, logging, monitoring, etc. collapsed. Would, for example, high-risk AI systems based on training, validation and testing data need to be retrained from scratch? Or would we take the risk of allowing the operation of high-risk AI systems whose data history has been lost?

It is not clear how other pieces of EU legislation could fill this gap. The proposed Data Governance Act (2020/0340(COD)), for example, is concerned with making public sector data available for re-use, sharing of data among businesses, and allowing data use on altruistic grounds. None of these objectives are related to the risks of AI systems. In terms of safety, the Data Governance Act is concerned with preserving privacy and confidentiality of data rather than with cybersecurity issues, albeit it suggests that data-sharing entities should ensure encryption or corporate policies to prevent unlawful access to non-personal data (Recital 18). Nevertheless, outside the data-sharing context, it appears that solutions for massive data losses would need to be provided by the AI Act.

Possible solutions would include off-grid storage of data regarding the documentation, monitoring, certification, and use of high-risk AI systems. This obligation could be introduced into the framework of the AI Act through flexibility by delegation. The Commission would have the power through various provisions in the AI Act to adopt delegated³⁰ or implementing acts that could specify such an obligation. Article 11 (3), for example, allows the EU Commission to adapt the requirements for the documentation of high-risk AI systems through delegated acts. The same is true for introducing new elements in the conformity assessment and declaration of conformity of high-risk AI systems under Articles 43 and 48.

Alternatively, **the EU Commission can adopt implementing acts where it considers that the specifications for high-risk AI systems are insufficient or there is a need to address specific safety or fundamental rights concerns** (Article 41). In order to adopt an implementing act, the EU Commission needs to consult a committee under Article 74 in line with Regulation 183/2011.

An additional solution would be **to establish a large number of ad-hoc sandboxes** (see Articles 53-55 of the Proposed AI Act on regulatory sandboxes) within which high-risk AI systems without any historical data can be re-tested and re-evaluated before being released on the market again.

With respect to high-risk AI systems used in critical infrastructure,³¹ for example, power grids, traffic control systems, hospitals, ICT-based public services, etc., the gap in the AI Act concerning additional safeguards to protect documentation, historical data, and monitoring data is even more problematic. Since this is critical infrastructure, it is crucial for the social and economic functioning of European society that such infrastructure is operative with as few and limited interruptions as possible. Therefore, **providers and distributors of high-risk AI systems to be used in critical infrastructure and services could be required to ensure that the service provided through the AI can continue even in case of a major cyberattack.** Whether it would be desirable to include a service guarantee in such exceptional circumstances is questionable, though, as the safety of the AI systems after a large-scale cyberattack could be compromised. The horizontal nature of the proposed AI Act has little sector-specific provisions, but in the case of critical infrastructure, such

³⁰ According to Article 290 TFEU, delegated acts provide the EU Commission with the 'power to adopt non-legislative acts of general application to supplement or amend certain non-essential elements of the legislative act' and require the consent of the European Parliament and Council. The proposed AI Act has an explicit provision on delegation in Article 73.

³¹ Management and operation of critical infrastructure is considered a high-risk AI system in the case of AI systems intended to be used as safety components in the management and operation of road traffic and the supply of water, gas, heating, and electricity (Appendix 3, pt. 2).

additional provisions could be necessary to achieve the development of trustworthy AI for critical infrastructures in the EU.

One possibility would be **an additional piece of legislation or a deployment of delegated acts by the EU Commission to specify requirements for critical infrastructure providers that use AI**. Current proposals do not yet fully address this issue. The proposed Directive on the Resilience of Critical Entities (2020/0365 (COD)) explicitly leaves it to the proposed NIS2 Directive to deal with cybersecurity of critical entities.³² The NIS2 Directive imposes on critical entities to have cybersecurity measures for 'business continuity and crisis management in place' (Article 18), which can be further specified through implementing or delegated acts by the EU Commission. The NIS2 Directive refers in no place specifically to the deployment of AI systems by critical entities, but a specification under Article 18 could make a link to an off-grid storage obligation in relation to data from documentation, monitoring, and use of high-risk AI systems implemented by critical entities.

Further, following a large cyberattack that has taken down a lot of critical IT infrastructure in the public and private sectors, **authorities might resort to AI tools for surveillance in order to identify the sources of the cyberattack**. These tools would need to meet the requirements of the AI act, which could potentially constrain authorities in how far they can use surveillance. The result is double-edged: while fundamental rights would be safeguarded from excessive infringement by public authorities, the sources of massive cyberattacks might not be detected. Furthermore, surveillance systems would either be classified as prohibited (if they used e.g., social scoring or real-time biometric data that do not meet the requirements and procedures of Article 5(1)(d), 5(2) and 5(3)), or high-risk. While high-risk systems would be allowed, the systems would first need to be certified, thus delaying their implementation and hence, the detection of sources of cyberattacks. If, however, the large-scale cyberattack turned out to be carried out by a foreign state and could be classified as an act of war, the use of AI systems for espionage, and thus for military purposes would fall outside the scope of the proposed AI Act (Recital 12 and Article 2(3)).

To sum up, the result of the stress-test of the AI Act against effects of a large-scale and unprecedented cyberattack is as follows:

- The vast majority of provisions in the AI Act address **high-risk AI systems**. The regulatory obligations imposed on high-risk AI providers, distributors, and users to mitigate risks from these systems to health, safety and fundamental rights involve a large amount of documentation, logging of activities, and monitoring. Similarly, certification and surveillance by competent authorities of these systems are based on documentation, activity logs, and monitoring of the systems. If a large-scale cyberattack destroyed all of this performance data of high-risk AI systems, significant risks and legal uncertainty would arise. The AI Act does not address such a situation in its current form. **Introducing off-grid storage obligations through delegated or implementing acts could be one solution but would require evaluation from a cost-benefit perspective.**
- In addition, **the NIS2 Directive could ensure that critical entities provide an added layer of safeguards**, thus creating synergies between the AI Act and NIS2 when it comes to critical entities.

³² Recital 8 of the proposed Directive states that '[...]given that cybersecurity is addressed sufficiently in the NIS2 Directive, the matters covered by it should be excluded from the scope of this Directive [...]'. Note however, that there have been calls to combine the Critical Entities Directive with NIS2 into one instrument, see EPRS Brief from 1 December 2021, available at: [https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI\(2021\)689333](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)689333).

- When it comes to **limited- or low/minimal-risk AI systems**, the AI Act does not impose any large-scale documentation, monitoring or certification requirements as they are seen to pose a lower risk to health, safety, and fundamental rights. **In respect of these AI systems, no significant weaknesses of the AI Act were detected in the stress-test.**
- If Member States resort to AI-systems in surveillance activities aimed at identifying the source of an attack, and if the surveillance systems involve the collection of real-time biometric data in public spaces, then **the procedural safeguards imposed by the AI Act, and the need for certification if the system has not been certified yet, might make a quick response difficult.** At the same time, these procedural safeguards ensure the protection of fundamental rights, and would thus be necessary. In this respect the AI Act could be considered to fulfil its objectives.³³

Event 2: Europe (and the world) flooded

The second HILP scenario concerns a **massive flooding due to rising sea levels, which has covered significant parts of the European continent.** The flooding has caused extensive migration, disputes over remaining pieces of land, and forced adjustments to new lifestyles and labour. Advanced technologies are still available, but many records of scientific achievements and materials are destroyed or located under the sea. This HILP is an extreme form of situations that can already be observed, e.g., in the Solomon Islands.³⁴

The future wheel exercise yielded the following relevant (for the AI Act) first-order effects of a severe and lasting flooding of large parts of Europe:

- Critical infrastructure being damaged or destroyed
- Civil liberties being limited in all or parts of Europe due to states of emergency

Extensive and sudden flooding affecting most of Europe will conceivably lead to damage to or destruction of critical infrastructure in many places, with accompanying losses, not only of the physical infrastructure, but also of servers that store data, and the same consequences as described above. Article 15 of the AI Act requires high-risk AI systems to be developed as to achieve an appropriate level of accuracy, robustness, and cybersecurity, including back-up and fail-safe plans. Article 42 specifies that systems that have obtained a cybersecurity certificate under Regulation 2019/881 shall be considered in compliance with Article 15.

At the same time, however, the submergence of servers and systems, and the resulting losses of data has more to do with the physical resilience problem of the systems than with cybersecurity. This aspect is not foreseen in the provisions as they currently stand and underlines that vulnerabilities in a piece of legislation may be exposed due to a variety of seemingly totally unrelated events. **Solutions could require servers that are stored in waterproof conditions, something that, at least in theory, could be required by the EU Commission through delegated or implementing acts as specified above.** Alternatively, backup storage in areas that will certainly not be affected by rising sea-levels could be mandated. This would prepare for severe

³³ Note, however, that there has been criticism of the provisions on facial-recognition technologies in the AI Act, arguing that the current standards actually fall short of protecting fundamental rights. See EPRS (2021). Regulating Facial Recognition in the EU, available at [https://www.europarl.europa.eu/thinktank/en/document/EPRS_IDA\(2021\)698021](https://www.europarl.europa.eu/thinktank/en/document/EPRS_IDA(2021)698021).

³⁴ According to Filho et al. (2020), sea-level rise in the Solomon Islands has led to the erosion of the coastal lines and submergence of parts of some of the islands already. This has led to forced relocation of inhabitants in inundated regions, food insecurity, saline pollution of drinking water, and has scarred the social tissue of the communities, leading to increased conflict e.g., over land.

flooding but would also increase the cost of AI significantly in the EU, thus harming the EU's competitiveness in the field. A thorough cost-benefit analysis should thus be undertaken before implementing such a solution.

A second problem that could ensue in this HILP scenario is **rising civil unrest, due to less resources, land, food, and commodities available to the European population, and massive migration from flooded areas to those areas that have remained above sea level**. Under these emergency circumstances, Member States might again resort to AI surveillance systems for public spaces in order to identify violent clashes early. This could considerably limit civil liberties, including the right to assemble, the right to privacy, etc.

Article 5 (2) of the proposed AI Act provides a limited exception to otherwise prohibited AI systems in law enforcement. This requires, however a balancing between the probability and scale of the harm in the absence of the use of the AI system in the specific situation against the consequences of using an AI system on the rights and freedoms of all persons concerned. **Hence, the legislation allows for political reactions to an emergency of this type, but in very strict boundaries** as in the case of exceptions to fundamental rights more generally. In addition, Article 5(3) would require the deployment of such systems to be first authorized by a judicial or independent administrative authority, which should ensure that the rule of law is upheld in these situations, and no arbitrary use of otherwise prohibited AI systems can be made.

3.3. Findings from the pilot test: Information and consultation of workers

3.3.1. The legislation selected for testing

The pilot testing was performed on three Directives:

- Council Directive 98/59/EC of 20 July 1998³⁵ on the approximation of the laws of the Member States relating to collective redundancies
- Council Directive 2001/23/EC of 12 March 2001³⁶ on the approximation of the laws of the Member States relating to the safeguarding of employees' rights in the event of transfers of undertakings, businesses or parts of undertakings or businesses
- Directive 2002/14/EC of the European Parliament and of the Council of 11 March 2002³⁷ establishing a general framework for informing and consulting employees in the European Community.

Directive 98/59/EC and Directive 2001/23/EC are based on Article 115 TFEU for the approximation of laws that directly affect the establishment and functioning of the internal market. Directive 2002/14/EC is based on Article 153 in conjunction with Article 151 TFEU that allows for adopting EU legislation furthering the harmonisation of laws to improve the dialogue between management and labour. All Directives aim at improving the protection of employees (in case of Directive 98/59 only employees of companies with more than 10 employees and in case of Directive 2002/14 only employees of establishments with more than 20 employees or 50 employees, depending on the Member State's choice) and reducing differences in the protection of employees across Member States when it comes to information and consultation obligations.

³⁵ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31998L0059>.

³⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32001L0023>.

³⁷ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32002L0014>.

3.3.2. Flexibilities in the legislation

All three directives include significant flexibilities in the form of granting Member States or national agencies discretion in the implementation of the Directives, as detailed below.

Council Directive 98/59³⁸ on collective redundancies defines collective redundancies as follows: in at least 10 workers in companies with 20-100 employees, 10% of workers in companies with 100-300 employees, and 30 workers in companies with more than 300 employees (which should receive a notice of at least 30 days) or redundancies of at least 20 workers no matter the size of the company (which should receive a notice of 90 days). In such cases, employers need to notify competent national authority in writing about projected collective redundancies, and the redundancies should not take effect until at least 30 days upon notice (Article 4 (1)).

- Flexibility 1: Member States may grant the competent authority powers to reduce the 30-day period (Article 4 (1)) - or to extend it (Article 4 (3)).
- Flexibility 2: Member States are allowed to introduce more favourable laws, regulations, or administrative provisions to workers (minimum harmonisation).

Council Directive 2001/23³⁹ provides for the safeguarding of employees' rights in the event of transfers, in particular, that the employment relationship is transferred to the new company (Article 3) and that the transfer itself cannot be taken as a ground for dismissal (Article 4), but dismissals 'may take place for economic, technical, or organisational reasons' (Article 4(1)). Continuous representation of workers needs to be guaranteed (Article 6), and information and consultation of workers should take place in 'good time'. Directive 2001/23 applies irrespective of the size of the company involved in the transfer.

- Flexibility: Articles 3 and 4 that contain the provisions on workers' rights given by the Directive do not apply if the former company is in insolvency or bankruptcy proceedings unless the Member States provide otherwise (Article 5).

Directive 2002/14⁴⁰ establishing a general framework for informing and consulting workers provides for a framework laying down a minimum floor of consultation and information duties on employers regarding economic, financial, and strategic developments; structure and foreseeable development of employment and related measures; and decisions likely to lead to substantial changes in work organisation or contractual relations. Member States can choose to apply the provisions of the Directive to companies with more than 20 employees or with more than 50 employees (Article 3 (1)).

- Flexibilities: The flexibility derives both from giving Member States significant leeway in how they transpose the Directive into national law and from deferring to the way that social partners implement the consultation and information duties. All provisions concerning practical arrangements and sanctions are very vague, leaving substantial room to manoeuvre to Member States.

Review Clauses

Directive 2002/14 on a general framework for workers' consultation and information contains a provision (Art. 12) that, not later than 23 March 2007, the Commission shall, in consultation with the Member States and the social partners at the community level, review the application of this

³⁸ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31998L0059>.

³⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32001L0023>.

⁴⁰ <https://eur-lex.europa.eu/eli/dir/2002/14/oj>.

Directive with a view to proposing any necessary amendments. No renewed review clause was introduced following the review.

3.3.3. Retrospective analysis: how did the legislation hold up during Covid-19

According to ILO (2021), the key issues directly addressing human rights at work during the Covid-19 pandemic were the right to *information* and *meaningful participation* of affected populations in decisions on Covid-19 pandemic related policy responses. While these rights are enshrined in the three directives analysed here, no immediate impact on the legislation at the EU level has made itself visible during the pandemic.

In both Germany and Italy, much was mitigated through furlough schemes⁴¹, reduction of working hours⁴², and targeted support to companies to retain the workforce⁴³, and Italy even introduced a ban on laying off staff⁴⁴. While the number of working hours dropped, and unemployment rose during 2020 in both countries,⁴⁵ **the extent of company closures accompanied by mass redundancies have been limited due to national or EU funding schemes**, and therefore the provisions of the directives that protect workers in cases of mass layoffs and company transfers were not widely put to the test. Nonetheless, the general consultation and information duties imposed under Directive 2002/14 were affected due to the significant adaptation of work schedules (in particular, short-term work schemes), hygiene measures, and other organisational processes. In Germany, for example, the German employment minister determined through a ministerial declaration that formal requirements for worker councils to meet physically when being informed, consulted and when they negotiated about measures being proposed could be replaced by videoconferences without violating the formal requirements in German law (ETUC, 2020). In Italy, trade unions and employers adopted a joint protocol that required the full involvement of trade unions and workers' representatives in the measures adopted in response to the pandemic by employers (ETUC, 2020).

3.3.4. Findings from testing the legislation against the scenarios

The three directives have been stress-tested against two scenarios based on HILPs: *Prolonged drought and wildfires in the Mediterranean*, and *global economic crisis*. Both of these HILPs would have a large range of environmental, social, political, economic, and technological consequences. For the purpose of our analysis, however, we focus exclusively on the possible first-order effects on labour markets identified through the future wheels exercise and connect them to a possible impact on the information and consultation of workers obligations derived from the EU Directives identified above.⁴⁶

The main finding of the test is that, **while the directives themselves have significant flexibility by leaving considerable room for decisions on their scope to the Member States, several**

⁴¹ <https://www.bloomberg.com/graphics/2021-furlough-jobs-unemployment-europe-united-states/>.

⁴² https://www.researchgate.net/publication/341409518_SHORT-TIME_WORK_SCHEMES_IN_THE_EU.

⁴³ <https://blogs.lse.ac.uk/euoppblog/2021/06/01/labour-hoarding-during-the-pandemic-assessing-the-impact-of-job-retention-schemes-in-europe/>.

⁴⁴ <https://www.thelocal.it/20210616/a-million-more-unemployed-fears-as-italys-covid-freeze-on-layoffs-set-to-end/>.

⁴⁵ In Germany, the unemployment rate increased from a low point of 3 % in July 2019 to a maximum of 4.1 % in October 2020, and in Italy, the unemployment rate increased from 7.3 % in March 2020 to 10.2 % in January 2021 (Eurostat recovery dashboard).

⁴⁶ For a mapping of individual provisions of the Directives to the identified effects of the HILP on labour markets, see Appendix 3.

situations can be identified where they would not apply unless the Member States chose to apply them. This is the case in general for small companies (thresholds differ between the Member States). The majority (66.3 %) of the workforce is employed in SMEs, and more than 93 % of the European enterprises are micro-enterprises.⁴⁷ In addition, an increasing number of enterprises are exempted because their business model and organisation deviate from those assumed by the directives. This includes enterprises operating through franchise models, enterprises where 'employees' are self-employed (a major example being the transport sector, where individual lorry drivers are contracted as sub-contractors), or platform-based businesses, where individuals provide services (taxi rides or food delivery for example) directly to consumers mediated by an internet platform. As a result, these directives are in practice only relevant for less than half of the European workforce, indicating that the aim of protecting workers, and informing and consulting them, might have a limited reach unless the Member States, on their own, decide to extend that reach.

Hence, the test of the directives, while showing that the functioning of the directives was not compromised in the scenarios against which they were tested, has exposed that an underlying main assumption behind the directives (that the workforce can be protected by requiring that they are informed and consulted about major changes in the workplace) does not reflect working conditions and new forms of work in large segments of the European labour markets of the 2000s. This vulnerability comes to light when unexpected events threaten the economy, and hence, employment, in Member States.

Below, the performance of the three directives in two different scenarios is analysed.

Event 3: Prolonged drought and wildfires in the Mediterranean

The prolonged drought and wildfires that have haunted the Mediterranean in this HILP are of such an extent that almost no agricultural activity survives in the countries surrounding the Mediterranean Sea. Very large parts of the vegetation are destroyed. In addition, water-intensive holiday places, hotels, clubs, etc. are no longer economically viable and need to be abandoned. This HILP would seriously impact on workplaces, mainly in agriculture and tourism, in the Mediterranean basin. The following immediately relevant consequences for labour markets in the Mediterranean parts of the EU of drought and wildfires were identified in the Future Wheel exercise:

- Workplaces in agriculture and tourism are lost
- Affected economies suffer a downturn

Across Europe, agriculture is dominated by family farms (81.4 % of the regular agricultural labour force)⁴⁸ – to which two out of the three Directives would not apply. This means that most agricultural workers in the Mediterranean region would not be covered by the protections of Directive 98/59 and Directive 2002/14, unless the Mediterranean EU Member States decided to extend the reach of the Directive through national law to smaller enterprises. The same is true for tourism: most accommodation establishments in the EU are SMEs.⁴⁹

⁴⁷ Micro enterprises are defined by the EU Commission as 'Within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million'. See Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (Text with EEA relevance) (notified under document number C(2003) 1422). The figures were obtained from Eurostat and refers to the 2018 calendar year (online data code: SBS_SC_SCA_R2)

⁴⁸ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agriculture_statistics_-_family_farming_in_the_EU#Structural_profile_of_farms_-_analysis_for_the_EU.

⁴⁹ <https://www.e-unwto.org/doi/pdf/10.18111/9789284419470>.

As already mentioned, the directives leave substantial room to manoeuvre to Member States. Therefore, the analysis has looked at the implementation in Italy (that would be directly affected by the adverse climatic events) and Germany (that would be exposed to secondary and tertiary effects). In Italy, *Directive 98/59* does not apply to companies with less than 15 employees; in Germany, the number is 20. Hence, in these countries, tens of thousands of workplaces could potentially be lost without the directives offering any protection to employees in family farms and small tourist enterprises, while workers in the few large corporations in these sectors would be protected through the directive. **While the provisions of the Directives could not catch these adverse impacts, there would still be the possibility of introducing short-term work schemes or other labour market interventions by the various Member States.** These would be introduced, however, completely separately from the obligations enshrined in the Directives, which would be largely ineffective in the case of this HILP.

Concerning *Directive 2001/23*, which applies in the case of company transfers, it is conceivable that some failing agricultural and tourism companies could be bought up by foreign investors and transformed into other businesses appropriate to extremely dry and hot circumstances, like solar parks. However, given that the territory could no longer be used for farming or tourism, it can be expected that acquisitions will mainly be connected to bankruptcies, in which case, e.g., in Italy, the guarantees for workers would not be applicable unless the parties to the transactions (i.e., the company undergoing insolvency proceedings and the future buyer) agree to it. This is a situation that the Directive explicitly allows for, (Article 5 of the Directive), unless Member States provide otherwise. The Directive does not foresee situations of mass bankruptcies.

With respect to *Directive 2002/14*, in Italy, the requirement to inform and consult workers on economic, financial, and strategic developments etc. likely to lead to substantial changes in work organisation, applies only to companies with more than 50 employees. As above, the fact that many companies in the agricultural and tourism sector are SMEs and even micro-enterprises would mean that in Italy, the general consultation and information duties of workers granted by the Directive would not apply for the majority of the workforce in these sectors.

Event 4: Global economic crisis

In the event of a global economic crisis developing at a high pace, the following primary effects affecting labour markets in the EU, and of relevance to the Directives being stress-tested were identified:

- Loss of personal income and social benefits throughout the labour force
- Business activities slow down

In a later phase, **it can be expected that companies or sectors doing well despite the general crisis will seek to acquire insolvent companies**, including in other countries.

Directive 2001/23 provides in Article 3(4) the so-called pension-exception. While workers that are employed by a failing company that is acquired have the guarantee that the acquiring undertaking needs to honour all rights and obligations from the previous employment contract, this does not apply to '... employees' rights to old-age, invalidity or survivors' benefits under supplementary company or intercompany pension schemes outside the statutory social security schemes' (Article 3(4)). Hence, while some of the social benefits and income of some workers (those of failing companies that are acquired) is maintained, important social benefits might be lost in transfers. If the goal were to involve the private sector more in covering the social costs of crises, it could be worth reflecting if it would be a good idea to remove the pension exception from Directive 2001/23, given that several Member States already have chosen to include pension guarantees in their

implementing legislation. On the other hand, this would create an additional burden on companies in times of crises. A thorough balancing exercise would be needed to decide on the best solution.

During a general slowing down of business activities, the impact would be as described above, under Event 3. As in that scenario, one solution that is independent of the three Directives in question could involve state support (based on EU or national funding) to avoid redundancies, for example in the form of short-term work schemes that were used during Covid-19. This would, however, exempt the private sector from covering the social costs of crises and might create an excessive tax burden on future generations.

It is to be expected that the crisis develops unevenly so that some economies and sectors recover at a faster pace than others. In the case that companies in economies that are recovering will acquire insolvent companies in third countries, the current Directive would not necessarily require the acquiring firm to guarantee the jobs of those that work in the acquired firm.

If the economies/sectors within the EU are recovering at different paces, however, it might be justified to place the burden of job guarantees on acquiring undertakings, as this could remedy the negative economic and social impact on workers from the global economic crisis. Again, this would require a balancing exercise, as a requirement to guarantee jobs might disincentivise company acquisitions in the first place.

3.4. Findings from the pilot test: Competition policy - State aid rules

3.4.1. The legislation selected for testing

EU State aid rules have been in place since the Rome Treaties and have the objective of preventing distortion of competition in the internal market from Member States granting selective advantages (subsidies, tax benefits, etc.) to certain companies. In principle, State aid is deemed illegal,⁵⁰ but the TFEU leaves room for exemptions from this general ban. The primary legal basis for determining the legality of State aid under EU law is Article 107 TFEU.

The default of Article 107 TFEU is that aid given by Member States (direct subsidies, tax cuts, loans on better-than-market terms, etc.) that fulfils the definition of Article 107 (1) TFEU is in principle illegal unless it can be exempted under paragraph 2 (aid having a social character or aiming to alleviate damage from natural disasters or exceptional occurrences) or paragraph 3 (aid for developing areas with abnormally low standards of living; to promote projects of common European interest; to develop specific economic activities where this does not adversely impact trading conditions; to promote culture and heritage conservation; or if decided by the Council following a proposal from the Commission).

Member States need to notify the Commission about any State aid they grant, which then needs to be approved by the EU Commission either under the criteria of 107 (2) or (3) TFEU. The rationale behind the general illegality of State aid in the EU law system is to avoid a distortion of competition within the internal market and ensure a level playing field.

⁵⁰ State aid is deemed in principle illegal in the EU since it distorts competition in the EU internal market. The distortion arises due to companies not 'winning the race' due to competition on their own merits, through innovation, lower prices, and higher quality, but through the state resources that they are granted, thereby also excluding other companies from the race that are competing on the merits.

State aid rules in the EU are currently undergoing reform in the framework of the State Aid Modernisation (SAM) plan and a revision of the General Block Exemption Regulation (Commission Regulation (EU) No 651/2014, 'GBER').⁵¹ The EU Commission has proposed in particular to reform the rules on risk finance aid for SMEs and R&D&I activities to make the award for these kinds of aids easier for Member States.

3.4.1. Flexibilities in the legislation

Flexibility through emergency clause

The Commission does not have much leeway when approving State aid that fulfils the criteria of Article 107 (2) as the wording 'shall be compatible with the internal market' indicates. Article 107 (2) also gives an example of inbuilt flexibility of the EU State aid framework for Member States to be able to give aid in moments of crisis or negative shocks: it states that '(b) aid to make good the damage caused by natural disasters or exceptional occurrences' shall be compatible with the internal market. Article 107 (3) (b) also allows for State aid to be given in cases of 'a serious disturbance in the economy of a Member State', but in this case the Commission has wider discretion to decide whether a situation in a Member State meets these standards.

Flexibility through granting discretion to agencies

When the Covid-19 pandemic hit Europe in March 2020, the EU Commission established a temporary framework enabling the Member States to compensate undertakings in sectors that were particularly hit due to corona restrictions under the conditions of Article 107 (2) (b) and 3(b). The Commission established specific conditions under the temporary framework that gave guidance to Member States about the kind of aid allowed (amount, type, target sector) in order to strike a balance between supporting struggling undertakings during the exceptional downturn due to the pandemic and safeguarding the internal market and a level playing field. The various conditions were further amended and expanded in five subsequent amendments.⁵²

A similar type of temporary framework was set up by the EU Commission during the 2008 financial crisis to remedy the adverse impact of the banking crisis on the banking sector⁵³ as well as on the real economy.⁵⁴ The Commission Communications do not create a broad exception regime, but only a specification of how the inbuilt flexibilities in State aid law will apply in a crisis situation. In that sense, the Commission provides legal certainty and fosters stability through its Communications (Gerard 2010).

Sunset clauses

Both the Commission Communications within the Covid temporary framework and the Financial Crisis temporary framework (except for the Second Banking Communication from 2013) have

⁵¹ Press release: https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5027; consultation website with relevant documents: https://ec.europa.eu/competition-policy/public-consultations/2021-gber_en.

⁵² Overview amendments: https://ec.europa.eu/competition-policy/state-aid/coronavirus/temporary-framework/amendments_en.

⁵³ Communication from the Commission on the application of State aid rules to measures taken in relation to financial institutions in the context of the current global financial crisis (the Banking Communication) [2008] OJ C270/ 8; IP/ 08/ 1495; Communication from the Commission on the application, from 1 January 2011, of State aid rules to support measures in favour of banks in the context of the financial crisis [2010] OJ C329/ 7; Communication from the Commission on the application, from 1 August 2013, of State aid rules to support measures in favour of banks in the context of the financial crisis [2013] OJ C216/ 1 (Second Banking Communication).

⁵⁴ Communication of the Commission: Temporary Union framework for state aid measures to support access to finance in the current financial and economic crisis [2011] OJ C6/ 5.

contained sunset clauses, i.e., clauses that specify a date after which the Commission's EU State aid policies will cease to have effect unless they are explicitly prolonged. Sunset clauses in the current General Block Exemption Regulation (GBER) have also triggered a review process of State aid rules generally.

3.4.2. Retrospective analysis: how did the legislation hold up during the Covid-19 pandemic

The Covid-19 pandemic put significant pressure on the State aid legislation. Due to lockdown measures and low demand, enterprises suffered liquidity shortages. In addition, restrictions, as well as lockdowns, and declining demand led to significant disruptions in global supply chains, which in turn caused major disruptions in the EU economy. In this situation, Member States were willing to step in by giving State aid to businesses threatened by bankruptcy.

As a result, a large amount of State aid notifications had to be examined and approved in a very short period of time by the EU Commission. To cope with this situation, a temporary framework was developed, which was first adopted on 19 March 2020, and subsequently adapted three times.⁵⁵ The framework specified measures that did not require the involvement of the EU Commission: wage subsidies, suspension of corporate tax payments, social security contributions, VAT (if applied to all sectors), or measures in line with Block Exemption Regulations.

The effectiveness of the temporary framework proved to be high. 'The majority of State aid cases are approved under the temporary framework (85 % of the total number of cases, 92.6 % of the budget). Hence, the recent policy change was a major stimulus to State aid use.'⁵⁶

There have however been several challenges connected to the use of the temporary framework (see e.g., Agnolucci (2021):

- Large discrepancies between amounts of State aid granted by different Member States;
- Increased public budget deficits and public debt of MS;
- Insufficient focus on SMEs;⁵⁷
- Failures to incorporate broader strategic policy goals of green and digital transformation and global competitiveness;
- Establishing an effective ex-post monitoring system to differentiate between genuine and protectionist State aid measures;
- Amount of State aid and economic losses were not proportionate in various Member States;

Table 3-4 shows the use of State aid and the temporary framework in Germany and Italy.

⁵⁵ van Hove, Impact of state aid on competition and competitiveness during the Covid-19 pandemic: an early assessment. European Parliament, 20 December 2020 (covers state aid measures by EU MS from March 2020 to 9 October 2020).

⁵⁶ Ibid., executive summary.

⁵⁷ Ibid., p. 28 ('Despite the explicit policy goal to support SMEs through state aid, this is hardly the case. The aid specifically directed to SMEs consists mainly of grants (39.73%) as well as guarantees (35.52%).').

Table 3-4: State aid measures approved (March 2020 to 9 Oct 2020)

Country	Art. 107 (2) (b)	Art. 107 (3) (b)	Art. 107 (3) (c)	temporary framework	TOTAL
Germany	3	2		10	15
Italy	1	1		21	23

Source: Van Hove, Impact of State aid on competition and competitiveness during the Covid-19 pandemic: an early assessment. Study requested by the ECON Committee of the European Parliament, 2020. Authors' elaboration.

Germany notified about 51 % of total State aid given during the Covid-19 pandemic (as of February 2021) but did not pay out as much as other EU Member States. No aid was given specifically to SMEs (information as of 9 October 2020).⁵⁸ Nonetheless, Germany notified aid to specific sectors in which many SMEs operate, like tourism.⁵⁹

As the table indicates, twice as many measures were approved under the temporary framework for Italy compared to Germany. In contrast to the German practise of not targeting aid to SMEs, aid given specifically to SMEs in Italy amounted to 6 billion euros.

To sum up, the State aid legislation did not provide for a situation like the one created by the Covid-19 pandemic but provided sufficient flexibility through the temporary framework that was put in place to manage the economic situation, and to provide legal certainty to Member States and companies. The framework proved effective in the short run, and it has limited distortions to the internal market. Nonetheless, as the list above indicates, the framework has not proven to be perfect and it has not been fully in step with other, important, EU objectives. Due to the flexibility that the temporary framework offers, however, these shortcomings could potentially be addressed in further amendments.

3.4.3. Findings from testing the legislation against the scenarios

The State aid legislation was tested against two hypothetical scenarios based on HILPs: The rise of a *New pro-war US president* and an *Outburst of the black economy*. First, it should be recalled that by default, the Treaty presumes that State aid is illegal with the exception of the situations described in paragraphs 2 and 3 of Article 107 TFEU and the provisions of the GBER.

Thus, weak spots in the legislation could appear for two reasons:

- Either the exceptions in the legislation are not sufficient to cover businesses needs in a crisis situation, in which case the national economies may suffer substantially,
- or State aid is being given illegally or fraudulently.

The test has found that both situations may occur. The findings of the test against each of the HILP scenarios is described in more detail below.

Event 5: New pro-war US president

In an unexpected rise in American imperialism, US policies have become increasingly aggressive and intolerant with respect to other world powers. Three main blocks dominate global policy: Asia, an alliance between the US and the UK and the Middle East. Within these blocks independence and protectionism has gained prominence. The rest of Europe has failed in creating a united force.

⁵⁸ Ibid., p. 47.

⁵⁹ Ibid, p. 32.

Member States are divided and uncommitted in their support and allegiance to any one block and follows several different paths. The result is a tendency towards chaos across large parts of Europe.

The future wheel exercise found the following effects of this scenario to be relevant for the State aid policy framework:

- EU and Member States divert more funds to military purposes
- Resources for innovation are diverted to cyber-warfare and security
- Environmental protection (and other EU policy priorities) is under-prioritised
- Economic downturns at national and international levels

If the EU Member States divert more public funds to military purposes exclusively (like the production of arms, ammunition, and war material), State aid rules do not apply. This exception, however, has to be interpreted strictly.⁶⁰

As soon as the funds would also benefit non-military activities, the State aid prohibition under Article 107 TFEU would apply and the EU Commission could step in.

While the Treaties consider State aid in principle illegal, the EU Commission is increasingly considering State aid as a part or instrument for achieving EU policy priorities. If Member States revert significant resources for military purposes, this will also negatively affect the achievement of other EU priorities.

The diversion of funds towards cyber-warfare and security could likely also affect SMEs detrimentally because they would likely lose their immediate importance in the day-to-day discussions of economic priorities and allocating aid. In the overall EU State aid framework, in particular in the GBER,⁶¹ aid to SMEs is generally considered not to be harmful to the internal market if the requirements of the GBER are upheld. With fewer funds left in the state pockets', SMEs would likely also receive less support, even though they are an important driver of jobs and innovation in Europe.

There is no positive obligation of granting State aid (the default is that State aid is illegal), however, so State aid rules cannot provide a solution to this. Other EU policy areas would need to be leveraged, like the establishment of EU funds similar to the EU Recovery Fund agreed to in July 2020 to remedy the economic losses caused by the pandemic.

Event 6: Outburst of the black economy

In this scenario, national economies rely to a large extent on 'black' (i.e., illegal) economies facilitated by transactions in crypto-currency and carbon credits and is interwoven with cyber-crime. This has left European societies and citizens vulnerable to the development of a 'black' cyber-economy involving identity theft, software piracy, hacking/scams, and counterfeiting.

The analysis has found the following effects of this scenario to be relevant for the State aid framework:

- Upheaval of the traditional financial systems
- Sharp rise in financial fraud and tax evasion
- Organised crime infiltrating political processes
- Decreasing legal certainty

⁶⁰ See e.g., Court of Justice Case C-284/05 *Commission v Finland*, and C-246/12 *Ellinika Nafpigeia AE*.

⁶¹ Under the GBER two types of aid to SMEs are exempted from prior authorisation by the EU Commission: Aid to SMEs and aid for access to finance for SMEs. Aid can be given up to a maximum amount depending on the nature of the aid (investment aid, aid for consultancy, for participating in fairs, for cooperation projects, for innovation and for risk finance).

➤ Rise in corruption

In this scenario, the financial sector would struggle due to a lack of funds and liquidity (except such banks that became involved in criminal activity). In this situation, Article 107 (3) TFEU on categories of aid that may be considered compatible with the internal market would apply, since aid can be given '... to remedy a serious disturbance in the economy of a Member State.' At the same time, the Bank Recovery and Resolution Directive (BRRD) 2014/59 provides an additional framework for dealing with struggling banks. State aid and the BRRD framework can apply jointly.

If aid were necessary to stabilize the banking system, the EU Commission could draw up a temporary framework with the conditions to grant aid to failing banks, like it did in the global financial crisis. The combined experience under the BRRD and the State aid framework should have equipped the Member States and Commission already with extensive crisis-management experience.

A destabilisation of the traditional financial system could, however, make it more difficult for SMEs to obtain risk finance aid under the conditions of the GBER, since financial intermediaries are key in delivering the aid to SMEs. The shaking of the financial system might thus have a negative impact on operating the State aid schemes designed to benefit SMEs as well as other areas under the GBER that rely on financial intermediaries to distribute aid.

In a situation where financial fraud and tax evasion becomes more frequent, some or all Member States may decide not to give aid or cannot give aid due to a sharp decline in tax revenues. In this situation, the EU State aid framework can no longer be supportive of EU priorities.

Organised crime infiltrating political processes could lead to State aid being given illegally or fraudulently. While the EU Commission has the power to declare State aid as unlawful or misused, and it can require the Member States to recover State aid from the recipients as a counter-measure,⁶² the Commission is still fully reliant on the Member State's administrative and legal system for State aid recovery to work. If the rule of law is already failing in the Member State, State aid recovery would likely not take place. This is a long-standing loophole in EU State aid law. Since the EU Commission has the powers, however, to institute infringement proceedings for a Member State's disregard of the rule of law, as the current case of Poland shows,⁶³ this could indirectly also help to limit the damage done to the State aid regime from a Member State where the rule of law has deteriorated.

⁶² Articles 108 (2) and (3), TFEU.

⁶³ Case C-204/21 *Commission v Poland*, based on Poland failing to fulfil its obligation to uphold the rule of law under the second subparagraph of Article 19(1) TEU, read in conjunction with Article 47 of the Charter, as well as Article 267 TFEU and the principle of the primacy of EU law.

4. Lessons learnt and recommendations

Section 4.1 presents lessons learnt from the research and pilot stress-testing in three EU policy areas carried out in this study. The section builds on the evidence presented in sections 1-3. It is followed by section 4.2, which presents recommendations to policy-makers for methods, organisational principles, and resource considerations that should be contemplated before introducing a system for EU policy stress-testing.

4.1. Lessons learnt

In this section, general lessons learnt from the research are presented, followed by sections covering specific lessons learnt with respect to stress-testing methodologies, organisational considerations, and costs, benefits, and trade-offs.

The research clearly indicates that no model for policy stress-testing exists that could be applied to EU policies as a ready-to-use system. Some countries, including the four countries serving as case countries in this study (Finland, the Netherlands, New Zealand, and the United Kingdom), apply elements of foresight to policies, albeit not in a systematic way. Stress-testing, as conceptualised in the study (to check the stability, strength, and 'health' of a particular policy in the context of high-impact, low-probability events beyond regular or operational norms in order to provide guidance on areas in need of improvement, restructuring, or rebuilding) is found to be used in some sectors and policy areas. However, it is fair to conclude, that policy stress-testing is not widely used as a tool to improve policy resilience.

Some policy areas lend themselves more readily to stress-testing than others

The research has only found one example of stress-testing of policies against specific HILPs. This stress-test was carried out in New Zealand, where fiscal resilience was tested against hypothetical, but plausible, events (an outbreak of mouth and foot disease in livestock and a major earthquake). Stress-testing against quantitative scenarios developed through statistical modelling is more common. In this respect, the research indicates that some policy areas are more amenable to stress-testing using quantitative modelling, while other policy areas, including the ones selected for the pilot stress-testing, do not lend themselves readily to this type of stress-testing. To the extent that an analysis of possible impacts of shocks or scenarios requires statistical data and models, it may be challenging to do stress-testing in policy areas where the factors producing the intended effects (e.g., social coherence or the wellbeing of citizens) are difficult to quantify.

Policy areas immediately amenable to quantitative stress-testing using statistical modelling include environmental policies, transport policies and fiscal policies. In all these areas, there is detailed statistical data available that can be used in model-based scenarios. The findings of the research confirm that model-based policy stress-testing is indeed mainly used within these policy areas. In this type of stress-testing, the policies are tested against a range of different outcomes of statistical models based on a set of assumptions about the development of a limited number of indicators. These indicators are without exception directly related to the policy domain (financial policies being tested against macroeconomic indicators, environmental policies being tested against climate models, and so on). Other than the example from New Zealand mentioned above, the research has not found examples of policies or legislation being stress-tested against events that originate or whose main impact is felt outside the policy domain.

Policies may be vulnerable to events outside their domain

The study has clearly confirmed that policies are vulnerable to all sorts of events, including such that originate in other domains. This is underlined in the findings from the retrospective analysis of the performance of the selected pieces of EU legislation in the Covid-19 pandemic. The impact of the pandemic was visible in two out of the three examined EU policy areas in which legislation were in place at the time of the onset of the pandemic. In the area of information and consultation of workers, Member States in many cases successfully put in place schemes to avoid situations where employers had to lay off most or all of the workforce. This may indicate that other measures combining the protection of workers with retaining workplaces were viewed as a better solution by most Member States, since these measures not only meant protecting workers but, in addition, bolstered the enterprises, enabling them to resume activities as soon as restrictions were lifted. In the case of State aid, a temporary framework had to be put in place to allow Member States to support ailing sectors and businesses. These examples indicate that stress-testing that only considers events within a particular policy domain will most probably not achieve its objective, to create more resilient policies.

Are particular types of legislation more resilient than other forms?

The pilot stress-test involved different types of legislation: a proposed act (the AI Act), three directives, and two articles in the Treaty on the Functioning of the European Union. Hence, the test gives rise to reflection on whether some forms of community legislation are more resilient in the face of rapid changes or disruptive events than others.

If a piece of legislation holds provisions that give flexibility to actors that are implementing it, one could assume that this would increase its resilience in the face of rapid changes. We found that the three types of legislation tested included the following forms of flexibility:

- The proposed AI Act calls on Member States to establish 'regulatory sandboxes'. It follows the precautionary principle by classifying AI applications according to their social acceptability, and it includes a review clause calling for review every five years.
- The directives on the information and consultation of workers give Member States significant leeway in how they transpose the directives into national law.
- The EU State Aid framework includes an emergency clause. This has allowed the Commission to introduce a temporary framework that exempted Member States from the general assumptions of the State Aid legislation.

These flexibilities are, however, not always a sufficient guarantee of resilience. In particular, the pilot stress-test of the AI Act revealed a significant vulnerability to cyber-attacks, associated with the extensive monitoring and reporting requirements of the act, which implicitly build on the assumption that providers and users of AI systems are always able to store data securely.

On the other hand, the flexibility of the EU State Aid framework, which includes an emergency clause and gives discretion to institutions, has proved very effective during the Covid-19 pandemic.

Stress-testing can improve policy resilience but does not guarantee policy relevance

The test of the three directives on information and consultation of workers indicates that these pieces of legislation are quite resilient to change in the sense that external events will not prevent the legislation from fulfilling its objectives (the information and consultation of workers). The analysis however raises a discussion of resilience versus relevance of policies. In the case of the directives, the stress-test found that they would not be relevant for the large shares of workers in agriculture and tourism that could become unemployed as a result of prolonged drought in the

Mediterranean because the majority of companies in those sectors are so small that the threshold requirements of the directives would not apply. In this case, the stress-test has revealed an apparent (intended or unintended) gap in the EU legislation. This observation could indicate that, while stress-testing legislation may improve the resilience of the legislation, it could be supplemented with the integration of other futures methods to ensure that the scope of EU policies responds to plausible future scenarios.

So, stress-testing, even if it does not point to specific 'tipping points' in the legislation, may still serve to initiate policy reflection about the basic assumptions of the policy. This points to an observation made by several of the interviewed stakeholders in the four countries: stress-testing does not eliminate a need for continuously reviewing policies, and it may even be of little value if exclusively conducted at the end of the policy process to assess robustness against a limited selection of possible futures. Situations change and evolve even after stress-testing, and while there are merits to stress-testing, as demonstrated by the pilot stress-tests, it should ideally be accompanied by more adaptive approaches to policy design.

4.1.1. Methodological considerations

Which futures/what HILPs to test against

Policy stress-testing is an attractive idea, which is gaining followers in a time of turbulence, where sudden changes and disruptions render forecasting, be it linear or more advanced, insufficient to ensure that policies designed today will be effective tomorrow. Hence, the idea resonates with the *bon mot* of many foresight professionals: *The future cannot be known*.

The research findings however clearly illustrate that, while the arguments for seeking to achieve more robust or resilient policies through stress-testing are convincing, and while policy-makers are increasingly concerned about the abilities of policies to withstand the impact of HILPs, the objective(s) of policy stress-testing should be made clear, and the exercise itself be carefully scoped and planned in order to achieve its objectives.

A discussion on the overall objective of individual stress-testing exercises is not only important in terms of what methods to choose, but also on a more general level. **There is wide agreement among the experts interviewed for this study that stress-testing can enhance policy design in different ways.** Seen in a narrow way, it may improve the robustness of individual policies against the specific risks addressed during stress-testing. If this approach is to be of value, it must be repeated regularly to ensure that a policy remains capable of withstanding a wider range of adverse events and developments, including those that may only be anticipated when reviewing a policy again at a later point in time. As underlined by some interviewees, stress-testing may also serve a purpose that goes beyond the individual policy. **Working with comprehensive scenarios or future wheels that map how alternative developments in one domain can have a ripple effect across other domains may reveal vulnerabilities in other policy areas.** Based on this background, stress-testing can serve to raise awareness of contingent risks and may, for example, underline the need for policy responses not previously thought of.

One of the main challenges concerns the selection of hypothetical future HILPs that can be used as stressors in the stress-test, as a simulation exercise. Since these HILPs are hypothetical, they can only be identified through a combination of previous experiences, unconventional thinking, and a keen ability of individuals to glean, interpret, and analyse weak signals that may or may not be prior warnings of events to come.

In this respect, the literature review, as well as several of the interviewees, have underlined the importance of bearing in mind the limited mental capacity of human beings when it comes to

imagining future events, and the ingrained emotional resistance to accepting the possibility of events that could threaten the livelihood or lifestyle of ourselves, our families or our (local or professional) communities. This is aptly illustrated by the reaction of many (most?) people in the early days of the Covid-19 pandemic. When health experts, using scientific knowledge and statistics foresaw a serious development with many deaths and overloaded hospitals as a result, they were initially written off as pessimists by the large majority of people who had never before experienced anything worse than the common flu.

Despite this, it is still possible to collect catalogues of possible future HILPs or risks and consider their consequences in several domains. The research has unearthed examples of such collections, but regrettably not of collections that are 'kept alive' through a systematic and ongoing effort to collect and analyse signals and monitor whether signals already collected appear to become more or less plausible to develop into a significant event as times goes by.

The next challenge concerns scoping. As most of the interviewed stakeholders have observed, **it is not technically nor economically feasible to test against all conceivable future HILPs, even if some are discarded as totally implausible.** Therefore, a stress-testing approach that requires testing against HILPs also requires that a process is put in place that will allow policy-makers to select, among HILPs in a catalogue or collection, those that presumably would be the most relevant stressors against which to test policies.

Finally, the case studies illustrate that **stress-testing is only one approach to 'future-proofing policies' among a range of methodological and organisational approaches.** The research suggests that a combination of forward-looking approaches used at different stages in the policy cycle is conceivably more effective than resorting to just one approach.

Lessons from the pilot test

The pilot test focused on legislation within three EU policy areas: AI and robotics; information and consultation of workers; and competition policy (State aid). The pilot test comprised an analysis of existing flexibilities in the legal texts, a retrospective analysis, looking at how the legislation fared during Covid-19, and prospective analysis, exploring how the legislation would fare if subjected to the consequences of high-impact, low-probability events (HILPs).

The prospective analysis included a selection aided by crowd rating, of two HILPs per policy area from existing catalogues of HILPs and risks; development of future wheels by drawing out plausible consequences of each HILP, and validation of the future wheels by experts; and an analysis of whether the provisions in the legal texts would hold up in circumstances described in the future wheels.

Overall, this methodology worked quite well. While testing against all conceivable HILPs is unmanageable in terms of time and resources, the pilot test demonstrated that value can be got from testing only against a small, but carefully selected, number of HILPs. Likewise, the process of involving a combination of sector experts and foresight experts in the validation of the future wheels added value to the exercise, even in the pilot setting where it was only possible to involve a very limited number of experts.

Hence, even if only a limited version of the methodology was applied, it enabled the study team to identify, with reasonable certainty, weaknesses in some of the legislative texts that will become evident under circumstances described in the future wheels, as well as mechanisms in the legislation rendering it able to withstand the impact of these HILPs.

Overall, the pilot test confirmed many of the lessons learnt from the literature review and country studies.

In addition, however, the pilot testing has given rise to methodological lessons of a more practical nature.

There are model processes available that allow for a systematic selection of HILPs

One such method is the Delphi model⁶⁴, well described in the literature. The study tested a variant of this method, namely *crowd rating* (described in section 3.1.3). Lessons learnt with regards to this method include:

- Access to an updated catalogue of HILPs is vital for selecting relevant events against which to test.
- The process of rating HILPs is inherently subjective. If it is done by experts, they may possess knowledge that will serve to qualify their assessment of, e.g., the chance of the event happening within a certain time frame, or the expected impacts. But no experts will presumably be able to make this judgment in a qualified manner across all HILPs to be considered, since they differ in nature.
- Hence, the number of people involved in the exercise matters. The more experts and stakeholders with different backgrounds and perspectives are involved, the better the chance of arriving at a selection that reflects the best-consolidated knowledge.

Drawing out consequences of HILPs can be done by mixed groups

- The exercise of drawing out consequences of HILPs has the added value of encouraging participants to think about alternative futures.
- Online collaboration tools, such as e.g., Miro, work well for brainstorming consequences of HILPs and for facilitating consensus on these consequences in a group, which can involve different stakeholders.
- Further, online facilitation tools facilitate the participation of people in different geographical locations without incurring travel costs.

Time and resources can be adapted flexibly

- In the pilot exercise, the test was done against separate first-, second- and third-order consequences of the selected HILPs. Considering the very limited time and resources spent on the exercise, the results were promising, in that the analysis actually identified vulnerabilities and weak spots in the legislation
- The results of the exercise indicated that even better results could be achieved by testing the legislation against 'full-blown' scenarios considering the interaction between trends, drivers, and events, rather than just single events and their impacts.

Stress-testing helps bring about futures literacy

A point made repeatedly in the literature as well as by interviewees is this: People, including experts and politicians, are in general reluctant to consider future events that they do not immediately think will occur, or that they think are not likely to occur. Experts in all four case countries have pointed out that, whilst some policy-makers are wary of using foresight approaches due to a focus on ensuring the short-time functioning of policies, others are sceptical that the outcomes of stress-testing and similar anticipatory exercises are sufficiently based on evidence to be of real value for the policy process.

However, as the pilot test has demonstrated, **the involvement of stakeholders in the processes to carry out stress-testing against HILPs aid the participants in considering future events that they would not otherwise contemplate, and the consequences such events may have for**

⁶⁴ See details on the Delphi method in Section 2.4.1 - Scenarios.

policies (and vice versa). If properly facilitated, it is indeed feasible to promote this mindset in the participants. Hence, there could be merit in requiring that legislative proposals should undergo stress-testing, using methods similar to the ones described here.

4.1.2. Organisational considerations

The research has identified examples of stress-testing of policies in sectors but has not found an example of a truly systemic national application of policy stress-testing across policy fields and administrative silos. However, all the four case countries have built-in organisational features aiming at future-proofing policies by involving policy-makers, stakeholders, and in some cases, the general public, in ongoing foresight exercises.

In all case countries, there are **independent, but publicly funded, agencies/bodies that are tasked with foresight and developing policy-relevant scenarios.** Where such bodies are linked to government or parliament through persons who hold positions, e.g., in a Ministry and on the board of such a body, this appears to facilitate policy impact.

In the EU context, the research has identified a number of initiatives. The European Strategy and Policy Analysis System (ESPAS) facilitates inter-institutional collaboration, while both the European Commission and the Parliament, in the shape of the Strategic Foresight and Capabilities Unit within the European Parliamentary Research Service (EPRS) have launched a range of strategic foresight initiatives.

The research indicates that the policy process needs to involve a structured network with well-defined roles and responsibilities, and processes for ensuring that the knowledge created in the network is actively used in the policy process. Support for research to generate evidence and expert judgement, for instance in the form of think tank reports, is thought by interviewees to be vital, just like media involvement and participatory events, where possible stressors for policy and future options are discussed openly. These discussions may well be facilitated through digital platforms, allowing for the participation of a broader audience. Several interviewees stressed transparency as all-important.

Finally, the research shows that continuity of efforts is key to successfully making policies more responsive to change.

4.1.3. Resource considerations

The more scenarios or the more detailed scenarios are considered, the larger the resource requirement. Some of the studies and projects identified in the literature study build on a multitude of activities involving a significant investment of human resources. The cost of establishing an organisation and a systematic approach for stress-testing EU policies could be expected to be quite high initially if it was to be built from scratch. **However, it should be borne in mind that there are already significant knowledge resources within the EU system that can be mustered.**

The methodology used is also of importance when it comes to resources. Quantitative modelling is generally costly since it involves the development of new models or adjustment of existing models as well as the collection of significant amounts of data collection and quality assurance of input and output.

Further, it should be recalled that the degree of uncertainty/probability of HILPs may vary considerably, just like some HILPs are very general in nature while others are more specific. Uncertainty and specificity are linked, as illustrated in the following example: An event including a massive rainfall causing mudslides and flash floods will with almost complete certainty take place somewhere in Europe within the next year. On the other hand, that this event involves a particular

river in a particular country is considerably more uncertain. In selecting the HILPs for the pilot test, **it is a priority to address the right level of uncertainty and specificity to ensure that resources spent on stress-testing against HILPs do not exceed resources set aside for general preparedness for contingencies.**

While stress-testing can help authorities to mitigate the negative consequences of high-impact, low-probability events, it cannot eliminate these events. Stress-testing as conducted in the pilot exercise gives ideas about specific threats to legislation. Thus, there is a risk that stress-testing may lead to contingency planning that is too rigid in nature. Outcomes of stress-testing can lead to policies accounting for specific shocks or scenarios. However, the future can unfold in many different ways, and if the potential shocks that were considered in a stress-test never materialise, this may lead critics to question the whole idea of stress-testing and discard it as creating unnecessary costs. On the other hand, stress-testing can also give rise to considerations about systemic changes that would increase the resilience of the legislation towards non-specific HILPs.

Therefore, the ability to adapt policies to changing situations may be more important than efforts to future-proof them against a limited set of scenarios. Interviewees have pointed out that a desire to create robust policies comes with a cost that increases with the number of events or scenarios that is considered. This means that the cost of ensuring policy robustness against all conceivable events can become astronomical. In this perspective, resilience through anticipation, adaptability of policies and an agile implementation system seems to be preferred by the case countries.

The abovementioned reluctance to consider foresight a valid input into policies may contribute to a lack of available resources for strategic foresight in government, making it difficult to promote and conduct policy stress-testing and the adaptation of its outcomes by decision-makers.

4.2. Recommendations

Below, a number of recommendations building on the findings of the study and lessons learnt are offered. In particular, the lessons learnt from the pilot exercise has given rise to recommendations of a methodological nature.

Before venturing into the recommendations, it is however important to reflect on and establish the purpose of this process. Stress-testing can, for instance, be done at the initial stages of the policy process to quickly identify and rule out policy options that perform poorly in scenarios representing expected or plausible futures. Likewise, the method can be applied to identify vulnerabilities of implemented policies in the face of scenarios exploring more unlikely future trajectories, such as impacts of HILPs across different domains.

Further, and this is particularly true in policy areas characterised by a high level of future uncertainty, it may be preferable to focus on developing more flexible policies that can be adapted over time rather than using stress-testing to future-proof policies against a limited number of anticipated events. Especially when covering longer time horizons, the different risks and opportunities arising from future developments are near impossible to gauge. The purpose of stress-testing may therefore also be to inform the design of policy responses addressing different possible futures and to identify thresholds for the implementation of one policy option over the other, depending on how the future actually unfolds.

4.2.1. Methods for stress-testing

Scoping the exercise

The study has indicated that it would be prudent to **exercise care in deciding which policies and legislation should be subjected to stress-testing, and in deciding when, in relation to the policy cycle, stress-testing should take place.** It could be considered to require that all proposals for legislation should undergo a 'light' stress-test much like the one carried out in the pilot exercise, and testing against a limited number (e.g., 2-4) HILPs, while the review of legislation which has been in place in a certain number of years could include a more thorough stress-test against more elaborated scenarios.

When qualitative scenarios are in focus, the study finds that **the number of scenarios in stress-testing should be limited.** Interviewees for this study point out that greater numbers of comprehensive, qualitative scenarios may pose further challenges both in terms of cost and in terms of ease of communication. It may, for example, not be feasible to work with a multitude of scenarios when wanting them to be co-developed or assessed during a limited time frame or by a range of different stakeholders since it may be complicated to communicate or relate to a greater amount of information. When deciding on the number of qualitative scenarios to use in stress-testing, it is, therefore, recommended to limit the amount and ensure that the selected scenarios are clearly distinct in nature. This allows for the in-depth development of several scenarios that nonetheless cover a significant part of the future spectrum.

The time horizon to consider in a stress-test should be decided with a view of the nature of the policy area and legislation in focus. Some policy environments may be characterised by less or a somewhat lower pace of change over time, making it easier to anticipate developments further into the future. Other policy environments may be linked to more frequent disruptive developments or events, making it both more difficult and less meaningful to try and anticipate their future horizon beyond a certain point in time. It may make sense to look more than a hundred years ahead when wanting to ensure the long-term water quality of a river in the face of climate change, whilst it may be almost impossible to anticipate the nature of cybercrime 50 years from now.

Streamlining scenario development

As the time for stress-testing is likely to be a limited resource in the policy cycle, methods to reduce the amount of time spent on preparing stress-testing exercises can be a valuable tool. This study has identified several approaches that, for instance, allow for efficient scenario development. As done in connection with the pilot stress-tests for this study, *scenarios may be based on existing foresight knowledge*, such as mappings of weak signals and wild cards or megatrends lists. Valuable insights may be gained from exploring how these challenge current policies. Likewise, it is possible to use existing scenarios produced by preceding foresight efforts (e.g., IPCC climate scenarios), although it should be considered to what extent these scenarios must be adapted to suit the purpose of a given stress-testing exercise.

Another approach that can be recommended is the use of *trend decks*,⁶⁵ which can be combined to create distinct scenarios that may represent and consider the impacts of HILPs. Exploring the combination of several unlikely future events and developments may also challenge the assumptions of those involved in scenario development and lead to additional insights regarding future risks and opportunities. Indeed, one of the foresight experts interviewed for this study emphasised that it is important for those conducting stress-tests to stretch their minds and open up

⁶⁵ See section 2.5.4.

in order to let go of their assumptions. This allows for a wider exploration of possibilities and may, for example, enhance reflections and discussions on second- or third-order changes and impacts.

Further, the '*four generic alternative futures*' as defined by Dator (2009) represent a framework for effective development of distinct scenarios, which can be adapted as necessary to a specific policy area to the extent that the available time and resources allow. One possible approach may be to add more details in domains of greater relevance for the policy to be stress-tested, whilst keeping the generic nature of others.

Take the future as a starting point

Stress-testing can be described as a forward-looking form of risk mitigation. However, the focus of stress-testing must not necessarily be on designing policies capable of withstanding or adapting to adverse future events or developments. A risk of this type of approach is that policy focus is concentrated on avoidance strategies and on negative expectations to the future, which may, in turn, lead to less focus on improvement and innovation. Instead, stress-testing may start with discussions about the desired future and go on to explore what policy measures would need to be devised or amended for an examined scenario to change and 'move' closer to this future. Rather than concentrating efforts on enhancing the individual policy, this approach takes a wider perspective, potentially encompassing and contributing to the development of several policy areas.

Make room for methodological pluralism

Following the findings of the study, it can be strongly recommended that while the stress-testing method tested here is 'policy agnostic' and allows room for the specificities of different policy areas, the selection of HILPs to test against as well as the time horizon considered can be adapted to the sectors addressed by the policies. While modelling approaches are well suited to stress-testing, e.g., infrastructure policies, they do not lend themselves well to policies in the social (or health) domain, where the impact of HILPs or scenarios on effect indicators are difficult to model due to the complexity of interactions in this domain.

4.2.2. Organisation and stakeholder involvement

Based on the findings, the following recommendations can be made:

Build on existing resources

Identify and make the best use of available structures, networks, resources, and knowledge rather than building an organisational unit for stress-testing from the beginning. The ESPAS initiative, as well as initiatives by JRC and the Commission services, all provide knowledge that could contribute significantly to a systemic approach to stress-testing.

Significant resources do not only exist within the EU system itself. It can be recommended to map foresight resources and organisations in Member States, within governments as well as among independent agencies and universities. Once mapped, such resources should be orchestrated as a network that can contribute to gathering intelligence, e.g., through horizon scanning and scenario analysis, and that can be mustered in the development and validation of scenarios for stress-testing.

Involve Member States

Member States' governments and parliaments are responsible for the implementation of EU policies and should therefore be involved in stress-testing. In parallel to the Finnish and Dutch experiences, it can be recommended to offer to train Member State officials and politicians in stress-testing methodologies and foresight more generally, so that they can perform stress-testing at the decentralised level.

Involve politicians

It can be strongly recommended to put processes should be put in place to involve policy-makers. This can ensure commitment from policy-makers and also encourage them to consider alternative options which have been foregone for reasons described in the previous section. This could take the form of a parliamentary committee, such as the Finnish parliamentary Committee for the Future, but other models could be considered.

Involve stakeholders with conflicting views

To avoid the risk of 'group-think' and blind angles, it is recommended always to involve stakeholders from a variety of stakeholder groups or positions, representing different perspectives on the future and the plausibility of future events. The capacity of the organisation to challenge assumptions and imagine alternative futures is key. Involving critical stakeholders will contribute to the robustness of the conclusions of a stress-testing exercise.

Ensure sufficient capacity

To orchestrate processes of information gathering and analysis requires a strong capacity to reach out to and commit external stakeholders, manage networks, including possible funding for activities in the network, and ensure the quality of the outputs of the partners and networks.

4.2.3. Resource considerations

Ensure funding for enabler role as well as for external resources

If the organisational principles as described above are to become effective, sufficient funding must be made available on a continuous basis. This involves funding for staff as well as for communication purposes.

Scale the process to the resources available

As emphasised several times above, time can be a scarce resource in the policy process. Likewise, the amount of foresight capacity can be limited where stress-testing is meant to take place. Therefore, it is important to adapt the scope and the methods used in a stress-testing process to the resources available. There are, as mentioned, shortcuts to scenario development. Additionally, the number and level of detail of scenarios should be kept at a feasible level. Stress-testing exercises are also scalable in relation to stakeholder involvement, which can entail iterative processes, such as the Delphi method or different forms of public consultations over a longer period of time. Stress-testing efforts that are meant to be smaller in scale may settle for a few expert interviews or an individual workshop. Although this entails additional costs, the services of external experts, such as academics or foresight practitioners, may be enlisted to support foresight efforts. Indeed, this study finds that this is common practice across government departments in the country case studies.

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Appendix 1: Country fiches

Country fiche Finland

Description of the use of stress-testing in the national policy process

Stress-testing of policies or legislation is not applied systematically in Finland. There are examples of foresight being used in the audit of policies, but this is not typically the case, and does not involve consideration of high-impact low-probability events. While stress-testing of legislation is not currently required in Finland, there are two examples of activities somewhat similar to stress-testing:

- In a very few specific projects, like the plans for storage of spent nuclear fuel, is systematic stress-testing against potentially critical events involved.
- Following the COVID-19 pandemic, NESAs, the National Emergency Supply Agency has developed scenarios in order to stress-test emergency supply planning (but not legislation) (Fjäder, et al., 2020).

Overall, the Finnish approach has so far prioritised the front end of law-making, or the design phase, over the subsequent phases in the legislative cycle, and forward-looking design of policies over stress-testing of legislation against high-impact, low probability events (SOIF, 2021).

This is illustrated in Finland's score on OECD's Indicators of Regulatory Policy and Governance (OECD, 2019). The scores clearly illustrate that in Finland, focus is on the design and development of legislation, and on methods for involving stakeholders in the process in a transparent manner. The implementation of OECD recommendations in the field of regulatory impact assessment has improved over the years, but Finland still scores lower than OECD average in this respect. Ex-post evaluation of legislation is less developed, and focus is on transparency rather than systematic adoption (OECD, 2019). This picture is confirmed by the desk research and interviews undertaken for this study. The Finnish Council of Regulatory Impact Analysis, who review all legislation with a view to improving legislative quality has '...drawn attention, on a regular basis, to the deficient presentation of impacts on the economy and society in particular in Government proposals', a state of affairs that the council ascribes to poor resourcing of impact assessment (Finnish Council of Regulatory Impact Analysis, 2020). Following the comments from the council, a government working group for the coordination of research, foresight, and assessment activities (The TEA Working group) has been set up to plan research activities that can underpin impact analyses (Anon., n.d.).

The resilience of public policies in a volatile physical and economic environment is sought through what is described by interviewees as 'knowledge-based decision making' or 'national foresight work', and ministries are expected to take the outcome of foresight activities into account when drafting legislation. However, while foresight methods appear to be well integrated into the policy cycle and involves the Finnish parliament as well as the government and all ministries, and while the strategies of multiple ministries are, at least in part, based on the development and exploration of possible future scenarios (OECD, 2019), the links between the extensive foresight and research activities, and the law-making process are not firmly established. The research indicates however, that strengthening these links is increasingly a priority for policy stakeholders.

Policy area/sector of application (if relevant).

Across all ministries and Parliament

No stress-testing of legislation as defined in this study was required at the time of researching and drafting the report.

If application is across policy areas, please describe the process

Impact analysis of proposed regulation is required, and the quality of the impact analysis is assessed by the Finnish Council of Regulatory Impact Analysis.

	Nuclear Waste	Finland is currently preparing a site for underground disposal of spent fuel from nuclear power plants (Anon., 2021). In the context of nuclear waste management, the plans are stress-tested against scenarios defined in terms of so-called FEPs, i.e., features, events, processes. ⁶⁶
	Security of supply	The National Emergency Supply Council (NESA) have developed scenarios that could potentially disrupt security of supply, but the scenarios are not used to stress-test concrete legislation. However, the council notes that 'resilience policy becoming the centre of attention of international communities may cause EU-level changes that can potentially have major impacts on security of supply. Developments that could bring about these kinds of changes include the ongoing renewal of the directive on the protection of critical infrastructure (ECI Directive) and the updating of the directive on security of network and information systems (NIS Directive) concerning the security obligations and disruption reporting of digital services.' (Fjäder, et al., 2020, p. 30), and that changes in these directives would directly influence Finland.
Legal basis or requirement for stress-testing policies	Legal basis	Impact analysis of proposals for legislation is required by the Bill Drafting Instructions of 2004 (Ministry of Justice Finland, 2008). The accompanying guidelines do not specify time horizon for impacts to be considered. The legal basis of the activities of the National Audit Office of Finland (NAOF) is the Constitution of Finland (1999), and the Act on the National Audit Office of Finland (OECD, 2015). According to interviews, there is a legal basis for the activities involved in preparing the Government's Report on the Future. and for considering scenarios in the policy process.
	Legal requirement	There are no legal requirements in place for any stakeholder to carry out stress-testing of legislation.
Purpose of stress-testing activities		While there are no requirements for stress-testing of legislation in Finland, there is an ambition to futureproof policies by using foresight as stated in the Government's Report on the Future: 'The rationale underlying reports on the future is to identify issues that will require attention over government terms and to lay out the Government's shared ambition for building the future.' (Oksanen, 2017, p. 11)
Description of the applied stress-testing activities		The main activities are listed below. - Assessment of the impact analysis accompanying all proposals for legislation is carried out by the Finnish Council of Regulatory Impact Analysis. The council issues statements ⁶⁷ providing an analysis of whether the government proposal includes an adequate description of the main objectives, intended impacts, change mechanisms, and estimated costs and benefits (households, businesses, public finances, national economy). With relevance for stress-testing, the statement also analyses whether the justifications of the government proposal are sustainable and transparent in terms of adequate knowledge-base.

⁶⁶ A description of the FEPs and scenarios used can be found in Miller & Marcos (2007).

⁶⁷ <https://vnk.fi/en/council-of-regulatory-impact-analysis> (Statements).

- Development of scenarios within the Government. Ministers jointly produce the scenarios; facilitated by the PM's office.
- Involvement of stakeholders in 'futures dialogues', using a tool for dialogues with citizens ('Timeout', see Timeout Foundation (n.d.)). The method entails carefully structured, but exploratory dialogues with small groups of citizens (young people have preference) with the aim of creating public debates about the future as well as collecting citizens' views on the future. An application of the method is described by Lahtinen (2021), who finds that this type of discussions is essential to ensure trust between civil society and government.
- Publication of the **Government Report on the Future**⁶⁸, with a theme (e.g., in 2018, the Future of Work).⁶⁹ The report is drafted in collaboration with the ministries and the Finnish Parliament who engage with the public, third sector, private sector and universities in the process (Prime Minister's Office, n.d. (4); Finnish Government, 2018). The Government is currently (June 2021) preparing the next Government Report on the Future, the theme of which has not yet been made public.
- Scrutiny of Government's Report by the Parliament Committee on the Future and preparation of the Committee's response in the shape of '**Parliament's Report on the Future**'⁷⁰. (Source: Interviews and Tiihonen (2013)). The Committee also commissions their own foresight, for example '**Towards a better future: technological opportunities and threats to the promotion of sustainable development**'⁷¹
- **Performance audits**⁷² carried out by the National Audit Office of Finland (NAOF). As part of performance audits, NAOF conducts assessments of governance and steering mechanisms involving amongst other things foresight information. The audits are thematic, addressing a policy area rather than a single piece of legislation (for example, '**Finland's international climate finance – Steering and effectiveness**')⁷³.

Actors/entities responsible for stress-testing	PM's Office	Main responsible entity in the production of foresight knowledge. The Prime Minister's Office orchestrates the process and leads the development of the Government Report on the Future.
	Ministries	Each ministry is required, once every term of government, to produce a Futures Review for their own branch of Government. The aim is to generate public debate and provide information for government deliberations. The reviews assess projections and situations in society and examine issues involving political decision making. The most current reviews were published in 2018 (Prime Minister's Office, n.d. (2))

⁶⁸ <https://vnk.fi/en/foresight/government-report-on-the-future>.

⁶⁹ The 2009 report focused on energy, the 2013 report on well-being and sustainable growth, whilst the most recent report was published in two parts in 2017 and 2018, both focussing on the transformation of work.

⁷⁰ https://www.eduskunta.fi/FI/naineduskuntatoimii/julkaisut/Documents/NETTI_TUVJ_13_2018_Committee_reports_2015-2018.pdf.

⁷¹ <https://www.eduskunta.fi/FI/valiokunnat/tulevaisuusvaliokunta/julkaisut/Sivut/towards-a-better-future.aspx>.

⁷² <https://www.vtv.fi/en/audit-and-evaluation/performance-audit/>

⁷³ <https://www.vtv.fi/en/publications/finlands-international-climate-finance-steering-and-effectiveness/>.

The Government working group for the coordination of research, foresight, and assessment activities (TEA Working Group)	The TEA working group is an inter-ministerial working group with representatives from all ministries, whose aim it is to enable the ministries to cooperate and exchange information more smoothly. The term of the working group, appointed by the Prime Minister's Office, is for an indefinite period. It is subject to an annual assessment by the Prime Minister's Office. It serves as the collective contracting body for the coordination of analysis, assessment, and research activities of the Government and its ministries. (Prime Minister's Office, n.d.).
Government Foresight Group	<p>Members of the Government Foresight Group are appointed for three years. In the current period (2020-2023), the members come from the following organisations:</p> <ul style="list-style-type: none"> - Chairman and a Secretary General from the Prime Minister's Office; - Finland Futures Research Centre, University of Turku; - Faculty of Management, Tampere University; - Committee for the Future, Parliament of Finland; - Finnish Academy of Science and Letters; - Ministry of Economic Affairs and Employment; - Aalto University; VTT (Technical Research Centre of Finland); - Secretariat of the Security Committee; and - Sitra. <p>The group lends support to national foresight work, joint foresight processes and the development of national foresight activities. A Secretariat assigned to the Prime Minister's Office performs preparatory work and aids the Government Foresight Group's work (Prime Minister's Office, n.d.).</p>
Parliamentary Committee for the Future	The Committee for the Future was established as a temporary committee in the Parliament of Finland in 1993. Its work was assessed (without any formal evaluation) as a success, and in 2000 it was turned into a permanent committee with 17 members and a secretarial. The committee serves as a Think Tank for futures, science, and technology policy in Finland. The Committee for the Future prepares the drafts of the future reports that represent the Parliament's responses to the Government and provides a comprehensive analysis and recommendations for amendments of the text. Other Committees are invited to provide opinions on parts of the report that are within their area of responsibility. The draft reports are discussed in the plenary session and are adopted as final versions by the Parliament. The future reports are published online ⁷⁴ (in Finnish and Swedish). They include legally binding statements as resolutions; these resolutions are then transformed into concrete actions and decisions by the Government (Parliament of Finland, n.d.; Hietanen, 2017). For example, the Committee Report on the Government's Report of 2017 included eight resolutions of various nature, from a recommendation to keep publishing the report in two parts, to requirements that the legislative needs of tax legislation, labour law, and social legislation following changes in the labour market are taken into account, and that the application possibilities of the Incomes Register are studied with

⁷⁴ https://www.eduskunta.fi/FI/vaski/Mietinto/Sivut/TuVM_2+2017.aspx.

a view to better utilisation of that register (Committee on the Future, 2021). Unlike other parliamentary committees, the Committee for the Future is not part of the legislative machinery: it does not discuss proposed legislation, and hence, party-political differences are not as important as in other committees (Koskimaa & Raunio, 2020; Parliament of Finland, n.d.).

Finnish Council of Regulatory Impact Analysis in the PM's office.

The Council is an autonomous and independent body, whose members are appointed by the government for a three-year term. The current term expires on the 14 April 2022. The main task of Council is to improve the quality of impact assessments of government proposals and the culture of legislative drafting in general (Prime Minister's Office, 2019). The Council scrutinises all draft laws with a view to assessing the quality of the impact assessments accompanying the draft legislation. There is no specific emphasis on the time horizon of impact, or whether the impact analysis considers different scenarios.

As yet, no ex-post evaluation of legislation takes place, but in March 2019, the Council submitted an initiative for introducing a government-level system for ex post regulatory impact analysis, and according to the 2019 Annual Review of the Council, the proposal is part of the Government Programme (Government Communications Department, 2019; Finnish Council of Regulatory Impact Analysis, 2020).

National Audit Office of Finland (NAOF)

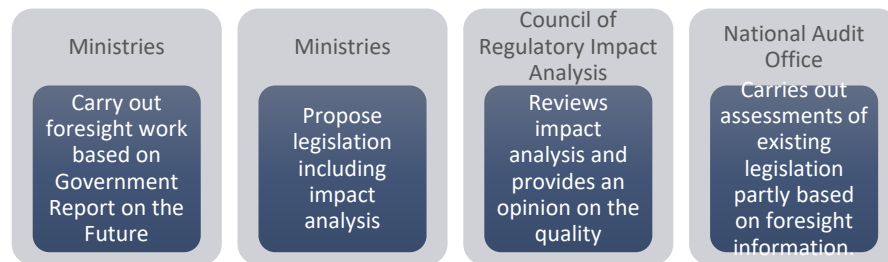
The task of the NAOF is to audit the legality of central government finances and compliance with the state budget. The NAOF performs its duties laid down in the Constitution through financial audit, compliance audit, performance audit and fiscal policy audit.⁷⁵ While the NAOF does not carry out stress-testing of legislation, one of its responsibilities is to carry out assessments of governance and steering mechanisms on the background of foresight information as part of performance audit. For example, a recent NAOF audit '...examined whether the steering of basic education supports the teaching of skills necessary in future working life. Examples of such skills include, for example, social skills, emotional skills, and learning to learn. The audit utilised the skills identified by the OECD as important for future working life' (VTV, National Audit Office of Finland, 2021).⁷⁶ Hence, while NAOF does not carry out stress-testing against HILPs, it contributes to 'future-proofing' by analysing the use of foresight information in policies. The analysis aims to establish whether the scenarios used are reliable and build on a solid information base. Where audits are risk based, the NAOF uses quality models to evaluate risks (source: interview).

⁷⁵ See <https://www.vtv.fi/en/audit-and-evaluation/>.

⁷⁶ The term 'future working life' may appear ambiguous, but the context of the quote clearly indicates that it should be understood thus: 'working life as it will evolve in the future'.

Stakeholders involved in stress-testing without direct responsibility	National Foresight Network and Sitra	<p>Sitra is an independent institution and a public fund. It is funded by the returns from an endowment originally granted by the Finnish Parliament in 1990. Its mandate is given by law thus 'The aim of the fund is to promote stable and balanced development of Finland, quantitative and qualitative economic growth, as well as international competitiveness and co-operation, especially by implementing projects that increase the efficiency of the national economy or raise the level of research and education or explore future development' (Finlex, 1990). Sitra reports directly to the Finnish Parliament.</p> <p>The National Foresight Network is not directly involved in stress-testing, but provides the knowledge base, scenario methodologies and tools and training that underpin policy design and would enable authorities to conduct stress-testing, should they so decide.</p>
	Municipalities	Required to produce their own foresight (source: interview).
	Regional/local authorities, NGOs	Participation may vary. Participate in, e.g., scenario workshops, consultations.
	The public	Participation may vary. Participate in, e.g., futures dialogues, scenario workshops, consultations.

Organisation and structure of stress-testing (main actors)



Source: Authors

Types of shocks and time horizons considered	No specific types	The activities most similar to stress-testing of policies do not have a focus on shocks, but more on broader trends. For government visions, the time horizon is 10-20 years, for specific policies, e.g., energy policies it may be considerably longer (for energy policy up to 2050, for environmental policies up to the year 2100) (source: interview). SDG 2030 targets are considered as well.
Methods used	Networked intelligence gathering	There is no single, well-described method. Since the process is networked, it utilises a rich range of foresight methods used by, e.g., the members of the Foresight Network.
	Interviews, workshops, and future dialogues	In developing the Government Report on the Future as well as in developing the response from the Parliamentary Committee for the Future, stakeholder involvement and expert involvement play a major role. ⁷⁷ Besides consultations with experts in the foresight network, the process typically involves several workshops with different groups of

⁷⁷ For a detailed account of the methods used to gather intelligence by the Parliamentary Committee on the Future, see Koskimaa and Raunio (2020).

		stakeholders, such as sector experts, businesses, and local and regional authorities.
	Horizon scanning	Utilised by members of the foresight network.
Additional methods and tools (if any) used to complement stress-testing activities	Megatrend cards	Megatrend cards are a collection of trends in the form of cards with short descriptions that can be cut out and used in a workshop (Sitra, 2018).
	Tool for identifying weak Signals	A process tool allowing a group to identify weak signals of change and discuss their potential impact. Identifying and interpreting weak signals is an integral element of developing foresight in Finland. ⁷⁸
Results and impact of stress-testing activities on final policies	Example	<p>Since stress-testing of legislation against future HILPs is not systematically applied, the impact of the isolated examples is difficult to pinpoint. The shared and persistent focus on developing future-oriented policies, the legal basis of the activities and institutions, and the fact that activities are based in the Government as well as in Parliament however all speak to a commitment to future-oriented policy-making, which, in its own way, could be perceived as an impact of activities.</p> <p>At a more concrete level, the NAOF recently (June 2021) audited Finland's security of supply and safeguarding it during the Covid-19 pandemic and found that 'Finland had mainly succeeded well in safeguarding its security of supply during the Covid-19 pandemic. The most significant problems were related to the availability of protective equipment used in healthcare at the early stages of the pandemic. In other sectors of key importance for security of supply, Finland has managed to prevent disruptions' (Kalijärvi, 2021).</p>
Challenges and trade-offs related to stress-testing identified by interviewees		<p>In small countries, like Finland, there is a risk of 'group think', whereby everybody agrees on common visions of the scope of future scenarios, perhaps overlooking developments and trends pointing in other directions.</p> <p>With specific reference to HILPs or wild cards, all interviewees agree that the low perceived probability of such events is a challenge for policy-makers and stakeholders, as illustrated by the finishing remarks in an assessment of the impact of the Parliamentary Committee on the Future by Koskimaa and Raunio (2020): 'It is perfectly understandable that MPs focus on issues that have tangible legislative or budgetary consequences. The Finnish Committee for the Future certainly deserves credit for trying to reduce political myopia. The absence of similar bodies in other legislatures suggests that introducing a long-term perspective to parliamentary work is not easy.'</p>

Organisations interviewed

Sitra

The Parliament's Committee on the Future

Aalto University, Systems Analysis Laboratory

NAOF

⁷⁸ <https://www.sitra.fi/en/cases/weak-signals/>.

Country fiche The Netherlands

Description of the use of stress-testing in the national policy process

Stress-testing of policies as defined by this study is not carried out systematically as part of the policy cycle in the Netherlands. Foresight has a long history in the Netherlands, with Royal Dutch Shell carrying out its first horizon scan exercise in 1967 (Andersson, 2021). The use of stress-testing/foresight in the Netherlands is currently most pronounced in the field of water/environmental policy.

A major flood in 1953, which killed several people, led to the foundation of the Delta Programme, a programme to ensure that the protective measures (dikes, dams, sluices) were in place and could withstand this type of events in the future, and that critical infrastructure could function during flooding.

The scope of the Delta programme, now in its second phase, has widened to include not only resilience against direct impacts of climate change but also water quality, urban issues, and health issues (source: Interview). Bloement et al. (2019) describe the programme's application of an 'adaptation pathways'-approach, which is related to Decision Making Under Deep Uncertainty (DMDU), a set of methods and tools encompassing the Dynamic Adaptive Policy Pathways (DAPP) approach described in the main report. In the planning period 2010-2014, four 'Delta Scenarios' were developed to formulate decisions and regional strategies that the Netherlands were to perform in the following 35 years, working with a planning horizon until 2100. In the preface to the 2021 Delta programme, it is noted: 'Greater regulatory focus should be placed on the interconnectivity between water and spatial taskings. This also opens up opportunities. In the Netherlands, water can bring out the best in us: water as a driving force and as a guiding principle!' (Delta Programme Commissioner's staff, 2020)

Hence, much attention is given to climate scenarios as a means to explore the impacts of possible future climates and to test the robustness of adaptation actions against these scenarios. These activities are the closest to stress-testing in the Dutch context. The impact of different time-dependent climate scenarios is analysed using model simulations and game experiments (Haasnoot, et al., 2015).

Since 2014, the impacts identified are translated into a National Adaptation Strategy, the aim of which is to involve local and regional governments more closely in the Delta Programme (source: interview).

The use of foresight has spread to other sectors. The utilisation of foresight in law-making is however uneven, and the guideline for impact assessment of legislation (IAK, Integrated Impact Assessment Framework) is not systematically 'joined up with or draw upon e.g., the research outputs of the four planning bureaus' (OECD, 2020).

Covid-19 has however increased the interest in foresight and in considering unexpected events in policy making. For example, the Study Centre for Technology Trends (STT) is meeting with a Ministry to discuss opportunities related to a greater share of the workforce working from home, hence reducing the need to provide transport opportunities and office space in public workplaces.

Policy area/sector of application (if relevant).

If application is across policy areas, please describe the process

All – emphasis however on infrastructure and the environment

In principle all sectors should include foresight information in the impact analysis of draft legislation. However, the emphasis on future-proofing is strongest in fields related to infrastructure and the environment, and focus is on climate-related events.

The **National Climate Adaptation Strategy of 2016**⁷⁹ and its accompanying implementation programme 2018-2019 sets a framework for actions to be taken to adapt to climate change, while the Delta Plan on Spatial Adaptation aiming at rendering the Netherlands water-resilient and climate-proof by 2050 supports government authorities and private parties in embedding the goals in policy plans (The Ministry of Infrastructure and the Environment, 2016). This is achieved, e.g., through the Climate Adaptation Standards Consultation

⁷⁹ <https://klimaatadaptatienederland.nl/en/policy-programmes/nas/>.

		Committee (OSKA); by sharing guidelines for the embedding of climate adaptation in environmental visions, plans, and implementation agendas; and by sharing best practices and know-how on implementation projects. (Delta Programme Commissioner's staff, 2020)
Legal basis or requirement for stress-testing policies	Legal basis	An act (<i>Aanwijzingen voor de Planbureaus /Protocol for the Policy Assessment Agencies</i> ⁸⁰) establishes Sector Planning Agencies as independent institutions financed by the state. Each agency is linked to a Ministry. Their number and sector have varied over the years. In 2021 there were three such planning agencies: Netherlands Environmental Assessment Agency (PBL), Netherlands Bureau for Economic Policy Analysis (CPB) and the Netherlands Institute for Social Research (SCP).
	Legal requirement	Lawmakers are required to use the Integrated Impact Assessment Framework IAK (see below). Further, municipalities and regional governments were required to perform stress-tests of their infrastructure plans before 2019 following an agreement between the ministries and local authorities. There are regular norms for flood safety levels (source: interview, CAS). One interviewee (PBL) observes that informal processes are just as important, if not more so than legislation. For example, when PBL published a study on the North Sea, which was not commissioned by the Government, they had a request from the parliamentary Committee on the environment to discuss the implications of the findings for environmental policies.
Purpose of stress-testing activities		'The aim shall be to ensure the clarity, simplicity and durability of regulations.[...] A regulation can be described as durable if it does not need to be amended frequently. From the perspective of legal certainty, it is advisable to make every effort to ensure regulations are as durable as possible. This also requires the essential policy choices to have been made in a well-considered manner before a regulation is drafted' (Kenniscentrum Wetgeving en Juridische zaken/The Knowledge Centre for Legislation and Legal Affairs, 2017).
Description of the applied stress-testing activities		All law-making processes should be subjected to an integrated quality assessment (IAK), which includes a requirement to accompany a draft regulation with a note specifying 'the costs to citizens, businesses and institutions and the costs to the government' (Kenniscentrum Wetgeving en Juridische zaken/The Knowledge Centre for Legislation and Legal Affairs, 2017), but there is no specific reference to costs associated with possible future events. A guideline to of a cost benefit analysis issued by two of the Planning Agencies, PBL and CPB recommends costs related to uncertainty and risk should be considered, and that scenarios can be used to evaluate relevant exogenous developments (Romijn & Renes, 2013). In 2019, the Dutch Government published a 'national environmental vision' to be implemented at the regional level in spatial planning. The vision summarised the government's intentions but did not include concrete measures. PBL (see below) stress-tested the strategy against two scenarios, a high economic growth scenario and a stagnation scenario (source: interview). The exercise included Wild Card analysis, considering positive Wild Cards like, e.g., a breakthrough for the hydrogen economy as well as negative ones like a change of the direction of the Gulf Stream. They used the PESTE ⁸¹ framework to identify and classify Wild Cards. According to the interviewee from PBL, it is important to start with a very divergent process, identifying

⁸⁰ In English texts, the Planbureaus are variably termed 'Policy Assessment Agencies', 'Planning Agencies' or 'Planning Offices'. We will use the term Planning Agencies. <https://wetten.overheid.nl/BWBR0031972/2012-04-01>.

⁸¹ Also known as STEEP: Social, Technological, Economic, Environmental, Political.

as many Wild Cards as possible and describing them. Subsequently, wild cards should be catalogued and classified according to PESTE. Only after these steps should the analysis of interactions and impact be initiated (Source: Interview, PBL).

Actors/entities responsible for stress-testing	Ministry for Infrastructure and the Environment	<p>Designing and implementing policies</p> <p>The latest National Climate Adaptation strategy was drafted in 2016. It was developed in a process involving public sector authorities at the regional and local level, water management authorities, knowledge institutes, private sector companies and societal organisations. The process included three workshop sessions (The Ministry of Infrastructure and the Environment, 2016).</p> <p>The strategy of 2016 has recently (2020) been reviewed.⁸² The main points of the review were:</p> <ul style="list-style-type: none"> - Full commitment should be given to urgent risks and spearheads, with a particular focus on heat, the built-up environment, and infrastructure; - The climate adaptation should tie in with other transitions and societal taskings; <p>It was recommended to invest in a long-term knowledge and monitoring system.</p>
	Delta Programme and Delta Programme Commissioner	<p>The Delta Programme Commissioner is the government official responsible for the Delta Programme. The Delta Programme Commissioner 'may participate in the Council for Financial Affairs, Economic Affairs, Infrastructure and Agriculture (RFEZIL) in his capacity as an expert. This sub-council of the Council of Ministers, which is chaired by the Prime Minister, is composed of representatives of the Ministries of Infrastructure & Water Management; Economic Affairs & Climate Policy; Agriculture, Nature & Food Quality; Finance; Foreign Trade & Development Cooperation; Social Affairs & Employment; and Education, Culture & Science.</p> <p>The Delta Programme Commissioner may advise the Cabinet members involved of his own accord, and, if need be, suggest that they use their powers should the progress of the Delta Programme threaten to stagnate'.⁸³</p>
	National Planning Agencies	Provide knowledge basis, including foresight and scenarios
	Municipalities and regional governments	All municipalities and regional governments in 2014 committed to undertake a stress-test in which they analysed extreme events, climate projections, key risks, and vulnerabilities. Every city did its own analysis, based on the Climate Damage Atlas (see under methods) and locally adapted modelling. The first cycle was completed in 2020 (source: interview CAS).
	National planning	Three publicly funded but independent agencies:

⁸² The review is in Dutch, the link can be found here: https://klimaatadaptatienederland.nl/publish/pages/125102/nationaal_perspectief_klimaatadaptatie.pdf.

⁸³ Quoted from the website of the Delta Programme: <https://english.deltaprogramma.nl/delta-programme-commissioner>.

Stakeholders involved in stress-testing without direct responsibility	agencies ('Planbureaus')	PBL (Netherlands Environmental Assessment Agency), CPB (Netherlands Bureau for Economic Policy Analysis), SCP (Netherlands Institute for Social Research) All three Planning Agencies target national policies and develop scenarios and foresight within their policy domain, but scenarios may also impact other domains.
	CAS, Climate Adaptation Services	CAS is an independent agency that works with the Dutch meteorological institute to provide a climate atlas ⁸⁴ for the Netherlands showing the physical effects of climate changes at the municipal level. The risks are divided into urban flooding, heat, drought, and coastal/river flooding and two scenarios are estimated: Current situation and major change. The intention is for the map to be used by the municipal and regional authorities for stress-testing their policies, especially in the fields of land use planning and infrastructure. CAS also hosts the national Climate Adaptation Platform ⁸⁵
	STT, Stichting Toekomstbeeld der Techniek (Study Centre for Technology Trends)	The Netherlands Study Centre for Technology Trends (STT) is an independent Expertise Centre, established in 1968 by KIVI, the Royal Dutch Engineering Society. STT produces foresight in all fields. ⁸⁶ The STT is publicly funded.
	Financial sector	Real estate investors and pension funds are important stakeholders in water management due to their investment in buildings and infrastructure.
	Other stakeholders	Water authorities, the Meteorological Office, hospitals in at-risk areas, critical infrastructures, and emergency services. Architects and real estate developers are involved in translating the results of stress-testing into the design of buildings, infrastructure, and cities.
Organisation and structure of stress-testing	There is no fixed procedure in place. The Delta programme provides input to political decisions at all levels from Municipalities to national Ministries and Parliament in the form of National Climate Adaptation Strategies and policy briefs, but there is no standardised schedule involved.	
Types of shocks and time horizons considered	Effects of climate change	1-2 years to a hundred years
	Other types of shocks	STT scenarios include the endangering of human rights, fake news (source: interview).
Methods used	Ex-ante impact analysis	Described above. In practice, little foresight information is used here, no use of wild cards

⁸⁴ Available at <https://www.klimaateffectatlas.nl/en/>.

⁸⁵ <https://klimaatadaptatienederland.nl/en/>.

⁸⁶ <https://stt.nl/nl/english-profile-publications>.

	Scenario workshops	Workshops with up to 50 participants, e.g., municipal developers, designers, researchers, citizens. Diversity of participation is considered more important than numbers.
	'Rehearsing the future' (currently being developed)	Workshops at the regional and municipal level with a view to teaching stakeholders at these levels to use foresight in policy design and planning
Additional methods and tools (if any) used to complement stress-testing activities	Wild Card analysis	To improve resilience, Wild Cards are increasingly included in scenario analyses. As many wildcards as possible are identified, classified according to PESTE and the possible interaction and impact analysed.
	Impact analysis	Mapping out impacts of specific dimensions of climate change (warmer, wetter, drier, rising sea level) on sectors. See the example in the annex.
	Modelling	Statistical models are developed to assess how the infrastructure will hold under different climate-related situations.
Results and impact of stress-testing activities on final policies	Initiatives at the municipal level to ameliorate the effects of extreme rainfall	According to the interviewee from CAS, the impact is directly visible at the local level as urban greening, regreening gardens, green roofs, and urban drainage plans.
	Growing interest in stress-testing in a wider sense	According to the STT interview, Ministries are increasingly interested in identifying risks and HILPs and improving their capacity to anticipate impact across sectors. This started even before Covid-19 but has been accentuated in 2020 and 2021.
Challenges and trade-offs related to stress-testing	According to two of the three interviewees, foresight is often still not taken seriously – it takes an effort to convince politicians to use scenarios. There is a tendency to prefer one specific scenario over the alternatives, so it is necessary to invest in communicating the plausibility of alternative futures to political decision-makers. In addition, it is difficult to persuade decision-makers to consider second- and third-order effects. According to one interviewee, the situation could be improved if politicians would be directly involved in the development of scenarios.	

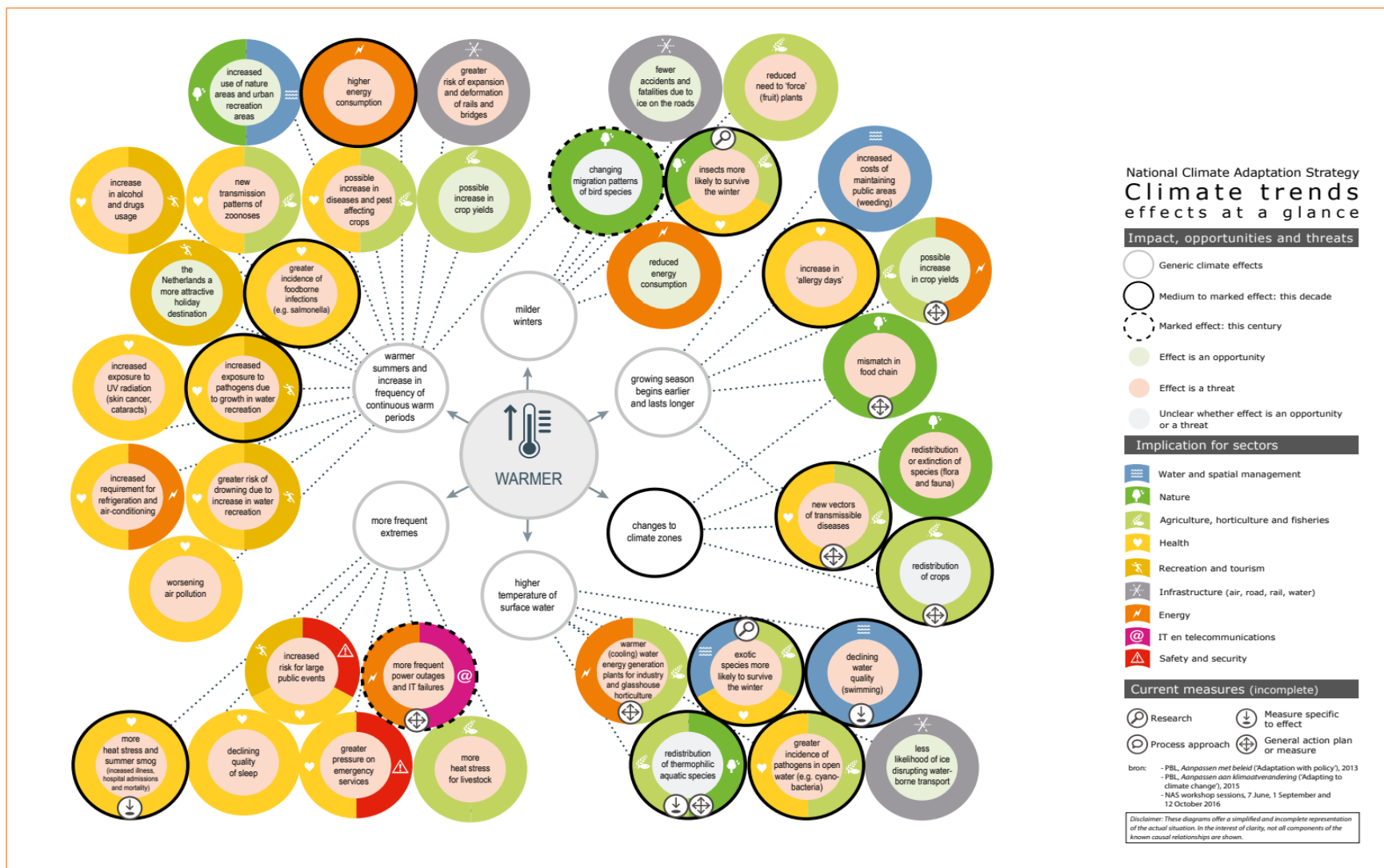
Organisations interviewed

PBL, the Netherlands Environmental Assessment Agency

CAS, Climate Adaptation Services

STT, Stichting Toekomstbeeld der Techniek

Example of impact mapping in National Climate Adaptation Strategy (The Ministry of Infrastructure and the Environment, 2016, p. 13)



Country fiche New Zealand

Description of the use of stress-testing in the national policy process	<p>Stress-testing is not widely used in the national policy process for various reasons. Among the most significant are the lack of a systematic integration of strategic foresight in government and difficulties in engaging decision-makers in using outcomes of foresight initiatives (SOIF, 2021; interviews).</p> <p>Nonetheless, stress-testing (or wind tunnelling) of policies against a set of possible future scenarios is considered to be good policy practice. Government agencies have a legal responsibility to monitor and ensure that regulatory systems remain functional over the long term due to the statutory obligation of regulatory stewardship (Ministry of Justice, n.d.).</p> <p>However, there is a clear tendency towards short-term thinking. General elections are typically held every three years in New Zealand, which causes some policy-makers to give a low priority to long-term perspectives. Whilst foresight capability and capacity are continuously being developed by the Strategic Futures group (see below), there is no formal process for stress-testing. It is typically done on an ad-hoc basis and often in haste at the end of the policy process (source: Interviews).</p> <p>More could be done to promote stress-testing, such as providing greater resources for scenario development and building stronger links between public servants with foresight capabilities and policy-makers in government. The Strategic Futures group, which currently encompasses a semi-formal community of foresight practitioners spread across government departments, could play a more formal role in supporting such efforts (source: Interviews).</p>	
Policy area/sector of application (if relevant). If application is across policy areas, please describe the process	<p>Transport</p> <hr/> <p>Fiscal policy</p> <hr/> <p>Environment</p>	<p>Scenario planning as part of long-term thinking in devising policies for mobility and the land transport system.</p> <hr/> <p>The New Zealand Treasury has conducted stress-tests to future-proof its balance sheet management. The stress-testing of fiscal resilience involved the use of scenarios based on HILPs (The Treasury, 2018).</p> <hr/> <p>Risk assessment combined with scenario analysis to identify possible impacts of climate change in New Zealand.</p>
Legal basis or requirement for stress-testing policies	<p>Legal basis</p> <hr/> <p>Legal requirement</p>	<p>The legal basis for anticipatory policy-making in New Zealand is the Public Service Act, which was enacted in August 2020 (Parliamentary Counsel Office, 2020). It introduced regulatory stewardship as a statutory obligation for all public service leaders. This means that chief executives of government departments (where most of New Zealand's legislation is administered) are responsible for taking a proactive and collaborative approach to monitoring and securing the performance of the legislation administered by them (Ministry of Justice, n.d.). This involves responding to change over time in order to secure the functioning of policies in the medium- and long-term (Department of the Prime Minister and Cabinet, 2021a). The Public Service Act does not define these time horizons any further, nor does it state a legal requirement to employ stress-testing as such. However, it obliges departmental chief executives to regularly publish Long-term Insights Briefings on trends, risks and opportunities that may affect New Zealand and its society in the future (Department of the Prime Minister and Cabinet, 2021b).</p> <hr/> <p>There is no legal obligation for policy-makers to stress-test policies.</p>
Purpose of stress-testing activities	<p>Stress-testing is primarily done at the end of the policy process for assessment purposes. Whilst iterative policy design is described as the ideal practice among some</p>	

	foresight practitioners in the public sector, stress-testing is typically not used for this purpose.		
Description of the applied stress-testing activities	<p>There is limited evidence of stress-testing activities as part of the policy process in New Zealand. The clearest example is stated below:</p> <ul style="list-style-type: none"> - Since 2013, the New Zealand Treasury is required to report at least every four years with an Investment Statement to the Parliament. The statement specifies the government's long-term fiscal position and considers possible fiscal challenges related to identified risks and trends (SOIF, 2021; The Treasury, 2021). For its 2018 Investment Statement, the Treasury conducted fiscal stress-testing with the help of three scenarios based on specific HILPs, namely a major earthquake, the widespread outbreak of foot-and-mouth disease and an international economic downturn. Potential impacts of these shocks on the national balance sheet were assessed for the next fifteen years (The Treasury, 2018). 		
Foresight activities that could inform policy stress-tests	<ul style="list-style-type: none"> - Like other government departments, the Ministry of Transport has a responsibility under the Public Service Act to provide long-term stewardship of the transport system (Minsitry of Transport, 2020). In the past, it has used foresight methods to explore potential risks and opportunities for the future of transport. For a foresight initiative in 2014, the ministry has consulted experts as well as the public to identify key drivers and generate four scenarios describing how society and demand for travel may look like in 2042. The scenarios were developed in workshops and informed by insights from expert focus groups. Two critical uncertainties were identified and used as a framework for scenario development (2x2 matrix approach, see section 2.4.1 of the main report). Impacts of the scenarios on possible future investment needs in the land transport system were calculated using a quantification model. The outcome of these activities were 12 insights into how the transport system could or should evolve (Lyons, et al., 2014). - The Ministry of Environment is legally required, since 2019, to publish national climate change risk assessments. The first was produced in collaboration with research institutes and external consultants and published in 2020. It identifies 43 priority risks by looking at vulnerabilities of different sectors, such as environment, infrastructure, and the financial system, to climate change (Ministry for the Environment, 2021). The impacts of these risks are assessed with the help of two climate scenarios, both in the present as well as the near (2050) to long-term (2100) future. Both scenarios are quantitative and based on long-term projections of possible climate change trajectories as developed by the Intergovernmental Panel on Climate Change. Outcomes of the climate change risk assessment are meant to feed into a national adaptation plan for the government's response to be published in 2022 (Ministry for the Environment, 2020). 		
Actors/entities responsible for stress-testing	The individual strategy or policy units of government agencies who choose to conduct stress-testing activities have responsibility for them. There is no central unit responsible for the coordination of stress-testing across government.		
Stakeholders involved in stress-testing without direct responsibility	<table border="1"> <tr> <td>The Strategic Futures group</td> <td>The semi-formal group began to form in 2016. It is a network of around 140 foresight practitioners, mostly strategists, planners, and policy practitioners in various government departments. They promote the development of foresight capabilities in government and offer peer reviews to interested departments having conducted foresight activities. There is a growing interest in the group's activities due to the statutory obligation for all government departments to produce Long Term Insights Briefings. According to an interviewed member, the Strategic Futures group has not done much foresight work together as a unit. Members generally share what they are doing within their agencies, but it has been difficult to get traction on joint initiatives. The group has trialled the use of foresight methods among a number of agencies and carried out some foresight discussions on the basis of these activities, but rather in an informal manner (source: expert interview).</td> </tr> </table>	The Strategic Futures group	The semi-formal group began to form in 2016. It is a network of around 140 foresight practitioners, mostly strategists, planners, and policy practitioners in various government departments. They promote the development of foresight capabilities in government and offer peer reviews to interested departments having conducted foresight activities. There is a growing interest in the group's activities due to the statutory obligation for all government departments to produce Long Term Insights Briefings. According to an interviewed member, the Strategic Futures group has not done much foresight work together as a unit. Members generally share what they are doing within their agencies, but it has been difficult to get traction on joint initiatives. The group has trialled the use of foresight methods among a number of agencies and carried out some foresight discussions on the basis of these activities, but rather in an informal manner (source: expert interview).
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External experts (academics, non-profits, and private providers)	These actors provide relevant insights and expertise on an ad hoc basis. Representatives from academia typically provide policy-specific knowledge for foresight initiatives (see Lyons, et al. 2014; Ministry for the Environment, 2021). External consultants with foresight expertise support capacity building and knowledge transfer. They may also help facilitate trend analysis, scenario development and other activities related to stress-testing (SOIF, 2021; interviews).
The public	Participates in public consultation activities, such as workshops to scan for trends and emerging risks.

Organisation and structure of stress-testing

There is no legal requirement to conduct policy stress-testing, which is mainly used at the end of the policy process following mandatory assessments, such as cost and benefit analysis. It is not always clear to what extent outcomes feed into final policy designs (source: Interviews).

The figure below summarises the steps involved in the stress-testing activities described above.



Source: Authors

Types of shocks and time horizons considered

Scenario planning in the Ministry of Transport	Four scenarios were developed using a 2x2 matrix based on two critical uncertainties (i.e., high-impact risks with future trajectories that could develop in opposite directions). They were the relative cost of energy (high vs low) and society's preference as to how it wants to access people, goods, and services (physically vs virtually). These dimensions were selected after horizon scanning exercises with a range of stakeholders and experts. The scenario planning covered a time horizon of 28 years (Lyons, et al., 2014). Although methodological descriptions of the project are available, no explanation for 2042 as the target year is given (Ministry of Transport, 2014)
Fiscal stress-testing for the mandatory Investment Statements	The impacts of three specific HILPs were considered in a stress-test by the New Zealand Treasury, namely, a major earthquake, the widespread outbreak of foot-and-mouth disease and an international economic downturn. The potential impacts of these HILPs were assessed for the next fifteen years after their simulated occurrence. According to the Treasury, this time horizon was defined as the applied fiscal forecasting model showed that the growth effects of a shock are unlikely to last longer than fifteen years (The Treasury, 2018).
Climate change risk assessment	Two scenarios considered, each based on a specific assessed risk. The first considers the possible cascading impacts of extreme weather events and ongoing sea-level rise, whilst the other examines how unevenly spread effects of climate change could exacerbate existing socioeconomic inequity. The risk assessment is looking ahead at 2050 and 2100 (Ministry for the Environment, 2020).

Methods used	Scanning for trends and drivers of change	A forward-looking perspective is part of the national policy process due to the statutory obligation of regulatory stewardship and the legal responsibility for government departments to publish Long-Term Insights Briefings at least once every three years (Ministry of Justice, n.d.; SOIF, 2021). The first round of briefings is currently being developed. They are to contain insights into medium- and long-term risks and opportunities in relevant policy areas and include policy options for addressing identified matters. According to the Department of the Prime Minister and Cabinet, the briefings are meant to stimulate public debate on long-term issues and inform decision-making by both government, business, academia and the wider public (Department of the Prime Minister and Cabinet, 2021b).
	Scenario development	Scenarios are generated in different ways. Typically, they are based on identified risks or trends, whilst trend decks and Wild Cards are also used to sketch out, or even combine, different images of the future. There are also various approaches in terms of who is involved in scenario development, often depending on the nature and scope of the given project. It may be done exclusively by internal scientific advisors and public servants with foresight skills, or with the help of external foresight consultants or scientific experts from academia.
	Assessment of impacts and vulnerabilities	Scenarios are primarily developed to allow for the exploring and assessment of the possible impacts of future risks, which in turn allows for the identification of specific vulnerabilities. The National Climate Change Risk Assessment, for example, identified vulnerabilities in a range of value domains, such as the economy, infrastructure, and governance (Ministry for the Environment, 2020).
Additional methods and tools used to complement stress-testing activities	None identified	
Results and impact of stress-testing activities on final policies	Example 1	Fiscal stress-testing activities inform the Treasury's regular Investment Statements to the Parliament. In the past, they have led to increased efforts by the Treasury to limit the extent of New Zealand's debt for the sake of greater financial resilience in light of specific shocks (source: Interviews). At the time of writing, there is little indication as to whether these stress-testing activities led to financial policies able to cope better with the COVID-19 pandemic.
	Example 2	The chief executive of each government department is obligated to publish Long-term Insight Briefings at least every three years. They inform the public domain about the medium- to long-term trends and risks faced by New Zealand society as well as suggest policy options to address these.
<p>Generally, the outcomes and results of stress-testing activities rarely feed directly into final policies. One of the reasons for this is a lack of commitment devices ensuring that policy-makers, to a greater extent, engage in and implement outcomes of stress-testing and related foresight activities. Although the value of anticipatory governance is widely recognised, stress-testing only plays a marginal role in the national policy process (source: Interviews). This may in part be due to the fact that the Public Service Act 2020 does not define how exactly outcomes of foresight initiatives, such as the Long-term Insights Briefings, should be used or adapted by policy-makers.</p>		

Challenges and trade-offs related to stress-testing

According to a national policy advisor, the number of valuable insights from stress-testing activities can be limited when they are being conducted with a too-narrow focus. In New Zealand, stress-testing rarely entails the consideration of second- or third-order impacts of considered shocks or scenarios. There is no systematic approach to stress-testing and the available resources for future-proofing policies are limited (source: Interviews).

Another challenge is confirmation bias, as those involved in stress-testing activities tend to explore and interpret risks and impacts according to their prior beliefs or values. On this background, one interviewee underlined the importance of collaboration between public servants with expertise and knowledge in different policy areas as well as the involvement of stakeholders with different backgrounds. However, this may be difficult to accomplish given that the semi-formal Strategic Futures Group comes closest to being a coordinating body for foresight activities in New Zealand.

According to another interviewed policy advisor, the evidence-based analysis of possible impacts of shocks or scenarios may be particularly difficult in policy areas concerned with aspects difficult to quantify, such as the wellbeing of citizens. Without statistical data and models, evidence must be based on available qualitative information.

Finally, it was a general concern raised by interviewees that some policy-makers are weary of using foresight approaches due to a focus on ensuring the short-time functioning of policies. Likewise, some policy advisors stated that policymakers tend to be sceptical about stress-testing and similar anticipatory exercises, doubting that their outcomes are sufficiently based on evidence to be of real value for the policy process (source: Interviews).

Organisations interviewed

Strategy unit at Inland Revenue

The Policy Project under the Department of the Prime Minister and Cabinet

School of Government, Victoria University of Wellington

The Treasury

Stratedgy⁸⁷ (consultancy offering strategic foresight advice and capability building)

⁸⁷ This is not a misspelling; the name of the company is a combination of the two words 'strategy' and 'edge'.

Country fiche United Kingdom

<p>Description of the use of stress-testing in the national policy process</p>	<p>Stress-testing of policies against specific scenarios or shocks happens rather sporadically in the United Kingdom. There is neither a legal obligation nor a common approach to policy stress-testing across government agencies. Whether it features in the design process of a specific policy tends to depend on the existing foresight capabilities in the responsible government department. When used as a policy tool, stress-testing is usually conducted at the end of the policy process for assessment purposes.</p> <p>Other foresight methods are applied more widely and systematically, specifically horizon scanning, to identify trends and emerging drivers of change as well as the development of scenarios to generate images and narratives of alternative futures. The Three Horizon model, which can be used to assess the change of strategic issues over time, is another example.</p> <p>Alongside guidance on how to conduct policy stress-testing, these methods are presented in the Futures Toolkit by the Government Office for Science (GOS) (2017), which plays a central part in the promotion of anticipatory governance in the United Kingdom. The GOS supports the embedding of foresight approaches in national policy-making and regularly publishes foresight studies on a range of subjects, including skills and lifelong learning (2018a), an ageing population (2019a), as well as citizen data systems and regulations (2020). These studies are typically championed by one or more government department(s) wanting to explore a relevant policy area.</p> <p>A unit in the GOS, known as the Futures Team, is dedicated to strategic foresight, offering in-depth scientific advice to government agencies as well as developing and disseminating foresight resources aimed at policy-makers, such as the recently published Trend Deck (GOS, 2021) for possible use in scenario development or stress-testing.</p> <p>Whilst the GOS is responsible for coordinating and promoting efforts to implement long-term thinking in the policy process, the British government has introduced additional measures to support a wider range of government departments and public bodies in using foresight in their practice. Since February 2020, these entities can use the Futures Procurement Framework to request foresight services, including guidance and support on horizon scanning and scenario exercises as well as capability building, from 27 external suppliers (UK Government, 2020).</p>	
<p>Policy area/sector of application (if relevant). If application is across policy areas, please describe the process</p>	<p>Environment</p>	<p>The Department for Environment, Food & Rural Affairs (DEFRA) is currently stress-testing the environmental targets set out in the UK Government's 25 Year Environment Plan against a range of scenarios (source: interview). As part of its long-term strategy, DEFRA has previously declared to work towards better monitoring and evaluation of the Plan as well as proposing that it should be amended at least every five years following progress reviews (2018).</p>
	<p>Health</p>	<p>In a Foresight report by the GOS on obesity (2007), the robustness of different policy responses is stress-tested against four scenarios, considering a time horizon of 2050.</p>
	<p>Other areas</p>	<p>Strategic foresight approaches, especially horizon scanning and scenario planning, are used in a range of policy areas, including food supply (GOS, 2011), urban development (GOS, 2016), and transport (GOS, 2019b).</p>
<p>Legal basis or requirement for stress-testing policies</p>	<p>Legal basis</p>	<p>The UK Foresight Programme, launched in 1994, promotes and strengthens the use of strategic foresight in government (Parliamentary Office of Science and Technology, 2009). It is currently based in the GOS, which aims to ensure that government policies are informed by scientific evidence and long-term thinking (GOS, n.d. (1)). Historically, the Foresight</p>

		<p>Programme can be traced back to a UK government White Paper from 1993, 'Realising Our Potential: A Strategy for Science, Engineering and Technology' (UK Government, 1993). It set out a series of reforms to enhance the UK's existing strengths in science, engineering, and technology to improve the nation's competitiveness and quality of life. Among the initiatives introduced were a programme to promote technological foresight activities and a new foresight fund (UK Parliament, 2001). At the time of writing, the UK's foresight ecosystem is funded via line-item funding, meaning that resources for foresight units, capacity building and projects are regularly considered as part of a cyclical budget process (SOIF, 2021).</p>
	Legal requirement	There is no legal requirement for policy stress-testing in the UK.
Purpose of stress-testing activities		<p>The GOS emphasises that forward-looking approaches should be used across all government departments to ensure that policy-making is future-proof and leads to the best possible outcomes (GOS, n.d. (2)).</p> <p>Although horizon scanning and scenario planning are more widely applied, policy stress-testing (sometimes referred to as wind tunnelling) is used to assess the performance of specific policy options in the face of scenarios representing different possible futures (GOS, 2016; GOS, 2017). This is mainly done in an ex-post perspective (source: Interviews).</p>
Description of the applied stress-testing activities		<p>The main activities are:</p> <ul style="list-style-type: none"> - Trend analysis and horizon scanning to anticipate how the future may unfold. - The participatory development of scenarios representing different possible futures, which are used to stimulate discussions on what strategic risks and opportunities a policy should address. Different stakeholder types are typically included in this process with the help of workshops and interviews, whilst the GOS also recommends the use of the Delphi method (GOS, 2017). - Regular Foresight studies, coordinated by the GOS in collaboration with individual government departments, present results of scanning activities as well as possible future scenarios in a wide range of policy areas (GOS, 2019c). - Stress-testing of specific policy options against a limited number of scenarios to assess the performance of these options in different possible futures. <p>Individual foresight activities may be conducted in government departments with internal foresight capacities. They are often facilitated by the GOS and its Futures Team.</p>
Actors/entities responsible for stress-testing	Strategy/Future units at government departments	There is no entity primarily responsible for stress-testing in the national policy process. It is more likely to be used as a policy tool in government departments with existing foresight capacities, such as strategy or future units comprising foresight practitioners.
	Government Office for Science	It is the objective of the GOS to ensure that government policies are informed by scientific evidence and long-term thinking. The GOS, therefore, supports stress-testing activities by developing relevant resources, doing capacity building in interested government agencies as well as offering support through the foresight practitioners in the GOS Futures team (source: Interviews).
Stakeholders involved in stress-testing without direct responsibility	External suppliers of foresight services	Government departments and public bodies can use the Futures Procurement Framework (UK Government, 2020) to request foresight services from a range of external suppliers, including universities, non-profit organisations, and consultancies. At the time of writing, it is not clear to what extent it has been used.

Experts and other stakeholders	To get external perspectives on policy-related issues and possible responses, foresight activities in the UK tend to engage a range of different stakeholders. Different projects related to a foresight initiative on the future of UK cities, for instance, involved the use of workshops, interviews or the Delphi method to consult urban development experts, researchers from academia, city/local governments, and local businesses (GOS, 2016).
The public	The public has been consulted for a range of foresight initiatives with the help of different approaches. These include events, such as public round table meetings where experts discuss relevant policy issues with the public (GOS, 2014), as well as drawing competitions aimed at schoolchildren (GOS, 2016).

Organisation and structure of stress-testing

The figure to the right illustrates the steps involved in policy stress-testing in the UK. The individual activities may be conducted exclusively by foresight practitioners in government departments, in collaboration with the GOS or with support from external suppliers of foresight services.



Types of shocks and time horizons considered

For the purpose of policy stress-testing, both emerging trends and high-impact, low-probability events are considered. The nature of shocks considered varies across stress-testing activities and policy areas (source: Interviews).

Different time horizons are considered depending on the policy area in focus. Horizon scanning activities typically look 10-20 years ahead, but sometimes, shorter time horizons are considered, for example, when trying to anticipate the impacts of technological developments.

Longer time horizons are considered in some foresight projects coordinated by the GOS, e.g., 2050 in studies on the future of the sea (GOS, 2018b) and obesity (GOS, 2007) or 2065 in a foresight study on the ageing UK population (GOS, 2019a).

Methods used

Scenario development	A common method to develop scenarios is the 2x2 matrix approach, where four scenarios are developed with the help of two axes of uncertainty. They represent two trends that are anticipated to have a high impact on a given policy area, and which are characterised by a high level of future uncertainty (they could possibly take opposite future trajectories) (GOS, 2017). Stress-testing in the UK usually involves the use of scenarios based on horizon scanning and trend analysis. Scenarios for stress-testing tend to be developed by foresight experts, for example from the GOS, together with external experts (see for example GOS, 2019a & 2019b).
Wind tunnelling	Different approaches are used to test how policy options perform in a range of specified scenarios. A common method is to assess to what extent individual policy objectives are met in the set of different futures considered in the stress-testing exercise.

Additional methods and tools (if any) used to complement stress-testing activities

Horizon scanning	Horizon scanning is a technique for identifying strategic issues that will be of importance in the future. It is employed in UK foresight initiatives to gather insights about emerging trends and events shaping the future (GOS, 2017). The GOS has produced a range of studies using horizon scanning to
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		explore alternative futures of different policy areas. Likewise, the Parliamentary Office of Science and Technology has regularly published policy briefs based on the outcomes of horizon scans (POST, 2021).
	Trend Deck	The GOS Trend Deck (2021) presents 118 trends in 10 different sectors. Each trend is briefly described and documented with statistical data on relevant historical developments, which allows for trend projections.
Results and impact of stress-testing activities on final policies	Limited uptake	Foresight projects are typically championed by individual government departments and coordinated by the GOS. They usually provide detailed foresight insights on long-term risks and opportunities to be addressed by policy-makers, for example in the form of reports and policy briefs. However, findings from the literature review and the interviews conducted for this study show that there is limited uptake of these findings by policy-makers. Stress-testing is often done on an ad-hoc basis and with limited resources in an ex-post manner (source: Interviews).
Challenges and trade-offs related to stress-testing		<ul style="list-style-type: none"> - Some of the interviewed experts underline that stress-testing may be of little value when exclusively conducted at the end of the policy process to assess robustness against a limited selection of possible futures. Situations change and evolve, even after stress-testing, which is why there is a need for continuously reviewing policies to enhance their robustness and resilience. - Interviewees also point out that the development of detailed scenarios based on evidence requires time and resources. There may be a limited window of opportunity for stress-testing in the policy process, making delays in scenario development especially problematic. - Last but not least, one policy advisor emphasises that stress-testing activities may lead to more robust policies, whilst not necessarily resulting in the most desirable ones. There may be competing priorities among decision-makers in terms of a willingness to take risks. According to the interviewee, some decision-makers prefer policies with basic performance across most scenarios, whilst others favour those performing best in a limited set of scenarios (source: Interviews).

Organisations interviewed

Government Office for Science (GOS), Futures Team

Department for Environment, Food and Rural Affairs (DEFRA)

Department of Health and Social Care

Natural England

School of International Futures (SOIF)

Appendix 2: Future wheels

All of the following six future wheels were developed and designed by the research team.

Legislation: The proposed AI Act

HILP-scenario: *Large-scale cyber attack*



- Social dimension
- Technological dimension
- Economic dimension
- Environmental dimension
- Political dimension
- Values dimension

Legislation: The proposed AI Act

HILP-scenario: Europe (and the world) flooded



- Social dimension
- Technological dimension
- Economic dimension
- Environmental dimension
- Political dimension
- Values dimension

Legislation: Information and consultation of workers

HILP-scenario: *Prolonged drought and wildfires in the Mediterranean*



- Social dimension
- Technological dimension
- Economic dimension
- Environmental dimension
- Political dimension
- Values dimension

Appendix 3: Stress-test – impact tables

Future Wheel 1: Large Scale Cyber Attack – EU AI Act Proposal

Primary Effects:

Effect	Provision AI Act Proposal	Argument
Irrevocable loss of data in all sectors	<p>High-risk AI systems:</p> <p><u>Article 10: data governance requirements for training, testing and validation data</u></p> <p><u>Article 11</u> requires ongoing technical documentation to show that AI system complies with AI Act requirements</p> <p><u>Article 12</u> requires automatic logging during the operation of high-risk AI systems to allow for monitoring</p> <p>Article 14: human oversight for high- risk AI systems</p> <p><u>Article 15:</u> robustness, accuracy, and cybersecurity requirements for high-risk AI systems.</p> <p><u>Article 17</u> requires quality management programmes in place, e.g., systems and procedures for record keeping of all relevant documentation and information</p> <p>Article 18: obligation to draw up technical documentation</p> <p>Article 20: obligation to keep automatically generated logs by high-risk AI systems</p> <p><u>Article 27</u> requires distributors to either ensure that AI systems comply with AI Act Chapter 2 requirements or withdraw them from the market</p> <p><u>Article 29:</u> also, users of high-risk AI systems need to keep the logs automatically generated by AI system</p> <p><u>Article 42: High-risk AI systems certified under cybersecurity scheme under Regulation 2019/881 shall be presumed in compliance with Article 15</u></p> <p><u>Articles 19, 43, 48,49:</u> Conformity assessment and declarations of conformity of a high-risk AI system</p> <p><u>Article 50:</u> document retention: technical documentation and quality management system documentation, as well as any documents by notified bodies need to be kept for 10 years</p> <p><u>Article 51 and 60:</u> register/database of high-risk AI systems</p> <p><u>Article 61:</u> post-market monitoring system ' shall actively and systematically collect, document and analyse relevant data provided by users or collected through other sources on</p>	<p>In this HILP, we assume that all cybersecurity systems established according to Article 15 or with a certification envisaged under Article 42 have failed due to the high and unprecedented sophistication of the cyberattack.</p> <p>The entire AI Act is based on a lot of constant monitoring, documenting, and storing data about the performance of high-risk AI systems (irrespective of whether they are data-heavy machine learning techniques or other forms of AI).</p> <p>Providers and distributors of high-risk AI need to keep ongoing documentation about how the system complies with the AI Act requirements (e.g., that high-quality training data is used), keep logs of the activity of the systems etc.</p> <p>Users also need to keep the logs generated by the AI system</p> <p>In addition, high-risk AI systems need to go through a conformity assessment by an independent body before they are marketed, and the data from this procedure needs to be kept and stored.</p> <p>Lastly, there will be a register of all accredited/certified high-risk AI systems</p> <p>--- if data in all sectors is lost, AI providers, distributors and users would no longer conform to the requirements of the AI act, as they would have lost all the data that they are required to keep.</p> <p>The same might be true for the public authorities and independent bodies that need to certify and monitor high-risk AI systems.</p> <p>The same would then also be true for the register.</p> <p>If all this data were lost, basically the whole monitoring and documenting system that forms one of the core logics of the AI Act to protect fundamental rights, public health and safety would be lost. There are also no explicit requirements that documentation needs to be kept in a paper trail or a disconnected digital data storage.</p> <p>There is no provision for what would happen if the whole system collapsed. Would all high-risk AI systems need to be retrained from scratch? Or would we take the risk of allowing the</p>

	<p>the performance of high-risk AI systems throughout their lifetime, and allow the provider to evaluate the continuous compliance of AI systems with the requirements set out in Title III, Chapter 2.'</p> <p>Article 65: ex-post procedure dealing with AI systems that present a risk at national level</p> <p>Articles 73 and 74: exercise of delegation by EU Commission and committee procedure</p>	<p>operation of high-risk AI systems whose data history has been lost?</p> <p>Possible solution: flexibility through delegation. The Commission would have the power through various provision in the AI Act to adopt delegated acts that could specify this, but it would need to justify on a cost-benefit basis why increased safety would be necessary.</p>
Increased awareness of specific vulnerabilities to cyber-attacks	<p>High-risk AI systems:</p> <p><u>Article 9</u>: risk management system needs to be put in place, requires identification of 'known and foreseeable risks associated with AI system'</p> <p><u>Article 11 (4)</u>: ' High-risk AI systems shall be resilient as regards attempts by unauthorised third parties to alter their use or performance by exploiting the system vulnerabilities. The technical solutions aimed at ensuring the cybersecurity of high-risk AI systems shall be appropriate to the relevant circumstances and the risks.'</p>	<p>After such large-scale cyber-attack all providers of high-risk AI systems would likely be forced to increase their cybersecurity systems. As new risks would become known, the provisions of the AI Act make sure that providers need to improve their cybersecurity measures.</p>
Not connected facilities manage better than those connected		<p>As above, the fact that not connected facilities manage better could be an argument for requiring cold/offline data storages or decentralized storage etc. by the EU Commission in delegated acts</p>
Consumers unable to use crucial digital services (e.g., IoT devices)		<p>There are no provisions in the AI Act that would guarantee that consumers are able to access AI systems, i.e., there is no service guarantee. Whether it would be desirable to include a service guarantee in such exceptional circumstances is questionable, though, as the safety of the AI systems after a large scale cyberattack could be questioned.⁸⁸</p>

Secondary Effects

Effect	Provision AI Act Proposal	Argument
Limited access to cloud data disrupts businesses and supply chains		This is something that the AI act does not address, but would normally be handled through contract law
Technology providers required to share digital evidence	<u>Article 64</u> : access to data and documentation by market surveillance authorities	Under the AI act, market surveillance authorities should be granted full access to training, validation and testing datasets, including APIs ⁸⁹ and other tools that enable remote access – if data in all sectors is permanently lost, high-risk AI system providers

⁸⁸ The European Consumer Organisation has argued that the AI Act should be concerned much more than it currently is with the users of AI systems.

⁸⁹ API stands for application programming interfaces, which is a piece of software that enables two applications to communicate with each other.

		<p>could no longer provide this kind of evidence.</p> <p>Increased risk of malfunctioning high-risk AI systems after the cyber-attack might increase monitoring activity by authorities – this is made possible under Article 64</p>
Widespread scepticism regarding the safety of digital products and services	<u>Article 53-55</u> : regulatory sandboxes for AI systems	<p>One of the main goals of the AI act is to foster innovation in the area of AI. One of the tools to do so is the setting up of sandboxes where AI systems can be tested without excessive regulatory burdens before they are allowed on the market. If there is widespread scepticism regarding the safety of digital products and services, all sandboxes might be terminated, having a negative impact on innovation.</p> <p>The AI Act does not contain any provisions on grounds to terminate sandboxes, or on grounds go keep them alive, this seems to be left to Member States' competent authorities.</p>
Intensified surveillance	<u>Article 5</u> : prohibited AI practices	<p>After the large cyber-attack authorities might want to use AI tools for surveillance – those would need to meet the requirements of the AI act and could potentially constrain authorities in as far as they can use surveillance. The result is double-edged: while fundamental rights would be safeguarded from excessive infringement by public authorities, the sources of massive cyberattacks might not be detected.</p> <p>Furthermore, such surveillance systems would either be classified as prohibited (if social scoring-like, or using real-time biometric data), or high-risk. While high-risk would be allowed, the systems would first need to be certified, thus delaying their implementation and thus the detection of sources of cyberattacks.</p> <p>The only exception is the use of AI systems for military purposes, which would be an available 'flexibility' in the unlikely event that the cyberattack is declared an act of war, and EU Member States would use AI systems for espionage purposes in response.</p>
Increased emphasis on cyber security and growing demand for IT skills	See considerations regarding primary effect 'Increased awareness of specific vulnerabilities to cyber-attacks' above.	

Tertiary Effects

Effect	Provision AI Act Proposal	Argument
Increased efforts to secure power plants, oil pipelines, etc.	Annex III point 2 specifies that 'AI systems intended to be used as safety components in the management and operation of road traffic and the supply of water, gas, heating and electricity' are considered high-risk AI systems	It would be necessary to verify whether the current obligations imposed on high-risk AI systems are sufficient to secure power plants, oil pipelines and so forth. Again, the Commission could likely specify requirements in implementing acts. Alternatively, this could be addressed under the proposed NIS2 Directive
Focus on decentralizing systems	See discussion above on 'irrevocable loss of data in all sectors'	

Future Wheel 2: The Great Tide: A New Planet – EU AI Act Proposal

Primary Effects:

Effect	Provision AI Act Proposal	Argument
Crucial infrastructure damaged or destroyed	See the case of irrevocable loss of data in all sectors in Future Wheel 1	With crucial infrastructure destroyed, there would likely also be a damage/destruction of servers that store data, and the same consequences as described in future wheel 1. Solutions could require servers that are stored on satellites or that are waterproof/floating, something that, at least in theory, could be required by the EU Commission through delegated acts. This would prepare for a case of a great tide in the long run but would increase the cost of AI significantly in the EU, thus harming the EU's competitiveness in the field.
Civil liberties are limited due to state of emergency	Article 5: prohibited AI systems	Article 5 (2) gives flexibility to restrict civil liberties through otherwise prohibited AI systems in law enforcement if the situation giving rise to the possible use, in particular due to the level of harm caused, and the consequences of using an AI system on the rights and freedoms of all persons concerned are considered and balanced against each other.

Secondary Effects

Effect	Provision AI Act Proposal	Argument
Increasing price of land in elevated areas	<u>Article 25 and 26</u> : require third-country providers of AI systems to appoint an authorized representative or an importer	If there is less land available in the EU there might be fewer persons that could be eligible as representatives or importers, which could increase the prices of importing AI systems into the EU significantly. There is no provision in the AI Act that would cover situations where third-country providers can appoint neither an importer nor a representative.

Tertiary Effects

Effect	Provision AI Act Proposal	Argument
Innovation and growth in sectors that are in demand	<u>Article 53-55</u> : regulatory sandboxes for AI systems	Regulatory sandboxes could help with development of AI in sectors that are in demand after the great tide

Future Wheel 3: Prolonged Drought and Wildfires in the Mediterranean – EU Directives on Worker Information

Secondary Effects

Effect	Directives	Germany	Italy	Argument
Workplaces in agriculture and tourism are lost	<p>Directive 98/59: 30-day period and obligation to consult with workers' representatives in case of mass-redundancies. Not applicable to SMEs</p>	<p>§17 Kündigungs-schutzgesetz - 30-day period, does not apply to companies with less than 20 employees</p>	<p>Art. 4 Legge 223/1991 Provides for a 45-day period unless the number of workers made redundant is less than 10, then it will be a 23-day period. Does not apply to companies with less than 15 employees</p>	<p>EU agriculture is dominated by family farms (they employ 81.4% of regular agricultural labour force)⁹⁰ – to most the Directives would not apply. This means that most agricultural workers in Mediterranean region would not be covered by the Directive. The same is true for tourism: most accommodation establishments in the EU are SMEs⁹¹.</p> <p>While the EU Directives allow for higher protection measures for workers, neither the German nor Italian implementing legislation apply to Micro- and Small enterprises. In this case only the Italian implementation would matter, as German employees would likely not be affected.</p> <p>As a result, there would be inequalities between agricultural and tourism workers of the few large cooperation in comparison with the very high number of employees of SMEs that would have no protection through information or consultation.</p>
	<p>Directive 2001/23 Applies in case of company transfers, i.e., transactions that involve a change in the entity responsible for a (part of a) business. Employees assigned to transfer are transferred</p>	<p>§613a German Civil Code German law goes further than the rights provided by the Directive. Also pension rights are transferred to new employer. Reps do not have to be consulted, but employees</p>	<p>Article 2112 Italian Civil Code Also, in Italy pension rights are transferred to the new employer, conditions might be adjusted. If any dismissals are necessary due to e.g., restructuring, the transferee must state this</p>	<p>The failing agricultural and tourism companies could be bought up – but given that the territory could no longer be used for these activities, there might be few acquisitions that are not connected to bankruptcies – in which case, e.g., in Italy, the guarantees for workers would not be applicable unless the parties (companies, i.e., the company undergoing insolvency proceedings and future buyer) to the transactions agree to it.</p>

⁹⁰ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agriculture_statistics_-_family_farming_in_the_EU#Structural_profile_of_farms_-_analysis_for_the_EU.

⁹¹ <https://www.e-unwto.org/doi/pdf/10.18111/9789284419470>.

	<p>automatically and based on their existing employment conditions, <u>except for pension schemes</u>. The transaction may not constitute the sole ground for dismissal, but dismissals for economic, technical, or organizational reasons are allowed. Workers must be informed, and reps consulted before the transfer.</p>	<p>must receive detailed information at least 1 month ahead of the transfer, so that the employee can exercise his or her 1-month objection right.</p> <p>The safeguards also apply in insolvency proceedings in case of the continuation of the employment relationship, but not regarding other claims as e.g., to pension benefits</p>	<p>information in the notification to the reps/trade unions/works councils</p> <p>Information must be provided to worker reps 25 days before entering into sale agreement if the transferring company has more than 15 employees</p> <p>Article 2112 only applies during insolvency proceedings if the two companies agree to it.</p>	<p>This is a situation that the Directive explicitly allows for, but it is not clear whether this would be a desirable outcome. The Directive does not foresee situations of mass bankruptcies.</p>
	<p>Directive 2002/14</p> <p>minimum consultation and information duties on employers regarding economic, financial, and strategic developments; structure and foreseeable development of employment and related measures; decisions likely to lead to substantial changes in work organization or contractual relations</p> <p>Does not apply to the public sector or SMEs</p>	<p>German law was considered compliant with the Directive. Most rules are enshrined in the Betriebs-verfassungs-gesetz. Information and consultation rules apply to any undertaking. A workers' council (Betriebsrat) that represents workers can be formed by any company with a minimum of 5 employees with full voting rights - i.e., SMEs can be covered under German law</p>	<p>Italian law implemented Directive 2002/14 in Decreto Legislativo 25/2007 -</p> <p>It only applies to companies with more than 50 employees</p>	<p>As above, the fact that many companies in the agricultural and tourism sector are SMEs would mean that in the example jurisdiction of Italy, which has Mediterranean shores, the general consultation and information duties of workers granted by the Directive would not apply, as Italy has chosen to apply these only to companies with more than 50 employees.</p>
<p>Affected economies suffer a downturn</p>	<p>As above</p>	<p>As above</p>	<p>As above</p>	<p>We could likely expect knock-on effects on other sectors in the Mediterranean economy. If larger companies with higher numbers of employees would be hit by the downturn, consultation, and information duties, as well as the employment relationship guarantees of Directive 2001/23 would apply. The question might be whether in a complete situation of crisis these duties, notification periods and so forth would be useless and unnecessarily costly. In this case, however, the EU Directives leave a lot of flexibility</p>

				to Member States in their implementation (e.g., it is possible to provide shorter notice periods in national law) - while the national laws implementing the Directive do not have emergency clauses or the like, general principles of law would probably allow for shortening down notice periods at national law in cases of crisis. In any case, the right balance would need to be found under national law.
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Future Wheel 4: Global Economic Crisis – EU Directives on Worker Information

Primary effects

Effect	Directives	Germany	Italy	Argument
Loss of personal income and social benefits	Directive 2001/23 in the case of a transfer of undertakings, the Directive precludes, in principle, that private pension and other insurance schemes will be transferred to the new employer, but allows Member States to diverge from this rule	§613a German Civil Code In Germany employee's private pension and other insurance schemes are transferred as a liability to the new employer in case of transfer. The exception to this rule are acquisitions in the course of a bankruptcy proceeding	Article 2112 Italian Civil Code As in Germany, employees' private pension and other insurance schemes are transferred as a liability to the new employer in case of transfer, unless the transfer occurs in the process of bankruptcy proceedings. In case of bankruptcy proceedings, the parties will need to agree whether private pension schemes and other insurances are transferred to the new undertaking	At least the workers that are employed by a failing company that is acquired, could have their private benefit schemes maintained as long as the transfer does not occur in the context of a bankruptcy procedure. This would allow for maintaining at least some of the social benefits and income of some workers. If the goal were to involve the private sector more in covering the social costs of crises, it could be worth to reflect if it would be a good idea to remove the pension exception from Directive 2001/23 given that several Member States already have chosen to include pension guarantees in their implementing legislation. On the other hand, this would create an additional burden on companies in times of crises. A thorough balancing exercise would be necessary to decide on the best solution.
Business activities slow down	as under 'affected economies suffer downturn' under Future Wheel 3	as under 'affected economies suffer downturn' under Future Wheel 3	as under 'affected economies suffer downturn' under Future Wheel 3	Same argument as under 'affected economies suffer downturn' under Future Wheel 3

Tertiary effects

Effect	Directives	Germany	Italy	Argument
Economies recovering well acquire insolvent companies abroad	See explanations on Directive 2001/23 under effect 'affected economies suffer downturn' under Future Wheel 3	See explanations on §613a German Civil Code under effect 'affected economies suffer downturn' under Future Wheel 3	See explanations on Article 2112 Italian Civil Code under effect 'affected economies suffer downturn' under Future Wheel 3	In the case that economies that are recovering well acquire insolvent companies abroad, the current Directive would not necessarily require to guarantee the jobs of the acquired firm. If the economies/sectors in the EU are recovering at different pace, however, it might be justified to place the burden of job guarantees on acquiring undertakings, as this could remedy the negative economic and social impact on workers from the global economic crisis. Again, this would require a balancing exercise, as guaranteeing jobs might disincentivize company acquisitions in the first place.

Future wheel 5: New pro-war US president – EU State aid law

Primary effects

Effect	Relevant State aid provisions	Argument
US and EU divert more funds for military purposes	Article 346 (1) (b) TFEU: '...any Member State may take such measures as it considers necessary for the protection of the essential interests of its security which are connected with the production of or trade in arms, munitions and war material; such measures shall not adversely affect the conditions of competition in the internal market regarding products which are not intended for specifically military purposes'	As long as EU Member States divert more public funds to military purposes exclusively (like the production of arms, munition, and war material) State aid rules do not apply. This exception, however, has to be interpreted strictly (See e.g., Court of Justice Case C-284/05 <i>Commission v Finland</i> , and C-246/12 <i>Ellinika Nafpigeia AE</i>). As soon as the funds would also benefit non-military activities, the State aid prohibition under Article 107 TFEU would apply and the EU Commission could step in.

Secondary effects

Effect	Relevant State aid provisions	Argument
Resources for innovation diverted to cyberwarfare and security	State aid rules in the EU are currently undergoing a reform in the framework of the State Aid Modernization (SAM) plan and a revision of the General Block Exemption Regulation (Commission Regulation (EU) No 651/2014, 'GBER'). ⁹² The EU Commission has proposed in particular to reform the rules on risk finance aid for SMEs and R&D&I activities to make the award for these kinds of aids easier for Member States. Current State aid rules for SMEs: Under the GBER two types of aid to SMEs are exempted from prior authorization by the EU Commission: Aid to SMEs and aid for access to finance for SMEs Aid to SMEs can be given without prior notification for a maximum of (Article 4 GBER). - Investment aid: EUR 7,5 million per undertaking per investment project - conditions further specified in Article 17	While the Treaties consider State aid in principle illegal unless justified under paragraphs (2) and (3) of Article 107 TFEU, the EU Commission is increasingly considering State aid as a part or instrument for achieving EU policy priorities. If Member States revert all their resources for military purposes, this will also negatively affect the achievement of other EU priorities. The diversion of funds towards cyberwarfare and security could likely also affect SMEs detrimentally. In the overall EU State aid framework, in particular in the GBER, aid to SMEs is a form of aid that is considered not to be harmful to the internal market, if the requirements of the GBER are upheld. With fewer funds left in the state pockets' SMEs would likely also receive less support, even though they are an important driver of jobs and innovation in Europe. There is no positive obligation of granting State aid (the default is that State aid is illegal), however, so State aid rules cannot provide a solution to

⁹² press release: https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5027 ; consultation website with relevant documents: https://ec.europa.eu/competition-policy/public-consultations/2021-gber_en.

	<ul style="list-style-type: none"> - Aid for consultancy in favour of SMEs: EUR 2 million per undertaking, per project – further specified in Article 18 - Aid for SMEs participating in fairs: EUR 2 million per undertaking, per year -further specified in Article 19 - Aid for SMEs for cooperation costs incurred by participating in European Territorial Cooperation projects EUR 2 million per undertaking per project - further specified in Article 20 - Innovation aid for SMEs: EUR 5 million per undertaking per project - Risk finance aid to SMEs of a maximum of EUR 15 million per eligible undertaking (Article 21) <p>Aid needs to be given in a transparent manner (Article 5) and needs to have an incentive effect, by materially increasing the scope of a project/activity due to the aid, leading to a speedier completion, or materially increasing the total amount spent by the beneficiary on the activity. Aid for access to finance for SMEs is considered to have an incentive effect (Article 6). Member States need to report and monitor on aid granted under the GBER framework (Article 11 and Article 12)</p>	<p>this. Other EU policy areas would need to be leveraged, like the establishment of Eu funds (similar to the EU Recovery Fund agreed to in July 2020 to remedy the economic losses caused by the pandemic).</p>
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Tertiary effects

Effect	Relevant State aid provisions	Argument
Environmental protection is under-prioritized	As under 'Resources for innovation diverted to cyberwarfare and security', the reform under the SAM also plans to align State aid measures with the EU Green Deal policies. To this extent the conditions for environmental and energy aid are to be revised to incentivize the giving of aid in these sectors.	As under 'Resources for innovation diverted to cyberwarfare and security', there are no tools under EU State aid law to commit Member States to give aid for certain policy objectives.

Economic downturns at national and international level	<p>Article 107 (2) and (3) TFEU both allow for giving of State aid to 'make good the damage caused by... exceptional occurrences' (Article 107 (2) (b)) and 'aid... to remedy a serious disturbance in the economy of a Member State' (Article 107 (3)).</p> <p>The GBER sets out circumstances in which the Commission considers that aid fulfils Article 107 (3) TFEU, for example when it comes to giving aid to SMEs (see above)</p>	<p>As during the global financial crisis or during Covid 19, giving of aid would likely be facilitated by the EU Commission, also through the setting up of Temporary Frameworks in which the Commission specifies which type of aid will be considered legal. In the temporary frameworks, players that are especially vulnerable during severe economic downturns, like SMEs, can benefit from additional criteria making the giving of aid to these players easier in a temporary framework (this was the case during Covid 19).</p>
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Future wheel 6: Outburst of the black economy – EU State aid law

Primary effects

Effect	Relevant State aid provisions	Argument
Upheaval of the traditional financial systems	<p>Article 107 (3) TFEU on categories of aid that may be considered compatible with the internal market:</p> <p>'aid... to remedy a serious disturbance in the economy of a Member State'</p> <p>At the same time the Bank Recovery and Resolution Directive (BRRD) 2014/59 provides an additional framework for dealing with struggling banks. State aid and the BRRD framework can apply jointly.</p> <p>Regarding SMEs: financial intermediaries are key to granting risk finance aid to SMEs (see Article 21 GBER)</p>	<p>If aid was necessary to stabilize the banking system, the EU Commission could, similar to its approach in the global financial crisis, draw up a temporary framework with the conditions to grant aid to failing banks.</p> <p>The combined experience under the BRRD and the State aid framework should have equipped the Member States and Commission already with extensive crisis-management experience.</p> <p>A destabilization of the traditional financial system could make it more difficult for SMEs to obtain risk finance aid under the conditions of the GBER, since financial intermediaries are key in delivering the aid to SMEs. The shaking of the financial system might thus have a negative impact on operating the State aid schemes designed to benefit SMEs (there are also other areas under the GBER that rely on financial intermediaries to distribute aid that would be negatively affected by instability in the traditional financial system).</p>
Sharp rise in financial fraud and tax evasion		<p>See arguments under 'Resources for innovation diverted to cyberwarfare and security' of future wheel 5. Even though the State aid framework might be one instrument to pursue overall EU priorities, if Member States decide not to give aid, or cannot give aid due to a sharp decline in tax revenues, the EU</p>

		<p>State aid framework can no longer be supportive of EU priorities.</p> <p>There are, of course, synergies here with other EU initiatives addressing corruption and financial crime, including under the programme 'An Economy that works for People' and the Anti-Money Laundering Legislative Package (AMLD 6 just having been proposed)⁹³</p>
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Secondary effects

Effect	Relevant State aid provisions	Argument
Organised crime infiltrating political processes	<p>Article 108 (3) TFEU: ' The Commission shall be informed, in sufficient time to enable it to submit its comments, of any plans to grant or alter aid. If it considers that any such plan is not compatible with the internal market having regard to Article 107, it shall without delay initiate the procedure provided for in paragraph 2'</p> <p>Article 108 (2): ' if, after giving notice to the parties concerned to submit their comments, the Commission finds that aid granted by a State or through State resources is not compatible with the internal market having regard to Article 107, or that such aid is being misused, it shall decide that the State concerned shall abolish or alter such aid within a period of time to be determined by the Commission.'</p> <p>Article 16 State Aid Procedural Regulation (Regulation 2015/1589) stipulates the rules for recovering unlawful or misused aid:</p> <p>' Where negative decisions are taken in cases of unlawful aid, the Commission shall decide that the Member State concerned shall take all necessary measures to recover the aid from the beneficiary ('recovery decision'). The Commission shall not require recovery of the aid if this would be contrary to a general principle of Union law.'</p>	<p>Organised crime infiltrating political processes could lead to State aid being given illegally or fraudulently.</p> <p>While the EU Commission has the power to declare State aid as unlawful or misused, and it can require the Member States to recover State aid from the recipients as countermeasure, the Commission is still fully reliant on the Member State's administrative and legal system for State aid recovery to work. If the rule of law is already failing in the Member State, State aid recovery would likely not take place. This is a long-standing loophole in EU State aid law.</p>
Decreasing legal certainty	As above	As above

⁹³ Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the mechanisms to be put in place by the Member States for the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and repealing Directive (EU) 2015/849 available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0423>.

Tertiary effects

Effect	Relevant State aid provisions	Argument
Rise in corruption	As under ' Organised crime infiltrating political processes'	As under ' Organised crime infiltrating political processes'

Policy-makers are seeking to 'future proof' policies in order to be better prepared for disruptive and unanticipated events. The application of foresight methods such as stress-testing can help achieve this goal. This study introduces a methodology for the European Parliament to stress-test legislation. The method can be integrated into existing law-making and scrutiny processes in the European Parliament. It draws on lessons learnt and recommendations stemming from independent research that encompassed a comprehensive review of reports and research studies, and in-depth research on four countries (Finland, the Netherlands, New Zealand and the United Kingdom), as well as a pilot-test for three policy areas (robotics and artificial intelligence, information and consultation of workers, and competition policy – State aid).

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