Guidelines for foresight-based policy analysis

STUDY

Panel for the Future of Science and Technology

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Policy analysis examines problems calling for a policy response and then proceeds to determine and assess possible courses for policy action (policy options). For complex problems or controversial issues, evidence-based policy options might not always be socially acceptable. Thus, policy analysis could gain from a foresight-based approach, which helps investigate the issue holistically and assess considered evidence-based policy options against societal concerns. Consequently, foresight-based policy analysis could be more widely and frequently used by policy-makers.

As a system of holistic and future-oriented thinking, foresight is a way of undertaking policy analysis, including in relation to the introduction or promotion of new technologies, in a context of complexity and controversy. It adds to the quality and usability of the policy briefings by ensuring that one systematically considers the views of all relevant societal actors and analyses the possible consequences of policy options.

Foresight goes beyond scientific and academic evidence, and assesses the policy options alongside the concerns of societal actors. This is especially important in a parliamentary setting, as it enables analysts to consider stakeholder views and geographical concerns/differences when assessing policy options.

This manual establishes a methodology and key considerations for a foresight process and foresight-informed policy analysis. It offers a conceptual clarification of foresight and foresight-based policy analysis, helps enhance the transparency of foresight processes and the quality of policy analyses, offers four general guidelines for conducting trustworthy policy analysis, and, finally, provides a practical framework with six basic components for foresight-based policy analysis.

This manual's overall purpose is to improve the quality of policy analyses and assessments by furnishing a solid foresight-based methodology and to strengthen Parliament's trust in these activities by making the foresight process and the resulting policy assessments transparent.

AUTHOR

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Foreword

In order to prepare future-proof policies on today's complex policy matters, the European Parliament needs insights and understanding of the evidence behind these issues.

Today, many science- and technology-related (S&T) issues, such as 5G technology, climate change and genome editing, are shrouded in controversy. Therefore, STOA is putting a growing emphasis on investigating the interactions between technological developments (for instance, the applications of artificial intelligence or genome editing), policy and society. The increasing rate of technological and other developments demands that the European Parliament be prepared for the future.

Since 2015, the Panel for the Future of Science and Technology (STOA) has adopted foresight practices for studies of science and technology-related policy issues that are complicated and/or have a controversial nature. This applies particularly to areas where clear-cut policy options are difficult to formulate or the controversial nature of the issue can hinder the acceptance of policies. This 'scientific foresight' approach broadens the traditional technology assessment (TA) practices by adding an emphasis on possible societal impacts of the policy options considered at the European Parliament.

After six years of practice, we are consolidating our methods. This is a good time to share our methodologies for two principal reasons. First, with this manual, STOA aims to make the scientific foresight process more transparent. Second, the manual may be of interest beyond STOA. Many other parliamentary and policy advisory bodies are investigating foresight approaches to improve policy analysis in increasingly contested and controversial contexts. Therefore, we consider this a good occasion to share our best practices with the wider policy and policy advisory community.

We hope it will be useful for everyone dealing with scientific evidence for policy and for working in the science-policy ecosystem.

This is the first edition of this manual. If it proves useful for foresighters in the area of new technologies, feedback can be integrated in future versions and hopefully the manual can thus become a reference point for foresight methodology.

Eva Kaili

STOA Chair

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1. Introduction

Adhering to a set of harmonised methods and approaches to policy analysis will increase the transparency, trustworthiness and quality of the supporting analyses prepared for the European Parliament. Such a set can be used for all kinds of studies and concerns:

- exploring the received requests or initiatives in a systematic manner;
- designing the extent and depth of a policy briefing or study;
- preparing policy briefings, including assessments of the interactions between technological or other developments and relevant stakeholders in society (for instance, those affecting the technologies as well as those affected by the applications of these technologies).

Overall, this manual aims to integrate a systemic-thinking capacity, as well as foresight capacity, into the policy analysts' work. It contributes to preparing the Parliament for a wide range of possible future developments – geopolitical, or scientific and technological.

The manual is structured as follows: it starts with an introduction summarising the purpose of policy analysts' work and their role within the European Parliament. Next, it explains the concepts of foresight, technology assessment (TA), and scientific foresight. This is followed by practical guidelines for conducting trustworthy foresight-based policy analysis, as well as general tips for policy analysis at the Parliament, and by extension, useful for policy advisers in other parliamentary or government settings.

This manual recommends four general guidelines for enhancing trustworthiness in policy analysis work:

(1) Analyse the system and draw the ecosystem to see the bigger picture;
(2) Explore and challenge possible biases (others' and yours);
(3) Explore the issue from all angles (STEEPED wheel);
(4) Analyse and assess possible cross-policy impacts.

The guidelines developed here focus on how to treat a request, which includes ways to:

- analyse the ecosystem of a policy issue;
- elaborate on the possible interactions of technological applications with society;
- assess the possible impacts of alternative policy options.

The manual suggests six practical phases to be considered when analysing a policy problem:

(1) Topic: a policy issue
    a. Ecosystem
    b. Evidence (analysis and assessment)
    c. Societal context
    d. Final briefing or study
    e. Communication to the Parliament

Further reading on foresight, relevant to our work in the European Parliament's administration, is listed in Appendix 1.

2. Policy advising at the European Parliament

The main responsibility of policy analysts within the Secretariat of the European Parliament is to help Members of the European Parliament (MEPs) obtain valuable insights that can support their reflections on policy issues. Their tasks include the following:

- Providing the European Parliament with objective and reliable information about ongoing developments (such as technological and geopolitical issues) and their interaction with broader society;
- Informing debates in the European Parliament on these ongoing developments and helping its Members and committees with policy-making;
- Offering the European Parliament, in the context of a given issue, a set of evidence-based policy options assessed from a wide range of angles based on the potential short- and long-term impacts of their application.

2.1. Instruments and output

While it is the role of elected officials to make and defend their choices for policy action, the task of European Parliament administrators is to:

- Assess the current technical, legislative and societal context of a development that has resulted in policy concerns;
- Outline possible alternative policy options for consideration;
- Describe the possible consequences of these options, particularly for the societal actors concerned (including civil society organisations, non-governmental organisations (NGOs), industries and services).

Their work is aimed at helping Members understand the evidence and possible future developments of the technologies and other topics with which they are dealing. Moreover, they should contribute to the understanding of possible courses for policy action by assessing their possible consequences.

The main outputs of European Parliament studies are supporting policy analysis, including policy briefings. The latter are papers that list possible courses for policy action, assessing possible impacts, including impact on society, all types of intended and unintended impacts and perverse effects on other policies. They should be used to strengthen the Parliament's preparedness for possible future developments, i.e. its anticipative power to deal with possible futures. In general, the policy analysts' work should inform the debate within the Parliament. Therefore, policy briefings have to list and explain multiple policy options while also analysing their potential disadvantages and benefits. Supporting studies and policy briefings should provide Members with a balanced and easily understandable summary of the potential outcomes of possible policy options.

2.2. Policy analysts as 'honest brokers'

It is accepted as best practice that scientific advisers should be what Roger Pielke calls 'honest brokers' in *The Honest Broker: Making Sense of Science in Policy and Politics* (Pielke 2007): '[t]he honest broker of policy alternatives seeks to integrate scientific knowledge with stakeholder concerns in the form of alternative possible courses of action'. Scientific advisers should be as impartial as possible when assessing scientific evidence and societal context, and formulating policy options based on them.

An honest broker approach includes evidence-based policy options and the assessment of possible tensions that policy choices can create with those involved (i.e. citizens and other stakeholders). This helps policy-makers choose wisely from the available policy options. Such an approach requires impartiality on the part of the policy analyst regarding policy questions. Specifically, appropriate advice on policy problems should reflect the range of opinions in the academic and scientific communities as well as the interests of the stakeholders.

2.3. Criteria for effective, trustworthy and high-quality analysis

It is important that some basic standards guide policy analysts' work. This helps newcomers at the various European Parliament research services, such as the Policy Departments and the European Parliamentary Research Service, including STOA. In addition, such standards make the output of the analyses more understandable for everyone involved in the process, including the Members.

These standards could be designed by benchmarking the methods used to the quality criteria of other organisations which advise policy-makers on S&T issues. The criteria and guidelines for effective and trustworthy scientific policy advising listed below are the most important ones expressed in the Organisation for Economic Co-operation and Development (OECD) report on Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists (2015) and in *The Politics of Scientific Advice: Institutional Design for Quality Assurance* by Lentsch and Weingart (2011). Policy advice should:

- Have a clear remit, with defined roles and responsibilities for the various actors.
- Involve the relevant actors, including scientists, policy-makers and other stakeholders, as necessary.
- Involve different disciplines in the advisory process to ensure a plurality of perspectives.
- Maintain distance between the advisers and advised in order to safeguard the independence of the former.
- Establish trust by maintaining transparent procedures.
- Ensure public access to all relevant information.

3. Foresight

Before going into further detail on foresight practices, this section briefly explains what foresight means.

3.1. What is foresight?

> Foresight is the analytical process of exploring what may happen in the future in order to prepare for it. It is not about predicting the future, but about minimising surprises.

Although interest in the future has been present for centuries, foresight presents a rather new and fascinating analytical approach. In *A Brief History of Futures*, Wendy Schultz (2015) presents an overview of the development of futures thinking and futures studies.

Foresight is an interdisciplinary branch extending across the boundaries of management, economics, social sciences and technology. It is also referred to as futures studies, futures research or futurology. Sometimes, a foresight practitioner is also called a futurist.

Accurate translations of the word 'foresight' emphasise the exploration of possible futures as opposed to forecasting. Forecasting is often based on modelling, i.e. predicting the future based on what one knows from the past and the present. Foresight, on the other hand, investigates what may happen in the future. It considers several options and is not limited to what is likely to happen. Importantly, foresight also identifies what actions can be taken and describes the scenarios to which diverse actions lead.

3.2. Foresight as a method of enhancing preparedness

Foresight is valuable for analysing developments in areas that are complex, include a high degree of uncertainty or could lead to controversy in society.

Foresight-guided thinking facilitates careful and critical reflection about the future and possible future developments. It aims to better prepare people for the future. It should be carried out in a manner that is sufficiently open-minded, interdisciplinary and participatory (i.e. representing an adequate set of stakeholders) and follows a multi-perspective approach. If done in this way, it can help policy-makers anticipate possible future developments and circumvent unforeseen negative outcomes, by anticipating them. Methods to do so include the use of 'What if…' questions and the 'Futures Wheel', which is a way of organising thinking and questioning about the future as explained in detail in Chapter 6 of this manual.

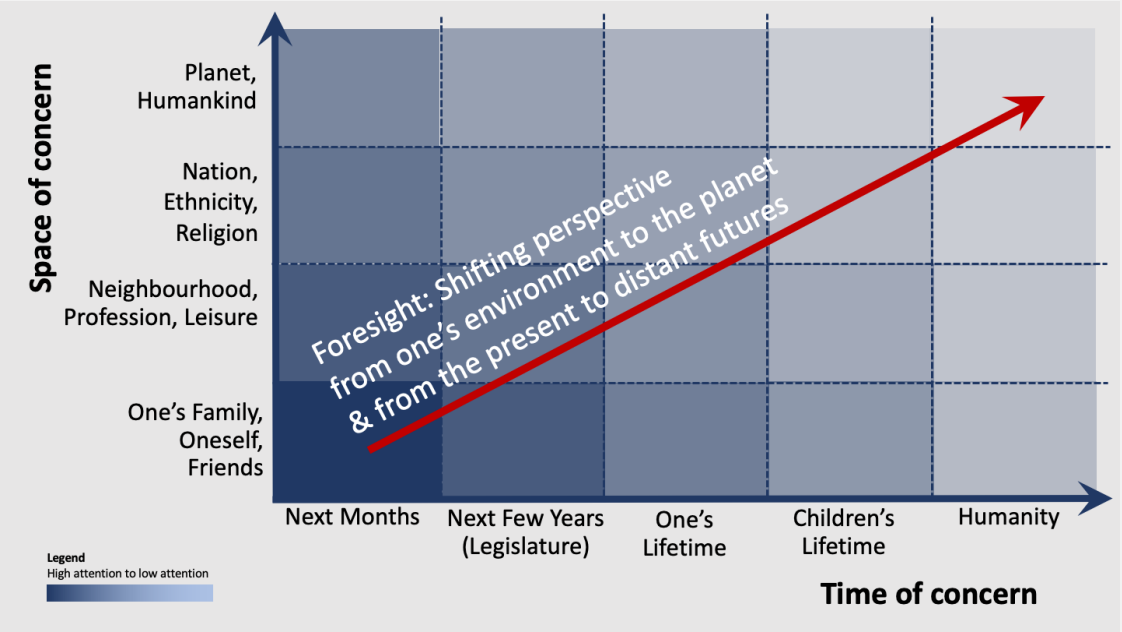
Strategic foresight is a framework for identifying and evaluating future possibilities and determining the best course of action. It serves as an input to strategic planning, not an alternative; it helps uncover opportunities and threats that traditional processes might miss. Foresight uses a range of methodologies, such as scanning the horizon for emerging changes, analysing megatrends and developing multiple scenarios to reveal and discuss useful ideas about the future.

Foresight-based policy analysis, with 'scientific foresight' being one specific type, involves exploring hypothetical future scenarios to support today's decisions for the future. Scenario work is especially useful when analysing complicated and/or controversial issues.

Foresight to stretch' attention in space and time

According to The Limits to Growth*, a report prepared for the Club of Rome's project on the predicament of mankind (published in 1973), people focus primarily on the short-term consequences of events and elements in their vicinity. Brainstorming on 'what if' questions in foresight meetings draws the participants' attention to a broader range of possible effects in larger environments and to longer time frames. By incorporating the participants' broadened perspectives into the assessment of technological impacts, advisers' scientific advice can become considerably more future-proof.

Figure 1 – Foresight shifting our concerns to larger times and spaces



* H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens III, *The limits to growth*, Potomac Associates, 1972.

3.3. Foresight at the European Parliament

3.3.1. ESPAS, the European Union institutions' strategic foresight network

The European Strategy and Policy Analysis System (ESPAS),[1] is an interinstitutional collaboration between officials working with the European Commission, the European Parliament, the Council of the European Union (EU), and the European External Action Service, with the support of the Committee of the Regions and of the European Economic and Social Committee, which monitors global trends and offers strategic foresight to the EU's decision-makers. The system was initiated by the European Parliament to help promote a serious conversation about where the world is heading over the medium to long term. An ESPAS Conference takes place every autumn to discuss EU challenges and choices, based on strategic foresight and global trends research.

3.3.2. Foresight at the Secretariat of the European Parliament

Within the European Parliament, foresight activities are embedded within the Directorate-General for Parliamentary Research Services (EPRS) of the Secretariat of the European Parliament. These include strategic foresight and scientific foresight.

[1] European Strategy and Policy Analysis System.

Strategic foresight

The Strategic Foresight and Capabilities Unit supports the European Parliament by helping foster a culture of 'anticipatory governance' and promoting thinking on and understanding of medium- and long-term trends, challenges and choices. It ensures that the European Parliament is well informed and prepared for the challenges of the coming decades by generating and coordinating analytical work on the risks, vulnerabilities, capabilities, opportunities and gaps where the EU could act with a view to promoting a higher degree of resilience and strategic autonomy. It promotes active participation in ESPAS – the process of EU interinstitutional, administrative-level cooperation on strategic foresight and long-term-trends – and reaches out to think tanks, academic bodies and other external partners in these fields.

Scientific foresight

The Scientific Foresight (STOA) Unit analyses the implications and options for future policy-making in the fields of science and technology. It commissions and publishes independent, cross-disciplinary studies on important issues in these areas; organises workshops with experts, stakeholders and research bodies; and participates in relevant external scientific events. STOA[2] activities are overseen by the Panel for the Future of Science and Technology, the STOA Panel. This is composed of 27 Members of the European Parliament, nominated by 11 parliamentary committees.

[2] Panel for the Future of Science and Technology (STOA).

4. Technology assessment and scientific foresight

Different topics may require different approaches. Technology assessment (TA) traditionally focuses on the state of a technology and its expected developments and impacts on society. A foresight approach is recommended when dealing with uncertain or controversial issues, where various actors in society may have concerns or fears – including some perceived by others as irrational. In contrast to the past, controversies surround many policy areas where science is relevant, such as genetically modified food, vaccination, climate change, nuclear energy or the evolution of artificial intelligence (AI). Controversial issues easily lead to polarisation; therefore, the scientific evidence and policy options derived from TA should be carefully assessed, based on the concerns expressed by all segments of society. This is where foresight helps prepare the policy briefings to better inform the readers on possible elements that they can keep in mind when making a decision.

This chapter briefly describes TA and scientific foresight, which are the main instruments used to conduct S&T-related activities. Further, this chapter describes some tools and purposes of foresight, such as horizon scanning and scenario work; it dives into different types of impact that may be considered; lastly, it describes how assessing possible cross-policy impacts might guide in stress-testing policy options:

> Technology assessment (TA) is the study and assessment of the effects of new technology on society. Scientific foresight is a foresight-based policy analysis, studying and assessing the effects of new technology on society, with an emphasis on preparedness for what may happen in the future, even when unlikely to occur.

4.1. Technology assessment versus scientific foresight

4.1.1. Technology assessment (TA)

Technology assessment (TA) refers to the study and assessment of the effects of new technologies on society, providing insight into the state of the technology, its expected developments and the impact its expected future applications would have on society. A significantly older tradition than scientific foresight; TA originally involved providing policy-makers with policy alternatives for solving problems in the development and use of technology. However, the world is coping with fast-paced new technological developments today, which considerably impact our daily lives. Many of the recent and upcoming applications of technology, such as the digitalisation of public administration, do not provide citizens with the choice to use a technology or not. As a consequence, the societal impact of the ongoing technological revolution is much higher than it ever was in the past.

4.1.2. Scientific foresight

Scientific foresight and TA are both inherently evidence-based, though they place different emphasis on how we investigate stakeholders' concerns. Scientific foresight adds to the analysis of the scientific evidence, providing insights on possible societal concerns; to gain such insights, one needs to collect information on society's hopes and fears about possible future developments, such as new applications of technology which might be quite disruptive (i.e. AI or genome editing). This makes it possible to describe evidence-based policy options in the broader societal context, expanding on possible developments that can cause concern for societal stakeholders. In sum, in a certain way, scientific foresight bridges the possible gap between science and policy by putting evidence-based policy options in a broader societal context, including societal acceptance, or reluctance, regarding the introduction of new applications of technology.

Scientific foresight goes beyond the assumptions made by the experts involved in the study of the state of technology, challenging evidence-based assumptions by interacting with people from different backgrounds (i.e. representing different disciplines as well as multiple stakeholders). This is especially relevant for issues which give rise to controversy with and within society.

A foresight approach can help balance evidence-based policy options with societal acceptance. It can, therefore, be crucial for policy-makers when making policy decisions.

4.1.3. Stakeholder engagement in mapping controversy

As stated, in a context of uncertainty, complexity or controversy, science may not always provide clear-cut answers for policy questions, as science is not the only relevant aspect. Solutions for bridging this gap should take additional elements into account, such as social acceptance. Such information could complement the evidence resulting from science so that policy-makers gain insight into the bigger picture, in which the evidence is balanced with societal concerns. To bridge this gap between science and policy, guidelines for stakeholder interaction exist.[3]

Stakeholder engagement forms part of foresight practices, as applied by the Scientific Foresight Unit (STOA) context since 2015. It constitutes a specific form of stakeholder interaction and can be conducted in various ways.

A stakeholder can be any person or group who has an interest on the issue and/or who stands to gain or lose from a possible course of policy action (a policy option). Stakeholder engagement may be defined as the activity of involving and communicating with actors who are potentially interested in, or affected by, a policy issue. Engagement can happen in different phases of a policy analysis. One way is to incorporate it at the outset of a study, in the design phase. Within the STOA activities, STOA might decide at the outset of a scientific foresight project, to organise a workshop to get a clear picture of what is at stake for different stakeholders in society. Such engagement can help design a study, in a way, including the identified societal concerns. A second method of stakeholder engagement is in the form of a foresight workshop, assessing evidence-based policy options or a set of diverse scenarios, which could be drawn using the analysis of the evidence regarding a certain policy issue. Such conversations aim to formulate arguments that arise expressed by diverse actors in society, in favour of or against certain policy options, and to acquire insights in societal concerns, including expressed beliefs, opinions, hopes and fears, regarding the science-based facts. The outcomes, as lists of arguments in favour of or against options, or concerns regarding certain development, are then used to assess the evidence-based policy options, with regard to the broad societal context.

Especially when assessing policy options regarding controversial issues (such as climate change, genome editing, 5G or nuclear waste), engaging a broad range of stakeholders is vital to ensure that policy advisers have the most complete view of the scientific evidence as well as of the societal concerns.

[3] D. Slunge, O. Drakenberg, A. Ekbom et al., Stakeholder Interaction in Research Processes – a Guide for Researchers and Research Groups, University of Gothenburg, Gothenburg, 2017.

4.1.4. Interdisciplinarity: A key trait in foresight exploration

Histories of the future

Among the many disciplines that contribute to foresight exploration, an innovative way of adding depth to foresight studies is to include a historical dimension. Three axes are particularly relevant for this contribution:

1. **Memory**: Adopting a historical perspective on a given topic enables policy analysts to work towards a kind of 'institutional' memory. This may be particularly relevant in the context of European institutions, where staff rotation is relatively regular. If such a memory can be established, it may enable analysts to learn from previous experience and build on past lessons.

> **Example:** STOA has learned from past confusion with scenario work including assumptions which were perceived as confusing or unrealistic by some of the participants. There is a distinct risk that assumptions are misunderstood as forthcoming policy choices for the European Parliament. In addition, if the technical details of a scenario are inaccurate or not clear, this hinders fruitful engagement with the scenario. By remembering the lessons of the Cyber-Physical Systems* study, STOA could successfully avoid these pitfalls in the study on Precision Agriculture.**

2. Understanding: While they may have their own specificities, many of the problems the European Parliament deals with, and in particular those that new technologies are meant to address, have a prior history. A historical perspective may be helpful for understanding the root causes of contemporary controversies, dilemmas and problems. Specifically, this can be useful in technology and policy assessments in order to decide whether a given technology/policy addresses the causes or merely the symptoms of a problem. Moreover, understanding the history of a controversy can provide insights into the reasons for societal acceptance or rejection of policies and technologies.

> *Example:* Contemporary societal scepticism towards the promises of Novel Genomic Techniques can partly be explained with reference to previously made promises of benefits of older technologies used in Genetically Modified Organisms. Knowledge of this history may help addressing the sources of societal scepticism.

3. Analysis: A historical perspective may underline the historical developments/contexts that shape our imagination, biases and methodologies. Here, academic disciplines such as intellectual history and history of political thought may prove particularly relevant for shedding light on the historical contingencies that influence our thinking. In this way, by making these historical and methodological 'biases' explicit, policy analysis can be rendered more solid and well-rounded.

> *Example:* Over the past twenty years, the idea that globalisation has accelerated and become a dominant phenomenon affecting politics in heretofore unknown depths has become almost a commonplace. This narrative has, for instance, informed early analyses of the electoral success of Donald Trump or Brexit, which presented these phenomena as reactions against the forces of globalisation. Historical approaches can show that the claims of the narratives of unprecedented globalisation in the 1990s are difficult to substantiate empirically: many aspects of what are frequently considered decisive proof for this narrative (e.g. increase in global trade and international organisations) can already be found at work to a similar extend in the 19th century.

* Ethical aspects of cyber-physical systems, Scientific Foresight Unit, EPRS, European Parliament, 2016.

** Precision agriculture in Europe, Scientific Foresight Unit, EPRS, European Parliament, 2016

Another way to avoid a lack of connection between evidence and policy is to ensure that the overall analysis is conducted in an interdisciplinary way. First of all, including appraisal and assessment of evidence from multiple disciplines helps broadening the analysis to the wider society. For instance, when examining a topic related to decarbonisation, various analyses could be combined, including those by energy experts, economists, environment and sustainability experts, behavioural scientists and so on. After obtaining interdisciplinary reviews of the collection of analyses, a final consolidated

report will provide a holistic view and be more useful for policy-makers to draw upon for well-informed and balanced decisions.

4.1.5. Examples of scientific foresight studies

The first main STOA foresight study, 'The ethics of cyber-physical systems (the 'robotics study'),[4] was also STOA's and the European Parliament's pilot scientific foresight study: it used a well-defined foresight approach, and its results were extensively used by several of Parliament's committees and contributed to the Parliament's resolution calling on the European Commission to propose rules for robotics and AI.[5] The resolution refers to several concerns discussed during meetings with various societal actors. These comprised liability issues in case of accidents with robots, including those of the owners and the designers. Amongst other impacts of the rise of robots debated during this study, were safety and privacy concerns; the fear of job losses and of deskilling, such as loss of driving skills when getting used to self-driving cars; and opportunities, such as regarding mobility and independence of people with disabilities.

Further examples of foresight studies conducted at STOA:

- Precision agriculture and the future of farming in Europe (2016);
- Assistive technologies for people with disabilities (2018);
- 3D bio-printing for medical and enhancement purposes (2018); and
- The future of crop protection in Europe (2020).

Examples of foresight studies conducted by the Policy Department for Structural and Cohesion Policies for the EP Committee for Culture and Education are:

- Current challenges and future prospects (2019)
- Culture and creative sectors in the European Union – Key future developments, challenges and opportunities (2019)

In addition to in-depth foresight studies, STOA produces a 'what if' series. These are instances of mini-foresight studies, focusing on the imaginable impacts of possible developments and related anticipatory law-making. A typical feature of a 'what if' project is that it reflects on an issue related to S&T from a future perspective. A 'what if', in essence, is meant to raise awareness about what could happen in the future and what may be needed – from a legislative point of view – to deal with it.

[4] Ethical aspects of cyber-physical systems, Scientific Foresight Unit, EPRS, European Parliament, 2016.

[5] European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)) P8_TA(2017)0051.

4.2. Horizon scanning

Horizon scanning is the systematic exploration, acquisition and use of information about events, phenomena and trends, and their mutual relationships. It is a foresight method which aims at obtaining an insight into a macro view of trends. It can be conducted at both macro and micro levels.

The types and purposes of horizon scanning are varied. Horizon scanning may be conducted for strategic purposes. Such scanning activities happen at a very broad level, without necessarily having a specific goal; they could also be carried out with a specific focus on one or more megatrends (e.g., demographic change, emergence of technology, resource scarcity, climate change) or technology trends (e.g., AI, nanotechnology, genetic engineering). Ideally, it is conducted on a continuous basis and is extremely resource-demanding.

Horizon scanning and policy-making

The 'Jon Day report'*, reviewing cross-government horizon scanning for the House of Commons in the UK, describes this type of horizon scanning as: 'A systematic examination of information to identify potential threats, risks, emerging issues and opportunities, beyond the Parliamentary term, allowing for better preparedness and the incorporation of mitigation and exploitation into the policy making process'.

Philip Hines** explains that 'Horizon scanning can inform and influence decision-making, through identifying opportunities and challenges, from an organisational to an international level'.

* Cabinet Office, United Kingdom Government, Review of cross-government horizon scanning, January 2013.

** P. Hines, Y.L. Hiu, R.H. Guy et al, Scanning the horizon: a systematic literature review of methodologies, BMJ Open, 2019.

STOA used Futures Platform[6] to create some horizon scanning reports on broad domains, such as future disruptors and the world after Covid-19.

Another purpose for horizon scanning could be framing a concrete action plan, such as setting detailed priorities within a multi-annual framework. In this case, a one-off or regular repeated horizon scanning might suffice.

In this perspective, STOA conducted a horizon scan on climate change, taking three dimensions into consideration: (1) society and values, (2) nature and Ecosystems, and (3) science and technologies.

Finally, a more focused way of horizon scanning, on a specific topic and at a certain moment in time, may be considered. This is, for instance, quite useful in analysing specific requests for scientific advice (or other policy analysis). Further, such an approach could be extremely helpful in supporting the design of concrete activities, such as STOA projects or events, in a manner which addresses all policy related areas. Using dedicated tools (such as Futures Platform) allows swift exploration of sometimes unfamiliar topics when preparing new studies or preparing publications, such as 'What if we could engineer the planet to help fight climate change?'[7]

To avoid confusion between the various levels on which horizon scanning can be conducted, this document further refers to specific or technical horizon scanning, as scanning of relevant evidence for analysis and assessment, i.e. the appraisal of the evidence.

[6] Futures Platform.

[7] L. Van Woensel with M. Fernández Álvarez, What if we could engineer the planet to help fight climate change?, Scientific Foresight Unit (STOA), European Parliament, February 2021.

Purpose driven horizon scanning

Wendy Schultz, a prominent foresighter,* formulates some tensions regarding horizon scanning activities for foresight work, as well as trade-offs to be made in designing horizon scanning. Horizon scanning is a highly resource-consuming activity. It is therefore important to undertake such scanning activities in a purpose-driven manner. The most efficient method is to combine human scanners with foresight platforms to scan the 'environment'. Horizon scanning conducted by other organisations may also provide valuable input.

Kerstin E. Cuhls differentiates choices between broad (time-consuming) and dense (quick) horizon scanning.

Both experts mention that horizon scanning often omits further sense-making and implementation activities.

Horizon scanning should not be done for its own sake, but should rather be purpose-driven, framed within foresight activities and lead to usable knowledge.

* Dr Wendy L. Schultz

** K. E. Cuhls, Horizon Scanning in Foresight – Why Horizon Scanning is only a part of the game, *Futures and Foresight Science*, 2019.

Examples of horizon scanning reports

Horizon scanning is often used when exploring possible impacts of new technologies. In addition to the above mentioned horizon scanning reports prepared for STOA, other examples of such reports include:

- Future technology for prosperity Horizon scanning by Europe's technology leaders (European Commission, 2019)

- Societal transformation 2018–2037. 100 anticipated radical technologies (Finnish Committee for the Future, Parliament of Finland, 2018)

- Global mega-trends: Scanning the post-coronavirus horizon (Global Trends Unit, European Parliamentary Research Service)

Horizon scanning methods

For scanning the future, it is useful to look for trends (whether in general or in a specific area) and identify drivers of change. The analysis of these trends aims at understanding current and possible future developments and their potential consequences for a range of relevant players in society. This requires having a prior overview of who these players are, as well as the 'ecosystem' of the topic and its possible developments. Such horizon scanning explores possible futures, including future developments that are less plausible. This is important for policy-making, because some unlikely developments or events can have a huge impact on society; therefore, ideally, policies are prepared for such eventualities.

Trends are the observed or expected developments of a technology or phenomena over time. They are defined as developments or changes that can be geopolitical, global or technological. Some specific trends are 'drivers of change'. These developments trigger changes; drivers of change trigger other trends and are usually the basic causes of global challenges.

Drivers of change are therefore closely related to global challenges. A renowned source on global challenges is the annual report published by the World Economic Forum ahead of the Forum's annual meeting in Davos, Switzerland. Based on the work of the Global Risk Network,[8] the report describes changes occurring in the global risk landscape from year to year.

4.3. Scenario planning and analysis

Scenario exercises are amongst the most common tools in strategic foresight. They are most useful for policy-making on controversial and complex topics. Scenarios are descriptions of how things may happen in the future or stories about possible futures. They are stories about the future. Asking 'what

[8] The Global Risks Report 2020, World Economic Forum.

if' questions is a useful technique for scenario thinking, which can guide foresight brainstorming activity for exploring possible futures.

Scenario thinking includes connecting possible future scenarios with the present. The present and possible future scenarios are linked by a certain 'pathway'. Describing these pathways often requires working backwards – starting from a possible future scenario and discovering how to get there. This is also referred to as 'backcasting'. At the European Parliament, backcasting activities look into the ways the current legislation fits these possible futures. Such backcasting can lead to various types of conclusions:

- Current legislation might be adequate for a possible future.
- Current legislation might have to be adapted to suit a possible evolution in the future.
- New legislation might be needed to prepare for the new, expected developments.

Such backcasting or stress-testing activity is crucial to ensure the European Parliament's anticipatory fitness and that the Parliament is prepared for what will or may come up.

4.4. Types of impact

Foresight is a methodology for systematically thinking about the future by envisioning a wide range of possible futures, from likely to very unlikely, and mapping paths that are likely to lead to or away from them.

Foresight analysis investigates the possible impacts of trends, which can have several natures. Three types of impacts are addressed below:

- desirable or undesirable impacts,
- intended or unintended; and
- hard or soft impacts.

4.4.1. Desirable and undesirable futures

The level of 'desirability' of a possible event is a subjective issue. What is desirable and undesirable depends on the perspective from which events are considered. For instance, coronavirus-related confinement measures may be desirable for virologists as they help fight the coronavirus crisis, but undesirable for many citizens because of how they affect social life.

Despite this, it is important not to focus on the desirable scenarios alone, but also on those that are undesirable to prepare for the future. In the context of policy foresight, considering the possible undesirable impacts of certain developments can alert policy-makers to what may happen, helping to prevent crises.

4.4.2. Intended and unintended impacts

We are all familiar with the side effects of medicinal drugs, i.e. the unintended consequences associated with their usage. However, these are not always negative; for instance, aspirin, originally used as a pain and fever reliever, is also an anticoagulant that can help prevent heart attacks and reduce the severity of thrombotic strokes and the damage they produce. Nonetheless, a measure can sometimes lead to adverse effects; an example is the drastic reduction of electricity consumption in lighting systems via the introduction of LED lights. This was expected to reduce the energy usage per household; however, because of the substantially lower electricity consumption, more lighting is often installed, potentially reversing the expected benefits.

4.4.3. Hard and soft impacts

Soft impacts are especially relevant to analyses related to scientific or technological developments. Scientific or technological foresight investigates both technical risks, on which technology

developers and regulators tend to focus, and social and ethical risks, which typically concern philosophers of technology and the public.[9] As Swierstra and Molder explain, typical hard impacts pose risks to safety, health and the environment. For instance, something may potentially explode or be poisonous. However, technologies do much more than perform their functions; they also shape the way we live, we experience the world, and what we value. For instance, smartphones push us to rethink certain norms: how we use them politely in the presence of others and how we handle the desire to check them constantly and the pressure of always being reachable. These are soft impacts. Another example that illustrates a soft adverse impact is that of the reduction of tar in cigarettes. Since low-tar cigarettes are less harmful (per cigarette), smokers may use this as an excuse to smoke more. Soft impacts are not easy to identify nor to quantify and are not always harmful. Furthermore, it is not always clear who, if anyone, is to blame for them. A technology does not directly cause its soft impacts, as they depend on how it is used.

4.5. Stress-testing of policy options: Assessing possible cross-policy impacts

Before finalising a policy briefing, it is crucial to carefully assess possible policy options on imaginable unintended impacts. By doing so in a systemic way, we can minimise unpleasant surprises, such as the perverse effects of a well-intended policy.

> An example of a policy leading to adverse effects was the EU's biofuel policy[10] within the Europe '20-20-20 strategy'. This biofuel policy stimulated the production of biofuel from plants (i.e. energy crops), aiming at achieving specified targets of blending of biofuels with fossil-based petrol and diesel. This EU energy strategy was related to actions to reduce greenhouse emissions as a response to the Kyoto Protocol in 2007. However, it led to a change in land use, from crops for food to crops for oil and – as a consequence – to volatile food prices that threatened global food security.

The risk of such negative surprises can be reduced by systematically including cross-policy impact assessment exercises for each of the considered policy options. In policy work, this assessment functions as a stress-test and helps policy-makers evaluate the adequacy of present policies by identifying unintended, problematic consequences. Therefore, it may substantially enhance the quality of the Parliament's policy briefings, which summarise the Secretariat's advice to the Members.

4.6. Biases as barriers to open-mindedness

We are all subject to biases, prejudices or preconceptions. Biases can systematically distort our perceptions of facts and affect how we make up our minds, weigh evidence and make assessments. They can mislead and fool us. Bias awareness may help harmonise the way we conduct our policy analyses.

We all have different backgrounds (studies, work experience, origins and interests). To enhance the trustworthiness of our publications, it may be beneficial for us to explore how we approach a topic in the most neutral way.

Let us imagine a hypothetical project on sustainable mobility. Moreover, let us assume that we have different backgrounds/interests. For instance, the following are some hypothetical cases:

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[9] T. Swierstra, H. Te Molder, Risk and soft impacts, *Handbook of Risk Theory*, Springer Netherlands, 2012.

[10] Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport.

- An engineer might immediately connect this to electric cars.
- A robotics expert might immediately connect this to self-driving vehicles.
- A climate expert might focus on car emissions.
- A geographer or economist work might worry about possible increased export of polluting cars to developing countries.
- A health expert might focus on avoiding hazardous emissions.
- Someone else might first try to define what 'sustainable mobility' means, with a possible emphasis on 'mobility' rather than transport.
- A person concerned about the climate might think about public transport combined with bikes.
- A psychologist might think of behavioural measures to encourage sustainable ways of mobility or the use of public transport.
- A philosopher might reflect on mobility and sustainability, and so on.

One of the four guidelines explained in the last chapter of this publication addresses exploring others' and your own biases.

5. Four practical guidelines for trustworthy policy analysis

Before describing how scientific foresight is exercised in practice, this chapter explains the four general guidelines for trustworthy policy analysis, which are highly relevant to the work of the administrators at the European Parliament.

Four guidelines for trustworthy policy analysis:

1. Analyse the system and draw the ecosystem to see the bigger picture.
2. Explore the issue from all angles (STEEPED wheel).
3. Explore possible biases (others' and yours).
4. Analyse and assess possible cross-policy impacts.

5.1. Guideline 1: Analyse the system and draw the ecosystem to see the bigger picture

Before dealing with a policy issue, taking a step back can enable you to see the bigger picture.

At the beginning of a foresight exercise for policy-making, it is important to take a step back to see the bigger picture. This involves exploring the scope of the topic, as well as outlining the ecosystem with all the stakeholders and actors.

Systems analysis is a technique that breaks a system into its component parts to study how those parts function and interrelate to accomplish the system's purpose.

One way to conduct a quick systems exploration is to consider the questions of

- what,
- who,
- why,
- where,
- when, and
- how.

Ideally, this exploration is carried out in a brainstorming session. Brainstorming sessions usually involve a number of colleagues, but it is useful to also invite a representative from the office of the Member who requested the analysis. First, to edit the specifications of a project, we need to understand the topic. For example, let us take a request on 'plastic pollution'. The questions and some of the possible answers are given below:

What is it about? For instance:

- Microplastics, macrodebris, single use plastics;
- Biodegradability of plastics;
- Plastic recycling: Which types are recyclable? How does it happen? How do we trace plastic waste?;
- Who produces plastic waste, how and why?;
- Where is plastic pollution generated and where is its impact felt?

What kinds of plastic pollution can occur? For instance,

- Plastic waste in general;
- Plastic pollution in the ocean;
- Toxins emitted when plastics are incinerated;

- Plastics in the context of biodiversity; for instance, those that end up on animals, those in animals meant for food (such as fish), plastics in drinking water or microplastics in the air we breathe;
- Plastics in products we use in daily life, such as in personal care products, cosmetic products and textiles;
- Endocrine disruption caused by plastics.

Some other questions, such as those that deal with alternatives for plastics, can also be mentioned:

- For which purposes are plastics used and why? How can they be substituted with other materials?
- What are the possible advantages and disadvantages of the alternatives for plastics? For instance, how much energy and which types of resources are used or saved when using glass bottles instead of plastic ones? What are the hygiene compliance requirements when the plastic packaging of fresh food is replaced with alternatives?

Reiterating these questions (what, who, why, where, when and how) can help gain further depth. This not only helps detail the topic in focus, but also produces a rough analysis of the stakeholders, including those involved or possibly affected.

Essentially, this phase helps to get a bigger picture of the policy issue at stake, i.e. its entire ecosystem. The outcome is a description of the topic and its ecosystem. This is an excellent basis on which to return to the requesting Member to discuss how to frame or reframe the study as an unambiguous policy question and how to set it up so that it is useful to the Parliament.

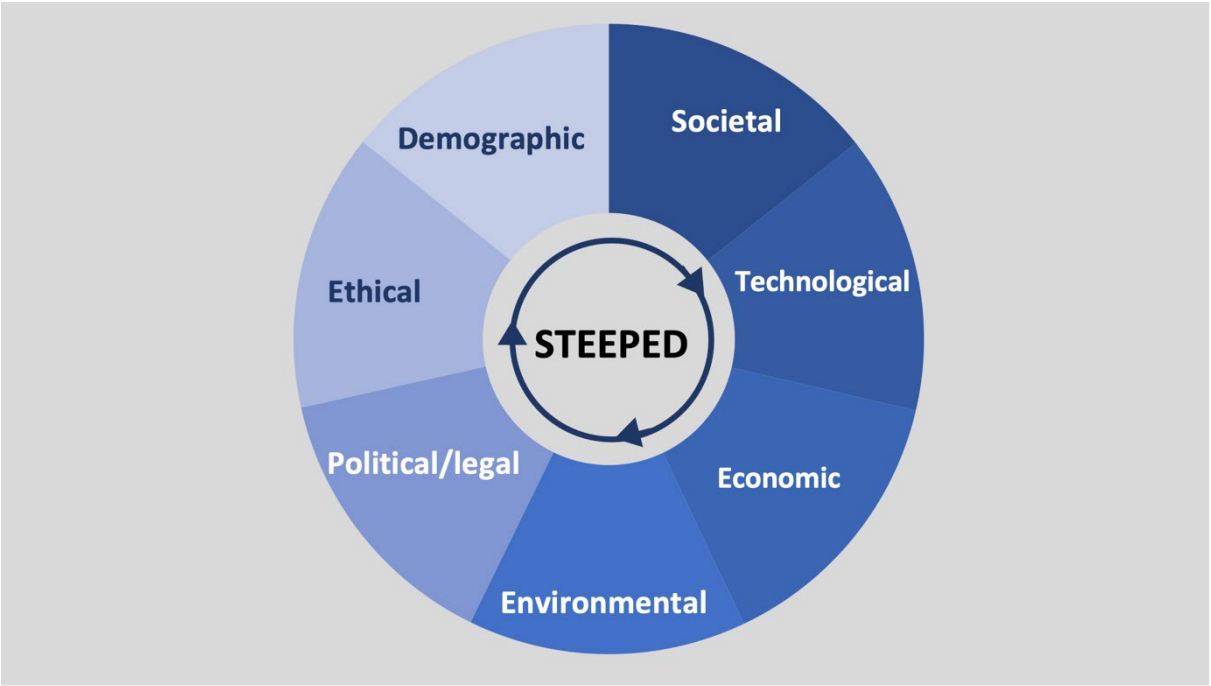
5.2. Guideline 2: Explore the issue from all angles (STEEPED wheel)

By looking at an issue from all angles, we can deepen our insight in the subject of our task.

When conducting foresight exercises as well as TA studies, we apply the STEEPED-approach to obtain insight into policy issues from a wide variety of perspectives. Ideally, this is done using a multi-disciplinary approach (in a discussion with some colleagues) and imagining the viewpoints of various stakeholders. During such an exercise, it is recommended to also concentrate on the possible unintended impacts of a technology and its relations with other topics, i.e. to brainstorm in an open way, thinking beyond initial assumptions.

The STEEPED scheme (Figure 2) is a checklist for exploring a topic. It helps ensure that you do not overlook a perspective and suggests, in a detailed scheme (Figure 3), some questions for consideration. However, it is not meant to be a rigid scheme. It simply specifies seven lenses through which we can examine the impacts of techno-scientific developments, thereby ensuring that all areas of interest or concern are covered. Not all of them are relevant to every topic; however, in general, technological, economic, environmental and ethical aspects are relevant to all S&T-related activities.

Figure 2 – Basic STEEPED scheme



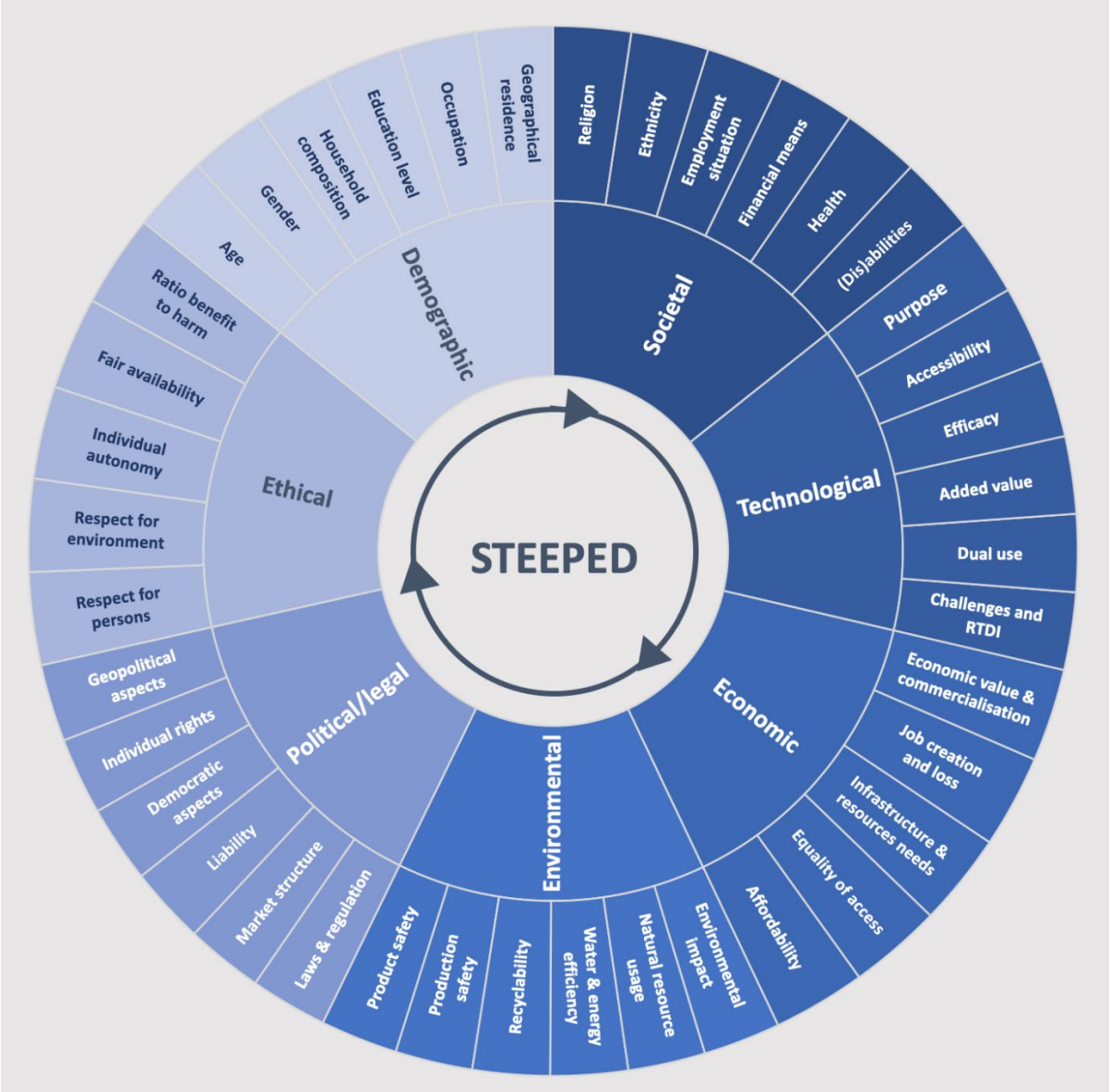
Source: L. Van Woensel, A Bias Radar for Responsible Policy-Making. Foresight-Based Scientific Advice, Palgrave Pivot, (ebook and PDF downloadable from the EP library via SpringerLink), 2020

The seven STEEPED lenses are explained below:

- The **societal** aspects include religion, ethnicity, employment status, financial means, wellbeing, presence of disabilities, and habits.
- Within the societal aspects related to analysing all implications and possible impacts of a particular type of technology. For instance, the introduction of self-driving cars might be highly appreciated by individuals with certain disabilities.
- The **technological** aspects include the purpose of a technology and its application, accessibility, efficacy, added value, dual use, research and innovation, and challenges.
- Within this aspect, one can also check, for instance, possible alternatives that can meet (partly or fully) the same purpose. One concrete example is that a part of the functionalities of 5G can be facilitated by fibre optic cable networks.
- Moreover, the potential for abusing a technology requires careful attention, such as whether it can be used only for its intended purpose or if it has a dual use (such as AI tracing people or their data without their consent).
- The **economic** aspects include jobs (creation and losses), value creation, skills dependency, resource dependency, infrastructure dependency and affordability.
- Within the economic aspects, let us consider the example of a project on hydrogen-fuelled cars. Such a project requires a very specific (not yet available) hydrogen infrastructure, which involves hydrogen fuel production plants, hydrogen pipeline transport, hydrogen stations and even a hydrogen highway consisting of a chain of hydrogen-equipped filling stations and other infrastructure along the road or highway which allow hydrogen vehicles to travel.
- The **environmental** aspects include resource efficiency, energy efficiency, water efficiency, recyclability, sustainability, process safety, and product safety.
- For example, the assessments of digital devices or electric cars show that the batteries commonly used today depend on specific minerals that are available in limited quantities on earth.
- The **political and legal** aspects include liability, competition and market regulations.

- The availability of rare earth materials required for the batteries of electronic devices or electric vehicles can be dependent on geopolitical issues (such as mines in conflict-affected areas in the Democratic Republic of Congo). Moreover, battery production is concentrated in China and can thus be dependent on geopolitical events.
- The **ethical** aspects cover respect for persons, respect for the environment, the availability of justice, collective wellbeing and individual freedom.
- For instance, citizens opt for a technology. You can choose not to eat genetically modified food thanks to proper labelling, but you cannot choose to live in a wifi-free world.
- Other obvious examples are related to AI-driven surveillance issues or AI-based decisions, which can have a vast impact on individuals (for instance, bank loan or job applications, privacy issues related to location and even emotion tracing).
- The **demographic** aspects include age, gender, household status, education level, occupation and place/region.
- Within the demographic aspects, one may consider, as an example, possible applications of genetic engineering for eradicating malaria by addressing the problem of malaria-transmitting mosquitoes. The relevance of the malaria issue differs, depending on whether one lives in a malaria-affected region.

Figure 3 – The STEEPED scheme with all of its areas



Source: Fig 3.4, L. Van Woensel, A Bias Radar for Responsible Policy-Making. Foresight-Based Scientific Advice, Palgrave Pivot, (ebook and PDF downloadable from the EP library via SpringerLink), 2020.[11]

5.3. Guideline 3: Explore possible biases

Understanding possible biases within a study's ecosystem helps harmonise the way we approach the questions posed by the Parliament. Confronting our own biases can help us become more open-minded and transparent

Bias means that opinions, perceptions and beliefs influence our conclusions in prejudiced ways. This influence perceptions of facts and opinions. Thus, biases may interfere with critical thinking and hence the rationality of conclusions and decisions. Some biases may even prevent us from reflecting on new evidence or facts with an open mind. At the same time, it may be impossible to avoid biases altogether, as they are integral to how we process and structure information about the world. For these reasons and to avoid false claims to objectively valid judgements, it is important to confront our biases and make them explicit.

This guideline describes a series of biases and presents these in the form of a 'bias wheel', grouping some commonly occurring biases in a systematic way. For more details on biases, further reading can be found in Appendix 1.

[11] Laminated leaflets with these schemes in high resolution are available on demand: lieve.vanwoensel@ep.europa.eu

Bias awareness is crucial for ensuring the quality and impartiality of our approach. It helps us be more open minded and reflective when dealing with evidence, especially since emotional opinions may

How to conduct a key assumptions check

(Eamonn Noonan, Strategic Foresight and Capabilities Unit, DG EPRS)

A key assumptions check serves the purpose of identifying and interrogating assumptions about a given topic. Care should be taken to encourage an open, non-hierarchical and future-orientated discussion.

Opening: identifying key assumptions

In the opening phase of the discussion, propositions and assumptions to be discussed are identified. This can be done in advance, through correspondence with participants, in order to save time. Each assumption – or sets of assumptions – identified is examined in a three-part discussion.

Part 1: Questions - Interrogating the assumptions

The discussion is structured by questions such as:

- What is the basis for making this assumption?
- Is there broad consensus about its importance for the EU?
- Has its importance grown over time?
- Is there data that confirms or contradicts the assumption?
- Under what circumstances might it be untrue?
- Has it worsened over time?
- Conversely, could it have been true in the past, but is no longer so today?
- If the assumption is invalid, what impact does this have on our analysis?

Part 2: Categorisation - how reasonable or unreasonable is a given assumption?

The group is invited to assign one of three categories to each assumption:

- Solid,
- Correct with some caveats,
- Unsupported or questionable.

Part 3: Key indicators – what information can show if the basis of an assumption is changing?

Groups are invited to identify key indicators:

- What events, developments, or data points give relevant information about individual assumptions?
- What events or developments would support or reinforce this assumption?
- What events or developments would contradict or weaken this assumption?

A summary of key takeaways should be prepared after the discussion. This should avoid attribution of individual comments or positions.

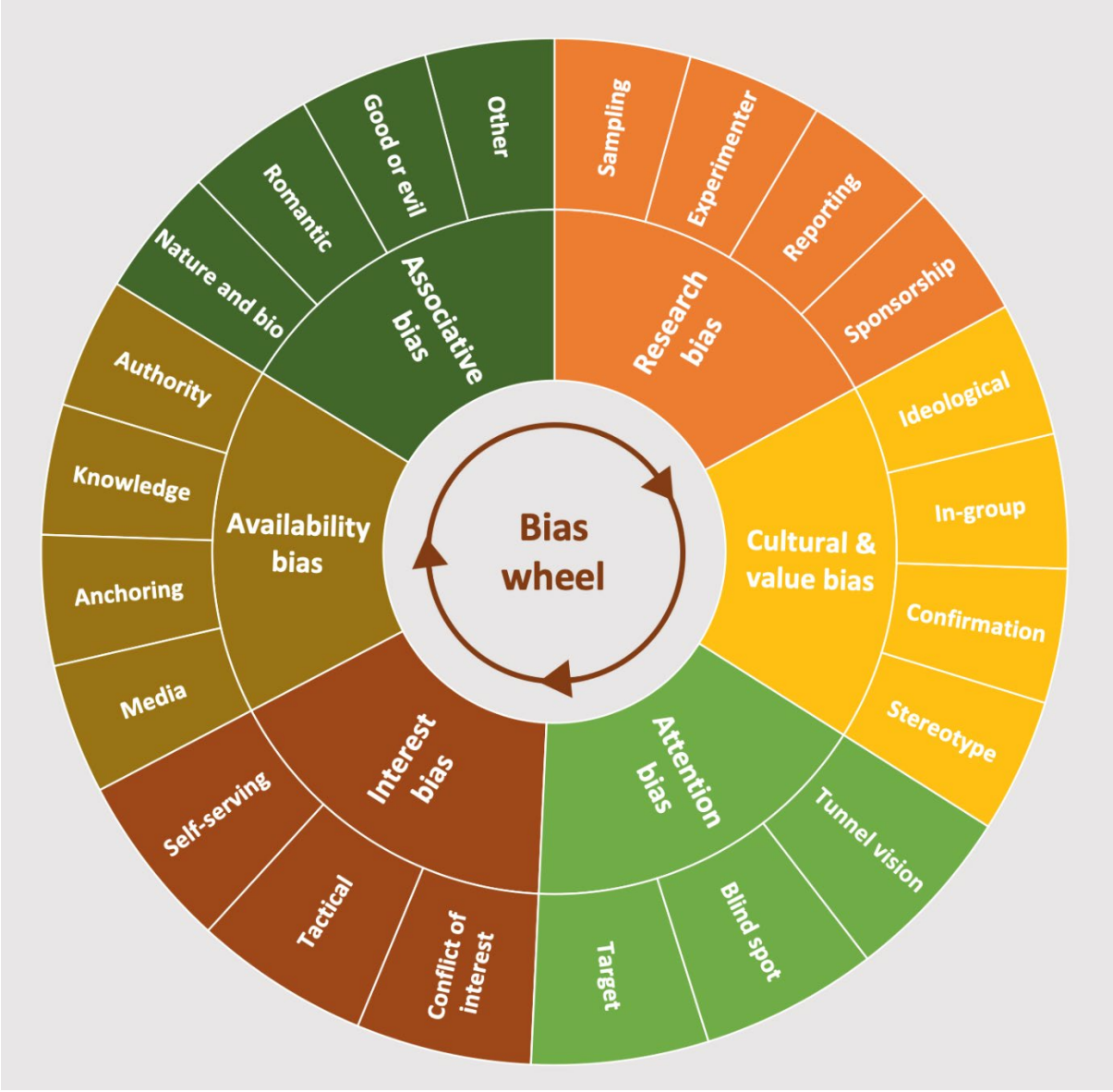
This approach is adapted from a process description in Pherson and Heuer.*

* R. H. Pherson, R. J. Heuer Jr, Structured Analytic Techniques for Intelligence Analysis, *CQ Press*, 2019.

intervene when working on controversial issues such as genetic engineering, nuclear technologies, chemical use or climate change. To imagine the possible biases of the considered stakeholders, exploring their known points of view (such as publicly available statements or opinion papers) can be helpful. Simultaneously, making the biases that inform judgements and analyses explicit increases transparency and trustworthiness.

There are dozens of biases, many of which are relevant to dealing with scientific evidence and policy. The 'bias wheel' is a visual guideline for biases, a practical tool to check one's own and others' thinking, that categorises biases into six sets. The first category is 'research biases' (biases that affect the generation of evidence or influence the availability of evidence). The five other categories are those that affect advisers' and policy-makers' assessments of evidence and the decisions based on them, which are distinguished as 'cultural and value biases', 'attention biases', 'interest biases', 'availability biases' and 'associative biases'.

Figure 4 – The bias wheel, a tool for becoming aware of biases in policy analysts' tasks



Source: Figure 2.1, L. Van Woensel, A Bias Radar for Responsible Policy-Making. Foresight-Based Scientific Advice, Palgrave Pivot, (ebook and PDF downloadable from the EP library via SpringerLink), 2020.

The six sets of biases are explained below:

(1) **Research biases**: affect the generation of evidence or influence the availability of evidence. Research biases can occur during sampling or while producing the research conclusions, and the biases of the scientists performing the research can influence the results. This also includes publication bias.

(2) **Cultural and value biases**: include ideological, in-group, confirmation and stereotype biases. An important example is confirmation bias, which is defined as the tendency to favour or selectively seek information that confirms one's core values, beliefs or hypotheses, while dismissing or selectively ignoring information that contradicts them. Although it is natural to want to confirm one's beliefs and counterintuitively look for evidence that falsifies them, the proper way to overcome confirmation bias is to take evidence that may contradict our opinions and include it in the output.

(3) **Attention biases**: include tunnel vision and blind spots and refers to the tendency to let one's present concerns affect evidence assessment. The blind spot bias can lead to relevant facts or information being overlooked. A simple way to avoid attention bias is to look at the bigger picture, undertaking a simple system analysis (who, what, where, why, when and how) and sketching the overall ecosystem of the issue being investigated. For instance, being convinced that electric cars are the solution for tackling climate change might make you overlook issues related to the materials needed for producing their batteries; focusing on the possible health issues related to 5G might make you blind to the advantages that 5G offers – for instance, in the medical sector. Looking for promising 5G applications might make you blind to the value of alternatives, such as optic fibre networks.

(4) **Interest biases**: These include self-serving biases, biases towards issues one supports, tactical bias, which is the deliberate and selective usage of evidence to defend one's views, and the conflict of interest bias, which arises when one's financial or other interests compromise one's assessment of facts or evidence.

(5) **Availability biases**: These biases limit the evidence to which one has access, pays attention to, or trusts. An important example is knowledge bias, often termed 'the curse of knowledge', which involves considering only the evidence that one understands or falsely assuming that one's interlocutors have the background knowledge needed to understand the evidence that one is presenting. Availability biases involve the tendency to consider examples that come readily to mind, are easily available or more representative than they actually are. Another example is authority bias, which consists of accepting what a trusted authority says, even when they lack the necessary technical background or speak about matters outside their expertise. An example of an availability bias is when people trust the information provided via their preferred social media channel – which are sometimes echo chambers or information cocoons – and do not seek facts or evidence outside the groups to which they belong.

(6) **Associative biases**: occur when associative thinking links otherwise unrelated concepts. For example, emotions can associate concepts, thereby interfering with reflective thinking and activating attention biases (such as tunnel vision and blind spots). Association biases can influence one's assessment of evidence; they include nature bias, which, in turn, includes bio or organic bias. For instance, what is 'natural' can be easily associated with 'good'. Another example of an associative bias is what we could call a 'romantic bias', which may make us ignore overlook evidence of greenhouse gas emissions and particulate matter generation linked to wood-burning hearths in domestic settings.

In sum, biases affect the generation and the availability of evidence, as well as our assessments of facts and evidence and, consequently, the decisions we make based upon them.

Of course, it must also be noted that not all biases should be prevented; some biases, such as ideological biases, are absolutely acceptable. However, advisers and those carrying out foresight preparing policy advice should be particularly and acutely aware of their own, personal biases.

5.4. Guideline 4: Analyse and assess possible cross-policy impacts

Finally, assessing the side-effects of the policy options and their interference with other policies can **prevent adverse effects being overlooked**.

5.4.1. Avoiding nasty surprises

To avoid policy actions that may be regretted, we should conduct a cross-policy impact assessment for each of the identified policy options. This involves identifying the existing policies that each policy option may affect. Earlier in the process, we have

- described the ecosystem of the issue (the elements of the issue as well as the relevant stakeholders);
- collected and synthesised relevant, available evidence;
- explored the variety of opinions and possible biases throughout the ecosystem; and
- investigated possible intended and unintended effects related to the topic.

This is easier to understand with the help of a hypothetical example: Imagine we are investigating a policy issue, such as plastic pollution, with the intent of proposing strong actions regarding the recycling of plastics. Our approach might include reflections on:

- the origins of plastic pollution and how it can be avoided;
- which types of plastics are or are not recyclable;
- scenarios for the selective collection of plastics (even certain types of plastics);
- the technologies of recycling;
- the possible applications of recycled plastics.

The assessments could include reflections on:

- what cannot be recycled;
- the flexibility of the plastics industry and the processes they apply;
- environmental and health impacts of various practices (such as the various steps in the recycling process);
- resources needed during the recycling process (especially water and energy);
- where the actual recycling will take place;
- tracing transported plastic waste, etc.

To explore the wider impacts, we could use 'what if' questions to deepen the analysis of possible future challenges. These 'what if' questions can address very unlikely developments, such as

- What if recycling companies dump or incinerate the plastics, especially in developing countries?
- What if non-recycled plastic waste causes pollution in the recipient country?
- What if plastics were banned in every industry?
- What if plastic waste could be processed so that it would vanish (such as in plastic-processing units running on plastic-eating enzymes and in the areas where they are collected)?

To allow the Parliament to make a well-considered and responsible – in their view – choice, the final policy brief should include a detailed assessment of the selected policy option, including a cross-policy analysis, to avoid undesirable surprises.

First of all, such a cross-policy impact assessment requires that the main policy area of the issue is clear. Then, the possible associated policies are explored. Finally, a systematic analysis of the issue along the Futures Wheel, as well as the potential exploration of 'What if' questions, can help identify any possible consequences that the initial policy may have for related policies.

5.4.2. Scanning for associated policies

For each identified policy option, we should scan the relevant related policies to prevent policy actions that may possibly be regretted. This involves identifying the existing policies that each policy option may affect and analysing the possible impacts.

We can identify potentially related policies by scanning the European Parliament competences that are highly relevant to STOA's work. An overview of these competences is given in Table 1.

Table 1 – European Parliament competences

European Parliament competences	
Agriculture	Home Affairs
Artificial Intelligence	Industry
Budgetary Control	Internal Market
Budgets	International Trade
Civil Liberties	Justice
Constitutional Affairs	Legal Affairs
Consumer Protection	Petitions
Culture	Public Health
Defence	Regional Development
Development	Research
Digital Transformation	Rural Development
Economic Affairs	Security
Education	Social Affairs
Employment	Tax Matters
Energy	Tourism
Environment	Transport
Fisheries	Women's Rights
Food Safety	
Foreign Affairs	
Gender Equality	

For the hypothetical case of plastic pollution, Parliament's services might have received a request from a Member of the Committee on Environment, Public Health and Food Safety (ENVI), working on environmental issues. We can imagine it to be also relevant to:

- public health;
- industry;
- research;
- consumer protection;
- food safety;

and even to:

- fisheries (given the high impact of plastics in the ocean on the fisheries sector);
- employment related to recycling processes (some of the recycling activities are fit for people with disabilities, such as work in sheltered workshops);
- tourism (pollution can have a negative impact on tourism); and
- development (when looking into plastic waste 'export' for recycling, what is the impact on the destination countries' environment?).

5.4.3. Assessing the impact on other policy areas

Once the relevant associated policies have been identified, another STEEPED-based exploration, focused on the imaginable effects of the policy, can add cross-policy impact elements to the assessment of each of the policy measures considered.

The outcome of STEEPED analyses can supply useful information for the assessment of policy options for the final policy briefing.

6. Foresight-based policy analysis in practice

This chapter describes the overall process of a typical foresight project, broken down into practical steps.

Foresight explorations have to meet some basic requirements. They should:

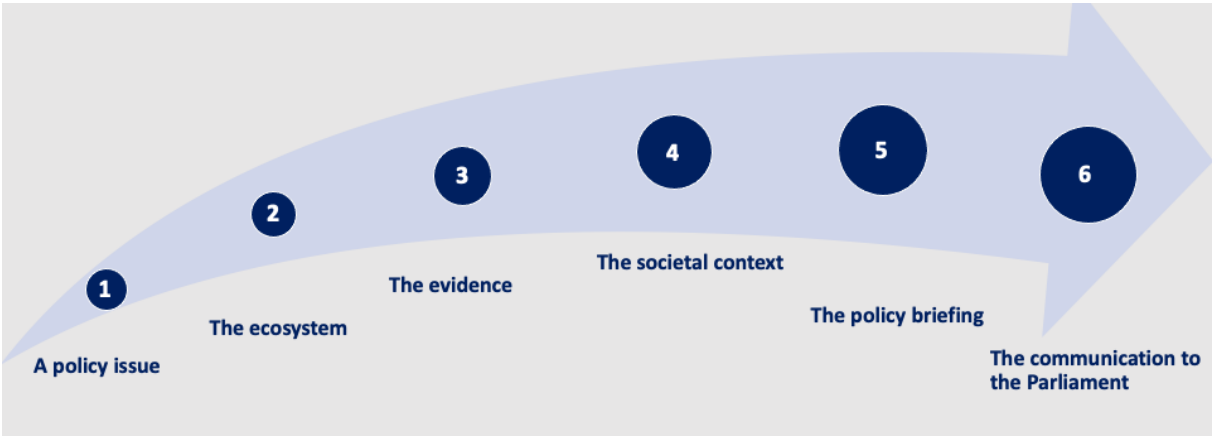
- use systemic 360-degree investigations to be as holistic as possible;
- be interdisciplinary;
- be inclusive and participatory;
- raise awareness of possible biases in the overall ecosystem, including of the foresight practitioners;
- systematically apply a cross-impact analysis for each of the considered courses for policy action.

The first section discusses the assessment and prioritisation of proposals. The next section explains how to look at the bigger picture of the policy issue, i.e. its scope and the relevance of the project to the Parliament, as well as an analysis of the stakeholders. The third section concerns the analysis and assessment of the evidence: i.e. the identification of possible sources, collection of available evidence, synthesis of what has been found and analysis in the context of the research question and policy issue. Foresight is especially relevant regarding complex, sensitive or controversial issues. This is explained in the fourth section, where we step into the foresight process. It explains the participatory exploration of the stakeholders' views for collecting the 'hopes and fears' regarding possible future developments. This happens during brainstorming sessions based on the exploration of possible future scenarios. The fifth section describes the components of policy briefings, and finally, the sixth section contains reflections on the communication of the findings about the policy issues, the evidence behind them, the societal views, and the policy options and their assessment.

This scheme offers a concept for scientific advice that bases policy advice on more than scientific evidence by taking into account policies' potential effects on society and the environment. This is particularly relevant in highly controversial contexts. It can be termed 'responsible scientific advice' (RSA) because of the features that it shares with responsible research and innovation (RRI), which Jack Stilgoe, Richard Owen and Phil Macnaghten have described.[12]

[12] Owen et al., 2012; Stilgoe et al., 2013.

Figure 5 – Foresight-based policy analysis process

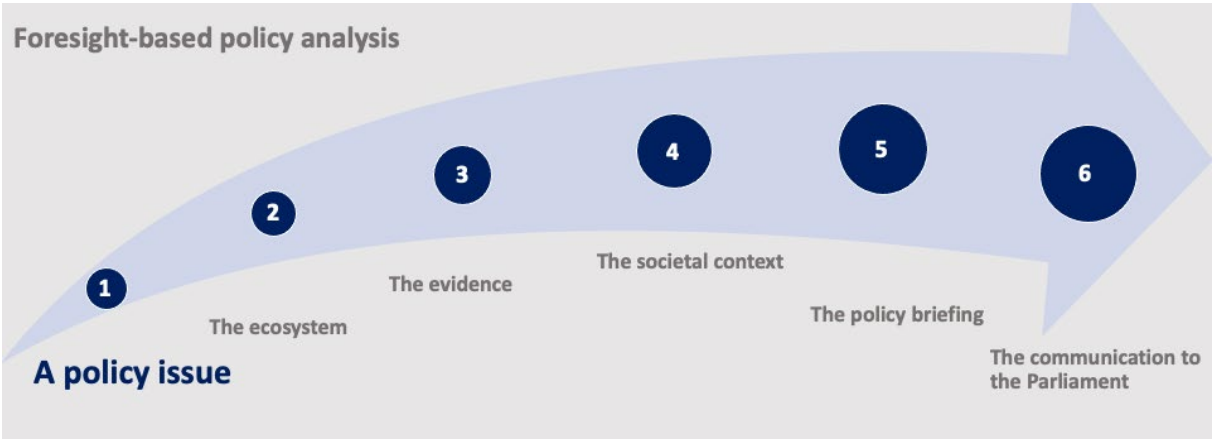


Source: EPRS

In the concluding summary, these six steps are summarised in an infographic, which can be used as a working tool.

Disclaimer: This process is designed as a general guideline and as such is not to be seen as a rigorous directive. Variations are of course possible to better fit the purpose of the project, for instance regarding the involvement of stakeholders, which can take place at different points such as in the designing phase or after a first draft of the policy options.

6.1. The design phase



This section discusses the importance of assessing a policy issue before diving into its analysis.

The purposes of policy analyses vary. They can support the parliament in many respects, such as the organisation of a hearing or workshop, with relevant analyses for the rapporteurs or with information to feed the debate in the parliament.

An analysis can be triggered by a request from the Parliament (a Member, a committee, a political group), or upon the initiative of an administrator or a service (a unit, a directorate, a directorate-general).

As a general rule, it must be determined whether the research topic is a new one, i.e. if an answer is already available and if the topic was previously covered in recent publications or activities by other reputable organisations.

Other aspects worth considering are the complexity of the topic and its possible controversial nature.

6.1.1. Framing and designing a policy analysis project

The first and most important decision in preparing a policy briefing or policy-analysis project is determining the focus of the study. This is best done by clearly framing the problem as a set of questions and answering them in ways that are of interest to the policy-makers who requested the study or are the target audience. Well-framed research questions will guide several aspects of the project, from collecting the evidence to communicating the policy options.

Meeting the Member who has requested a briefing, or their assistant, is a good practice that helps the analyst understand the problem as conceived by the requester. Analysts should be careful to frame the task in a manner that ensures political impartiality in the analysis.

So, for instance, one has to frame the research question apolitically and ensure that the study topic and objectives are formulated in such a way that they can be addressed impartially. However, these should also include the specific focuses that the policy-maker has requested, while possibly approaching these in a broader manner. The objectives of the analysis and its relevance for current or future parliamentary work should be considered in the preliminary investigation, framing the request and the extent of its possible reach.

Thus, the framing stage ends with a description of a well-formulated research question and a plan for addressing it. The key elements for such a framing note include an analysis of its relevance for the Parliament and a preliminary exploration and consultation of the existing sources of relevant evidence. The use of the STEEPED scheme to analyse from all possible perspectives, is strongly advised. It is recommended to use STEEPED in each study's specifications to ensure that no relevant perspective is overlooked in its analysis.

Three lines of responsibility for policy advisors

As an alternative to the idea of the independent science advisor who stands above the broader public and the political discussion, the philosopher Heather Douglas* proposed a model of three lines of obligation. Science advisors and policy analysts should understand themselves as simultaneously obliged to the broader public, the scientific community and the advisee. By making sure that in their analysis they honour all three, they cultivate trust from all of them. Rather than seeing the advisor as independent, these three lines provide a resource to resist the pull of political power. Responsibility to the scientific community means ensuring the validity of the scientific content and revealing value judgements on the part of the advisor. Responsibility to the advisee means that the advice should make the decisions made transparent in the presentation of the advice. The advisor has to justify how they balance their obligation of clarity with the fact that complete scientific detail is frequently unhelpful for policy-makers. Finally, responsibility to the broader public means giving them the tools to assess the politicians' response to the scientific advice and enabling them to make their own decisions. At the same time, it means ensuring that their interests are taken into consideration. Heather Douglas stresses the idea that trust here arises from the constraints placed on the scientific advisor/policy analyst, rather from some sort of objective independence.

This model is particularly helpful for understanding the foresight approach, as it puts emphasis on this threefold responsibility. By developing evidence-based policy options and assessing their social acceptance and impact, the analyst's advice can increase its trustworthiness, particularly in highly-controversial contexts.

* Professor Heather Douglas

6.2. Seeing the bigger picture

This section explains how to look at the bigger picture of the policy issue, i.e. the briefing's scope and relevance for the Parliament, as well as an analysis of the stakeholders. To see the bigger picture, one needs to portray the entire science-policy ecosystem of the subject. This will also contribute to understanding its degrees of complexity and controversy in society. Furthermore, the administrator responsible should ideally verify their findings with those of a colleague from another field and background; interdisciplinarity enables more connections to be uncovered.

First, there are six useful guiding questions for seeing the bigger picture:

Who?	What?	Where?
When?	Why?	How?

(sometimes referred to with the mnemonic 'Five Whiskeys and a Hangover').

Then, guided by STEEPED, explore:

- the topic,
- sources of evidence,
- the stakeholders.

In cases where an issue is complex or controversial, a foresight approach is strongly recommended.

After the framing stage, a systems analysis should be undertaken. In their initial analysis, analysts zoom out of the research question to obtain a holistic overview of the policy issue, which may be discussed with the policy-maker who requested the analysis.

6.2.1. Analysing the research topic

In the preparatory analysis of a request for a study, policy analysts first break down the research question into sub-questions. To ensure that no relevant sub-question is overlooked, one can analyse the research question in accordance with the STEEPED wheel. The STEEPED scheme has been used for STOA's foresight projects since early 2015. Its use is recommended for science- and technology-related policy issues to ensure that any such issue is investigated along the most extensive range of perspectives under a 360-degree approach. However, it is also relevant for other subjects. This checklist specifies seven lenses through which the impacts of techno-scientific developments can be examined to ensure that all areas of interest or concern are verified:

1. Social aspects,
2. Technological aspects,
3. Economic aspects,
4. Environmental aspects,

5. Political and legal aspects,
6. Ethical aspects,
7. Demographic aspects.

Depending on the subject, not all perspectives in STEEPED are relevant. Nevertheless, the scheme serves as a guiding tool to avoid overlooking relevant aspects and stakeholders.

6.2.2. Drawing the 'ecosystem' and analysing the stakeholders

The next step is to determine the types and sources of scientific and societal inputs for the research question. In the information about the societal context (hopes and fears, public acceptance of new technologies and their applications or other developments, attitudes about policy measures, etc.), the preparatory analysis of the ecosystem needs to include a stakeholder analysis, to be prepared in as broad a manner as possible for the next steps. This involves determining who is or may be affected by the problem and who can affect the policy decision. The STEEPED scheme is useful for listing possibly relevant stakeholders, particularly when used in brainstorming sessions with colleagues. The stakeholders, experts, policy-makers and policy analysts together shape the 'ecosystem'.

The constituents of a policy ecosystem in a typical policy issue include:

- Actors in the policy field:
  - Parliaments and governments,
  - Legislators,
  - Parliamentary committees or intergroups for whom the request may be relevant;
- Policy analyst(s);
- Knowledge community:
  - Scientists and academics from various disciplines,
  - Knowledge centres such as research agencies,
  - High-level think tanks;
- Developers and consultants;
- Public services;
- Societal stakeholders, i.e. anyone affected by the issue (technology, application) or the related policy:
  - Industries,
  - Non-governmental organisations, such as those for environmental and consumer protection or humanitarianism,
  - Other civil society organisations;
- Other special interest and pressure groups;
- Media;
- Social media.

6.2.3. Sources for getting an overall understanding of the issue

In addition to using general resources for research on the topic, Parliament has two useful in-house sources that should not be overlooked:

An excellent tool for European Parliament administrators comes from the Scientific Foresight Unit, namely the European Science-Media Hub (ESMH).[13] The ESMH provides evidence-based information on a wide range of topics. It offers information on new scientific developments as well as scientific topics that attract media attention, focusing on trustworthy information. These address the scientific and technological issues shaping our future from many angles. This is therefore a very good starting point for exploring new topics, especially when they are related to science or technology.

[13] European Science Media Hub (ESMH).

It may also be useful to consult the database of parliamentary questions asked by Members of the European Parliament.

The next section describes which sources can be used for an in-depth investigation, and Appendix 2 contains a detailed list of relevant sources.

6.3. Appraisal of the evidence

This section explains the appraisal (scanning and assessment) of the available evidence, which is at the core of policy analyses. As explained above, this is a 'technical horizon scanning' – scanning trends and evidence about a specific topic, *in casu* the policy issue which is investigated.

Every in-depth analysis of a policy issue requires the systematic appraisal of evidence and other relevant information on emerging issues (geopolitical, technological, etc.) to understand their current state, trends and expectations. It includes:

- identification of possible sources of evidence;
- collection of available evidence or even existing synthesised evidence;
- synthesis of what has been found;
- analysis and appraisal of the relevant evidence in the context of the research question and policy issue.

During the analyses, it is a good habit to list the main 'takeaways' for later communication or to highlight in the final briefing. It can help to draft a preliminary, varied set of policy options based on the evidence-based expectations.

A technical horizon scan helps structure the research and focus, to prepare a draft analysis by designing the activity in the most efficient way, building on existing information.

6.3.1. Types of input

Advisers and other analysts should draw on a wide range of input sources. Four types of input can be distinguished:

1. available evidence syntheses;
2. original scientific evidence;
3. an overview of relevant legislation;
4. the stakeholders' views.

The first two categories belong to the assessment of the evidence. The third category of information is required for the actual policy-analysis work for the compilation of the final policy briefings. The fourth category is not part of the 'evidence' part of the study; it belongs to the foresight part, the investigation of the societal views, and is explained in the section on 'policy briefings'. However, to

understand the scope and purpose of the activity, a preliminary overview of available legislation and ongoing legislative work is helpful.

6.3.2. The power of interdisciplinarity

To ensure that wide-ranging evidence is available for assessing the impacts on society, analysts can make sure that the collected evidence is as comprehensive as possible by including evidence from a wide range of disciplines and by analysing these findings in an interdisciplinary way.

Example: Consider a rather technical research topic, such as self-driving cars

Plenty of scientific evidence will be available from the engineering point of view. However, one could also investigate the human factor regarding trust in such vehicles; the ethical and legal issues surrounding the liability of the developers, owners and users of self-driving cars; the impact on car manufacturing; a possible change regarding private car ownership; privacy issues for car users; cybersecurity and other safety issues; the possible impact on the job market; the dependency on internet connectivity; consequences for specific societal groups, such as people with disabilities; etc.

Usually, the exhaustive collection of relevant evidence and its syntheses and analyses are outsourced to external experts. Their analysis should focus on possible developments and their impacts on society. It is recommended – especially in cases of complicated or polemic issues – that the analysis of this multidisciplinary context is conducted in an interdisciplinary way, collectively by experts from a varied range of disciplines. Such a group of analysts could include several of the following specialisations: engineers, natural scientists, social scientists such as behavioural scientists, philosophers, lawyers, economists and anthropologists.

This would allow the diverse findings to be connected and combined in the overall analysis of the knowledge about the issue.

6.3.3. Sources of scientific evidence and its synthesis

Evidence synthesis is the process of compiling information and knowledge from many and varied sources to inform debates and decisions.

We should not duplicate work already done. Thus, the process of determining inputs for the research begins with an overview of existing work on the research sub-questions and closely related questions, as well as an overview of the evidence syntheses provided by fellow advisory services. In the case of Parliament's Policy Departments and STOA, these could be the members of the European Network of Parliamentary Technology Assessment (EPTA)[14] and knowledge centres, such as research agencies. For other European Parliament services, some think tanks are more relevant.

However, we have to be vigilant regarding the impartiality of think tanks. These organisations address topics from specific perspectives, steered by their ideology, purpose and funding. Even EPRS could be considered a pro-European Union think tank. However, because they are usually well written and accessible, the syntheses produced by high-level think tanks can be quite useful, albeit employing all necessary vigilance. Provided they are carefully checked, input from think tanks enhances the efficiency of Parliament's work.

Whatever the sources, syntheses of evidence should always be critically examined and updated when appropriate, as well as double-checked for their quality and impartiality in the case of those produced by other bodies.

Appendix 2 gives a detailed but non-exhaustive list of trustworthy knowledge centres and high-level think tanks along with their internet address (URLs). These sources can be consulted during the

[14] European Network of Parliamentary Technology Assessment (EPTA).

scoping phase when preparing a policy briefing, or for the assessment of project proposals and the preparation of specifications for studies requested in support of the committees' or Members' work.

Note: During the entire process, it is important to keep a list of key takeaways that may be useful for later communication to the Parliament. This especially counts for some specific pieces of evidence that may be notable or thought-provoking

6.3.4. Legal baseline

In addition to scientific evidence, it is crucial to have an overview of the legal baseline of the issue, i.e. a collection of the relevant existing legislation. Usually, at EPRS, this work is first done in a rough form by a STOA administrator and then further outsourced to experts, who can be in-house as well as external. A most relevant source for this part of the work is the Legislative Observatory,[15] the European Parliament's database monitoring the EU decision-making process.

6.3.5. Outcome of the assessment of considered evidence

The external experts' (contractors') task is mainly to analyse the impact of scientific and technological developments. They should describe the issue and its context. For the elements detailed in the study's specifications, they provide a description and analysis of the state of the art and expected future developments. Their main input consists of the description of approaches to solving technology-related problem areas and identifying policy options for action in a manner helpful to the Parliament's role.

Such contractors are also expected to suggest policy options on the basis of scientific evidence, assess them based on the effects on society, and describe the ways in which they can contribute to tackling the policy problem. As a common practice, the study reports include a chapter that describes evidence-based policy options and their assessment in detail.

These projects lead to the identification of possible future concerns and opportunities, which are – in what is called a 'legal backcasting phase' – mirrored by a list of policy options and additional ethical and legal reflections on possible new legislative initiatives, which may help anticipate possible future developments.

In cases where this work is part of a scientific foresight process, the policy options will be challenged during the process (next step).

6.4. Mapping the societal context

[15] Legislative Observatory, European Parliament.

For controversial subjects, preparing a well-assessed set of policy options requires insight into public opinion and stakeholder views and their possible influence on the political sphere. These insights will help to insert, in the final study report, reflections on the public and other stakeholders' perceptions of the assessed technology-related issue.

6.4.1. Stakeholder analysis

Stakeholders include anyone who is concerned about or affected by the policy issue.

A stakeholder analysis serves to identify who is affected by the issue under investigation, who will be affected by policy decisions, and who can affect these decisions. It then selects individuals representing these stakeholders to express their opinions and emotions about the development and policy options in the foresight conversation. There are many ways to categorise stakeholders, and the method that advisers employ in the stakeholder analysis is a determinant of the quality of the foresight study.

A well-structured stakeholder analysis is needed, ensuring that no relevant actor/stakeholder has been overlooked.

The foresight methodology[16] used at STOA since 2015 applies a seven-perspective scheme for exploring issues from all angles. This is called STEEPED, and is explained in detail later in this manual, in the chapter on practical guidelines for trustworthy policy analysis. This scheme offers a frame to analyse possible stakeholders. The STEEPED scheme looks from seven perspectives, including those affected by the issue under investigation, who will be affected by policy decisions, and who can affect these decisions, and technological, political and legal, ethical, and demographic aspects. It is useful for listing possibly relevant stakeholders, particularly when used in brainstorming sessions with colleagues.

The constituents of a policy ecosystem – including the stakeholders – are enumerated in section 6.2 of this manual and embrace actors in the policy field, the knowledge community and societal stakeholders, i.e., anyone affected by the issue (technology, application) or the related policy, special interest groups and pressure groups.

A traditional way to classify stakeholders is to visually map them on a 'power versus interest grid'. A power-interest grid model shows the grouping of the stakeholders based on their level of authority ('power') and their level of concern ('interest') regarding the policy options. It is vital to pay close attention to all groups of stakeholders, especially those who hold less power regarding the issue.

6.4.2. Stakeholder focus

The foresight phase will assess public opinion and stakeholder's views and their possible influence on the political sphere. The purpose is to prepare the ground for the final report to provide reflections on the public and other stakeholders' perceptions of the issue. For this societal assessment, it is important to ensure that social scientists participate in the project team. For the brainstorming meeting to be effective, good facilitators must be involved.

The report of a foresight study includes a stakeholder analysis and a summary of stakeholder's views. It evaluates the findings on possible future developments during the analysis and assessment of the available evidence with regard to the opinions of the stakeholders.

Typical stakeholder engagement within foresight-based policy analysis entails the collection of stakeholder concerns about a diverse set of hypothetical future scenarios or evidence-based policy options. This can take place by participants replying independently (for instance, in a survey), or

[16] L. Van Woensel, D. Vrscaj, Towards Scientific Foresight in the European Parliament, EPRS, European Parliament, 2015.

collaboratively (in a meeting), or during a foresight conversation between the stakeholders to clarify their concerns, aimed at obtaining insight into the range of societal concerns about the issue. In such a conversation, no consensus is necessary. All the concerns formulated are listed. Participants also abstain from judging whether or not a concern is scientifically correct. They help each other to clearly explain all concerns.

6.4.3. 'What if' questions

A wide variety of facilitation techniques is available to collect stakeholder's views. A powerful tool for thinking about the possible effects of new developments are 'What if' questions,[17] that is, systematically posing 'what if' questions in conversations on science and its applications to policy problems. 'What if' also reflects the precautionary principle, which applies to policy actions on issues involving uncertainty and which is increasingly important in policy regarding the environment and technologies that involve many uncertainties (e.g., genetic engineering), or are socially disruptive (e.g., robotics and AI). 'What if' questions prevent advisers from assessing policy options for techno-scientific issues too hastily and may increase the quality of the final policy briefing.

6.4.4. Envisioning possible future developments

Foresight conversations or brainstorming sessions seek to challenge the assumptions of possible future developments from the evidence-base and assess the scenarios; they should involve stakeholders in a representative manner. So far, STOA's foresight studies have included one or more brainstorming sessions with stakeholder representatives, held in physical meetings on European Parliament premises. However, online tools for various types of surveys, including Delphi-like ones, provide alternatives to bring stakeholder representatives together for face-to-face group sessions. Such surveys are based on evidence-based work and inform the stakeholders about the expert findings; they are given or informed about the first set of scenarios, which they can challenge. While STOA has not yet used such surveys, the European Commission did in the BOHEMIA study.[18] For the two foresight studies conducted by the Policy Department for Structural and Cohesion Policies within DG IPOL mentioned in section 4.1.5 Examples of scientific foresight studies, interviews and online workshops were held for collecting the stakeholders' views.

Foresight discussions or surveys are facilitated interactive exchanges between a group of stakeholders, experts and administrators. They enable an exchange of views, opinions and concerns regarding the possible future developments elaborated in the set of scenarios and consider the stakeholders' views. Every member of this 'panel' can air their judgements, as well as the reasons behind them. The purpose is not to convince the other members that one view is the right one; rather, it is to enable a broader understanding of what may happen or be needed in the future.

In such brainstorming sessions, the participants put forth their views on the elements involved (for instance, the scenarios) in two or more rounds. After each round, a facilitator provides a summary of the expressed views for further feedback. All participants are encouraged to revise their earlier answers in light of the other participants' responses. After several rounds, the scenarios are consolidated, and the next part of the foresight work consists of exploring the scenarios to address the stakeholders' concerns; this also entails several consecutive rounds. In the end, the policy options can also be the subject of another round of consultation.

[17] J. Ravetz, The science of 'what-if?', Futures, 29(6), pp.533 –539, 1997.

[18] Beyond the Horizon: foresight in support of future EU research and innovation policy (BOHEMIA), European Commission.

6.4.5. Scenario development

For the exploration of possible futures, a set of fictive, imaginable but not necessarily likely future scenarios should be considered. These scenarios should be diverse, including unlikely and disruptive scenarios, and be conveyed in an acceptable narrative of the future.

The synthesis of the scientific evidence and the first assessment of possible impacts on society is the basis used by stakeholders and technical experts to envision the technology's possible (intended and unintended, hard and soft) impacts.

The diverse scenarios should include aspirational as well as disruptive futures. Exploring disruptive scenarios helps the final outcomes – the concerns to be taken into account when making policy choice options – become more robust and resilient. Examples of disruptive scenarios are 'a world without agrochemicals' or 'a six-metre rise in sea level'.

It is important that alternative or varied scenarios be created and emphasised as fictitious, to avoid the false assumption that the scenarios are somehow predictions of the future. It should be clear to all those involved in the scenario work and overall foresight exercise that the scenarios are not forecasts, but rather images of possible future developments. The scenarios should be sufficiently thought-provoking, internally consistent and plausible. Each scenario should be fundamentally different from the other.

Scenarios can be drafted by building on the combination of outcomes of the analysis of the available evidence and the outcomes of the brainstorming exercise with the stakeholders. These can be prepared by a small team of policy analysts, ideally with input from some external participants, such as experts or stakeholders and possibly with the help of a scenario-method expert. Usually, these are the result of a '360-degree envisioning' exercise that uses the STEEPED approach and explores possible hard and soft impacts.[19] Also 'What if' questions are excellent guides when developing scenarios.

6.4.6. Scenario exploration: Appraisal of the identified societal concerns

The scenario exploration usually takes place in the second brainstorming round. In EPRS, STOA administrators, together with an external contractor, then propose explorative scenarios for participants to investigate those concerns in more detail. These investigations uncover key societal issues which the policy must address.

During this session, stakeholders and experts explore the scenarios in a participatory approach, in which the stakeholders, alongside experts, policy-makers and policy analysts, envision possible future developments, analyse the impact of scientific and technological developments and assess the considered policy options.

For example, STOA's foresight investigation of the ethics of robotics revealed that the liability for accidents involving self-driving cars was a key societal concern; this discovery led the European Parliament to call for EU-wide liability rules for robots and AI. Thus, advisers gather insights into society's collective policy preferences and aversions, which are then taken into consideration in the formulation and assessment of policy options.

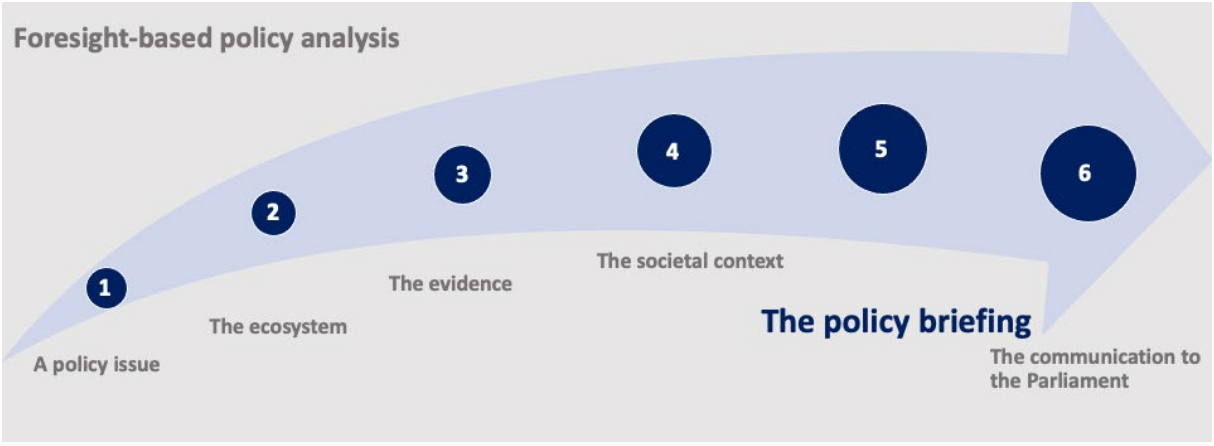
6.4.7. Foresight outcomes

The outcome of the foresight exercise is a description of where different policy pathways may lead. This takes the form of different scenarios, and aims to be anticipatory. Each scenario includes a detailed assessment of possible impacts on society and in other policy areas.

[19] See Section 4.5.3: Hard and soft impacts

It is essential to build a list of societal concerns ('hopes and fears') expressed throughout the exercise. The 'hopes and fears' are then categorised according to EU policy areas and parliamentary committees. This makes the list easily accessible to Members and committees.

6.5. Policy briefings



Policy briefings are the main output of policy analyses and STOA studies. Policy briefings are documents that list possible courses for policy action, 'assessed' for their possible impacts: impacts on society, intended and unintended impacts and perverse effects on other policies. Therefore, policy briefings list and explain multiple policy options, assessing them and describing their potential disadvantages and benefits as well as general impacts.

This section explains how policy briefings are conceived and how pathways can be worked out to pave the legislative way to implementation, i.e. the legislative process, starting from the time of the study to possible future implementation. Such pathways can help the Parliament anticipate desired future occurrences while also gaining insights into how undesirable but possible future developments can be handled.

Thus, the final policy briefing compiles the insights and reflections from previous phases, helping articulate and assess policy options and devising backcasting to alternative futures.

6.5.1. Initial legislative input to the final policy options

By analysing the bigger picture of the policy issue to be investigated at the beginning of the project (see Section 6.2), an initial selection of relevant legislative texts is assembled. The administrators' project inputs include an initial overview of institutional memory (legislative texts), which they employ in the analysis of policy options and the design of roadmaps to possible futures.

For outsourced studies, external experts may suggest policy options on the basis of evidence that they collected and analysed. Finally, in the foresight phase, more elements may come to light that necessitate further tweaking of the policy options and their assessments.

During the foresight phase, additional societal concerns, which were not mentioned in the initial evidence-based report, may come to light.

The following case is taken from STOA's scientific foresight 'Ethics of Cyber-Physical systems' project:

When experts consider a policy option that encourages self-driving vehicles, considering this as the expected future, a foresight meeting could demonstrate resistance from citizens who do not trust self-driving vehicles, or alternatively, like driving their car themselves. They could have come up with a series of 'what if' questions such as:

- What if a self-driving vehicle is hacked?

- What if something goes wrong? Will we be able to take over the control of a self-driving car, and if so, will we still have sufficient driving skills?

Such new insights and reflections can lead to updating the initial list of policy options.

Further, after developing a set of diverse scenarios and exploring these during a foresight session, this exploration may lead to uncovering more details about the possible concerns (hopes and fears) voiced by the various stakeholders.

- What about liability if something goes wrong?

- Who owns the cloud data collected for the operation of these vehicles?

- How will a self-driving car solve dilemmas requiring an ethical judgement? For instance, when a choice needs to be made between hitting a pedestrian crossing the road and injuring the passengers in the car.

These additional insights and reflections help analysts revisit the policy options identified at the end of the appraisal of the available evidence.

6.5.2. Assessing cross-policy impacts

As a final quality control stage, we should also assess the impact of policy options on existing policies. This involves identifying the existing policies that each policy option may affect and analysing their possible impacts. This assessment can help ensure that the advice given to policy-makers will not lead to decisions that will be regretted and require revision. Cross-policy assessment also allows policy-makers to become more aware of their potential blind spots.

The Futures Wheel, which is illustrated in Figure 6 below, is a suitable method for the assessment of cross-policy impacts. It helps to visualise the possible direct and indirect future impacts of a particular policy option.

As a result of this impact assessment, the policy options that are to be compiled in the policy briefing may be updated, and their assessment may include more elements related to the possible impact on other policy areas. Conducting a cross-policy impact assessment may substantially enhance the quality and value of the final policy briefing.

The outcome of this analysis can supply useful information about the aptness of each of the policy options, which can lead to adaptation of the initial policy options. The analysis can also supply further elements for the assessment of policy options for editing the final policy briefing.

6.5.3. Assessing possible impacts by the Futures Wheel

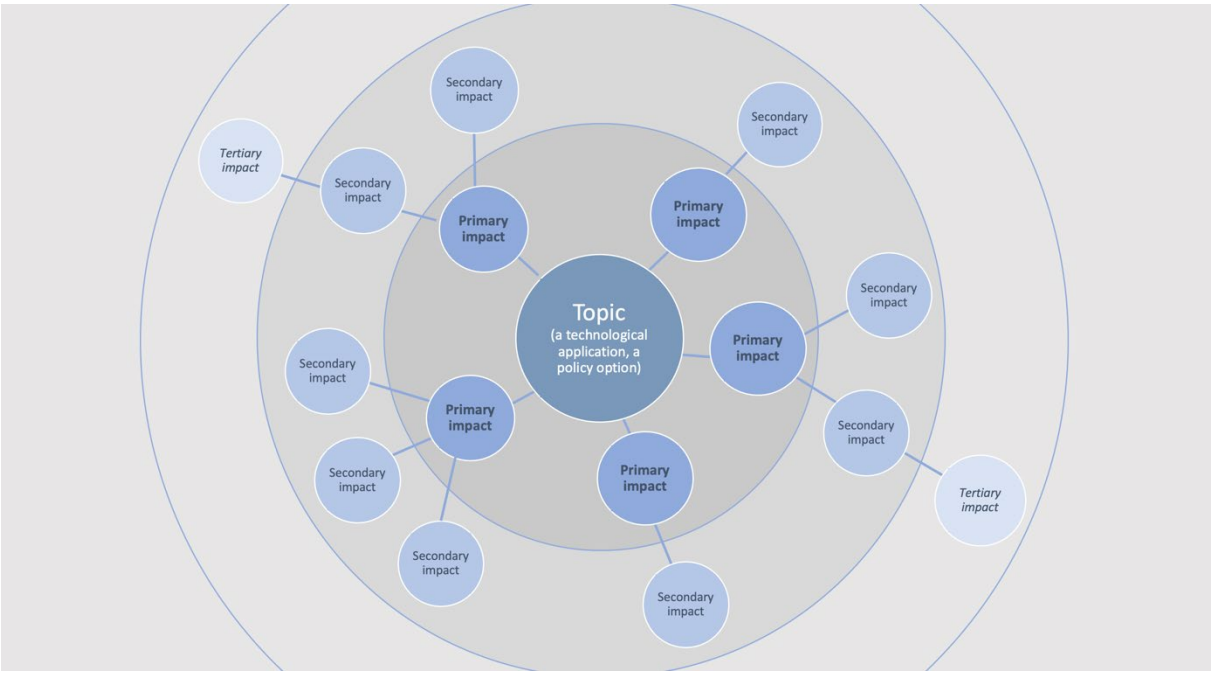
A practical brainstorming method for assessing possible futures is the 'Futures Wheel' (Figure 6). This is a visual method allowing anticipation of the direct and indirect future consequences of a particular change or development. It is a way of thinking about the future – and questioning it – in a structured manner.[20]

[20] J. C. Glenn, The Futures Wheel, 2009.

Description of the Futures Wheel by Jerome Glenn (see Figure 6):

'The Futures Wheel is a way of organizing thinking and questioning about the future––a kind of structured brainstorming. The name of a trend or event is written in the middle of a piece of paper; then small spokes are drawn wheel-like from the centre. Primary impacts or consequences are written at the end of each spoke. Next, the secondary impacts of each primary impact form a second ring of the wheel. This ripple effect continues until a useful picture of the implications of the event or trend is clear.'

Figure 6 – The Futures Wheel



Source: J. C. Glenn, The Futures Wheel, 2009.

The concerns collected in this manner – the societal stakeholders' 'hopes' and 'fears' –yield valuable input for the assessment of the policy options in the final policy briefing. Working with the Futures Wheel implies considering a wide range of potential impacts. This frequently leads to asking 'what if'-type questions, which consider the possible impacts of the options on society in a broad manner. Thus, the briefing can support the Parliament in making future-fit decisions and, generally, in their preparedness for likely future developments.

In 2021, STOA conducted a methodological study involving the Danish Board of Technology (DBT).[21] The DBT provided STOA with access to their online engagement tools and guided them in experimenting with the survey methods they apply in their work, such as the work done for the Danish Parliament.[22] This online stakeholder engagement was found to be an efficient way to gain insights in societal concerns.

[21] See STOA study on A framework for foresight intelligence, (forthcoming).

[22] An example of a STOA project for which these tools have been used is the study on challenges in the 21st century regarding genetic technologies for plants and animals.

6.5.4. Formulation of policy options, including ethical and legal reflections

At this step, the list of policy options will be finalised by verifying that they are based on the underlying scientific evidence and that their assessment in terms of possible impacts on society and interference with other policies has been taken into account.

Finally, the policy options can be complemented with in-depth ethical and legal reflections. These reflections should be integrated into the assessment of the policy options for the final policy briefing.

6.5.5. Legal backcasting: Stress-testing while building roadmaps to the future

Once they have formulated a set of policy options for each of the selected futures, STOA administrators can design roadmaps to and away from those futures, starting from the current legal framework. This comprises the legal backcasting phase.

In practice, legal backcasting connects the present and the future by plotting pathways from the present situation to possible future ones (desirable or undesirable), as explained in Chapter 4.

6.6. Communication to the European Parliament

This final section reflects on conveying the findings about the researched policy issue, the evidence supporting them, the societal views regarding the issue and the policy alternatives and assessments to Parliament. This communication phase is crucial and, therefore, requires careful reflection on the takeaways of the study, as well as the level of detail with which the various parts of the study have to be communicated and to whom.

6.6.1. Impartiality

Policy analysts should, in the communication of their findings, be aware of their usage of subjective words, which can twist an audience's interpretations of what communicators say. They should also avoid crossing the line between reporting facts and advocating policies if they do not want to compromise their trustworthiness. Scientists should, as a general rule, stick to the evidence and refrain from making policy recommendations.

6.6.2. Communicating evidence-based policy advice

To inform the Parliament of possible responses to a policy problem, the 'honest broker' approach is the ideal. An honest broker is a neutral mediator who goes beyond communicating scientific evidence and formulates a range of evidence-informed policy options, which integrates the scientific evidence with the stakeholders' concerns (i.e. the societal context), aiming at empowering policy-makers.[23]

6.6.3. Communicating foresight-based policy-advice

When informing an audience about the outcomes of foresight-based studies, it is important to clarify that these studies balance the evidence and evidence-based solutions regarding a policy issue with the societal context, such as concerns about the development of the technology and the acceptability of possible policy choices.

The purpose of this communication is to feed the debate at the EP by offering insights and reflections about a technology-related development to support them in their decision-making and preparations for future developments. This includes the following elements:

- Offer the Parliament insights on the policy issue in a holistic manner.
  - Provide evidence-based insight into the issue.

[23] R. A. Pielke, *The Honest Broker: Making Sense of Science in Policy and Politics*, Cambridge University Press, 2007.

- Provide insight into the societal context, i.e. the stakeholders involved and their opinions, hopes and fears.
- Share the assessment of suggested policy approaches and build on reflections about the impact of the possible policy decisions, including consequences for various stakeholders in society, as well as interferences between policy areas.
- Offer possible roadmaps for anticipating future developments, if available, such as ways to prepare the legislative paths towards a future development desired by Members, or to avoid unwanted futures.

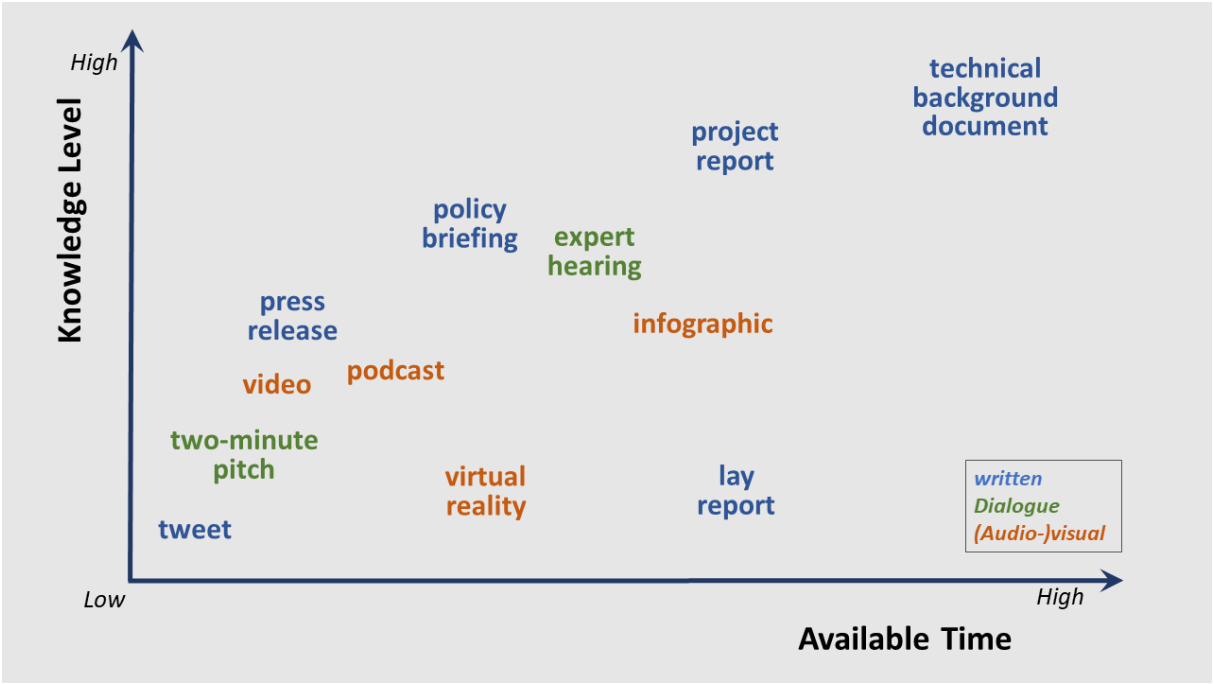
The overall exercise is aimed at enhancing the Parliament's preparedness for what may happen or be needed in the future, which consequently helps society become better prepared for the future.

6.6.4. Key messages for communicating scientific advice and possible formats

A general guideline for communicating the outcomes of a study is to first decide on the message(s) to convey. For comprehensive communication about emerging developments, we have to carefully select thought-provoking takeaways on the issue, evidence and societal context, as well as the possible adverse results of which policy-makers should be aware.

The Parliament's policy analysts should make their advice clear and useable for Members. There is no single way to do this, for policy-makers are invested in different policy issues to diverse extent and the background of their technical and scientific knowledge varies. Consequently, the appropriate format for communicating advice to policy-makers with diverse involvement in the policy issue varies from a two-minute 'pitch' to a detailed technical report that includes all of the evidence. Figure 7 summarises possible communication formats in terms of presentation, attention time and audience expertise. Communication formats include written communication, expert hearings, podcasts and videos, infographics and, potentially in the future, virtual reality.

Figure 7 – Formats for communicating policy advice



Source: EPRS

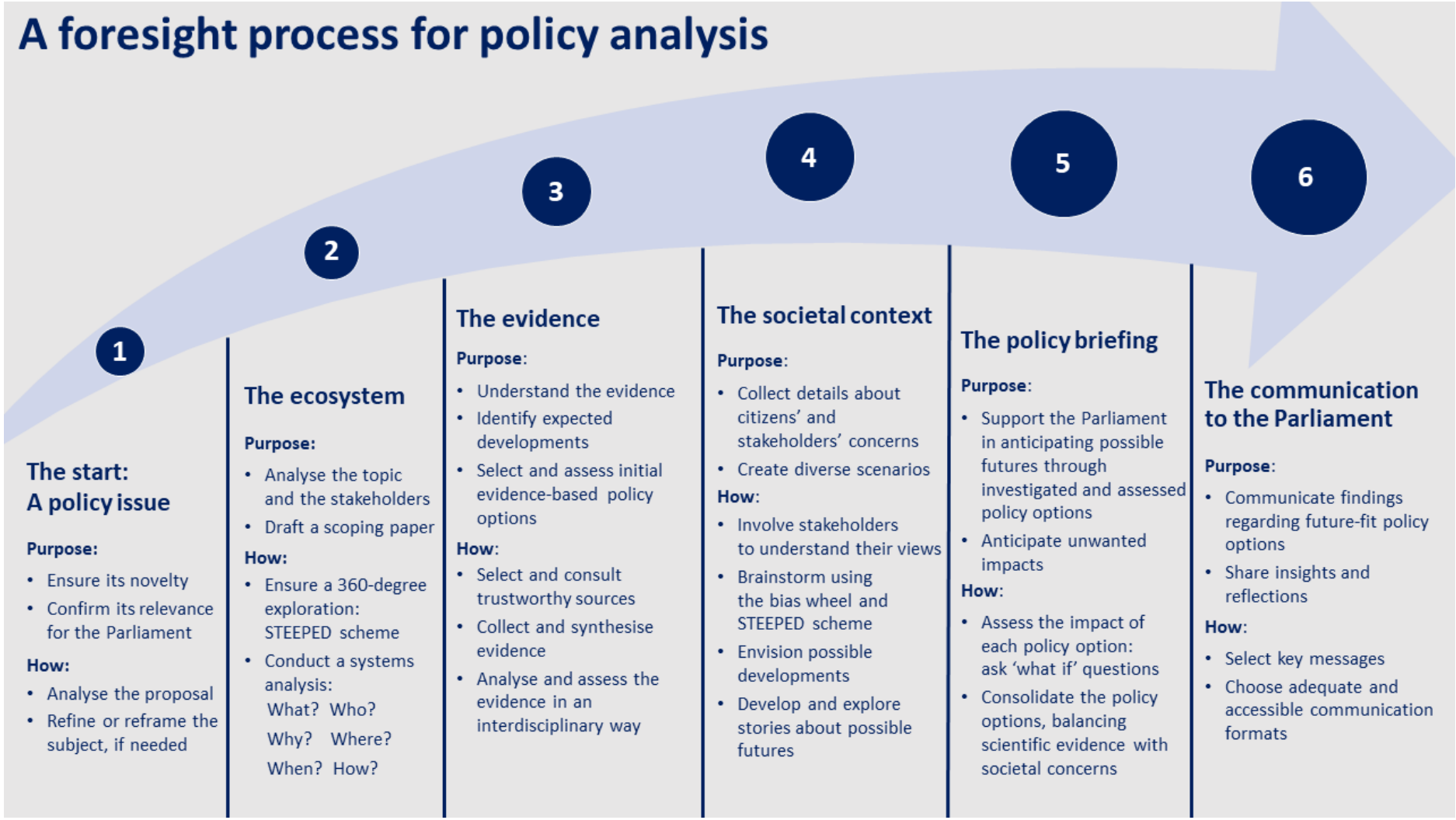
7. Summary of the foresight-based policy analysis process

This closing chapter presents a summarised scheme for foresight-based policy analysis, from the initial request or idea of investigating a policy problem to the final communication of the findings to the intended audience. By adopting standardised quality procedures that are transparent and clear to our clients (the Members of the European Parliament and parliamentary committees), we can establish Parliament's administration as a trustworthy, quality service that provides both insights into policy issues and possible action to address these issues in a future-fit manner.

This scheme focuses on employing a foresight approach in policy analysts' work. This is to support the Parliament with insights into the evidence related to a policy problem, as well as foresight-based reflections on how evidence-based policy options may impact society or interact with other policies. By doing so, administrators working as policy analysts also feed parliamentary and societal debates.

The summarising scheme in Figure 8 depicts one model of the course of a scientific foresight project. The model can be adapted, depending on the complexity and urgency of the policy problem and the available resources, i.e. the available budget, human resources and expertise.

Figure 8 – Steps and tools for a typical foresight-based policy analysis



Source: EPRS

8. Selected bibliography

Disclaimer: References used in the document that cannot be found in this selected bibliography are linked throughout the text using hyperlinks. These can be consulted on the digital version of this document.

Cuhls, Kerstin E., Horizon Scanning in Foresight – Why Horizon Scanning is only a part of the game, *Futures & foresight science 2* (2020), No 1, Article 23, (https://doi.org/10.1002/ffo2.23), 2020.

Hines, Philip, Li Hiu Yu, Richard H. Guy, Angela Brand and Marisa Papaluca-Amati, Scanning the horizon: a systematic literature review of methodologies, *BMJ Open*, (doi:10.1136/ bmjopen-2018-026764), 2019.

Glenn, Jerome C. *The futures wheel, Futures research methodology,* version 3, The Millennium Project, 2009.

Lentsch, Justus and Weingart, Peter, *The Politics of Scientific Advice: Institutional Design for Quality Assurance*, Cambridge University Press, 2011.

Organisation for Economic Co-operation and Development (OECD), Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists, IDEAS Working Paper Series from RePEc, 2015.

Owen, Richard, Macnaghten, Phil, and Stilgoe, Jack, Responsible Research and Innovation: From Science in Society to Science for Society, with Society, *Science and Public Policy 39 (6)*, (doi: 10.1093/scipol/scs093), 2012.

Pielke, Roger A., *The Honest Broker: Making Sense of Science in Policy and Politics*, Cambridge University Press, 2007.

Ravetz, Jerome., The science of 'what-if?', *Futures*, 29(6), pp.533-539, 1997.

Robinson, Warren, Meadows Donella H., Meadows Dennis L., Randers, Jørgen and Behrens William W, The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind,Universe, 1973.

Schultz, Wendy, A Brief History of the Future, *World Future Review*, 2015-12, Vol.7(4), pp. 324-331, 2015.

Stilgoe, Jack, Owen, Richard, and Macnaghten, Phil, Developing a framework for responsible innovation, *Research Policy*, 42(9), (doi:10.1016/j.respol.2013.05.008(, 2013.

Swierstra, Tsjalling and Frederica te Molder, Hedwig, Risk and Soft Impacts, 2012, in Roeser, Sabine, Hillerbrand, Rafeala, Peterson, Martin and Sandin Per (Eds.), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk,* Springer, pp. 1050-1066.

Van Woensel, Lieve, *A Bias Radar for Responsible Policy-Making. Foresight-Based Scientific Advice*, Palgrave, 2020.

9. Appendices

Appendix 1: Further reading on foresight and foresight for policy

- Bell, Wendell, Foundations of Futures Studies: Volume 1, History, Purposes, and Knowledge: Human Science for a New Era, Routledge, Taylor & Francis Group, 2003.
- Bell, Wendell, Foundations of Futures Studies: Volume 2: Values, Objectivity, and the Good Society, Routledge, Taylor & Francis Group, 2004.
- Bishop, Peter C., and Hines, Andy, *Teaching about the Future,* Palgrave Macmillan, 2012.
- Centre for Strategic Futures, *Foresight: A Glossary,* Prime Minister's Office, Singapore, (Published on www.csf.sg), 2017.
- Government Office for Science (UK), *Code of Practice for Scientific Advisory Committees),* (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/278498/11-1382-code-of-practice-scientific-advisory-committees.pdf), 2011.
- Grunwald, Armin, Technology Assessment in Practice and Theory, Routledge, 2019.
- Hines, Philip et al., *Scanning the horizon: a systematic literature review of methodologies,* BMJ Open, (doi:10.1136/ bmjopen-2018-026764), 2019.
- Lentsch, Justus. and Weingart, Peter, The Politics of Scientific Advice: Institutional Design for Quality Assurance, Cambridge University Press, 2011.
- Meadows, Donella. H., Wright, Diana, *Thinking in Systems: A Primer,* Chelsea Green Publishing, 2008.
- Organisation for Economic Co-operation and Development, Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists, IDEAS Working Paper Series from RePEc, 2015.
- Oreskes, Naomi, and Conway, Erik M., Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming, Bloomsbury Press, 2010.
- Kenner, Robert (Director), *Merchants of Doubt,* Sony Pictures Home Entertainment, 2015.
- Schwartz, Peter, The Art of the Long View: Planning for the Future in an Uncertain World, John Wiley and Sons, 1998.
- Pielke, Roger A., The Honest Broker: Making Sense of Science in Policy and Politics, Cambridge University Press, 2007.
- Shell, *Scenarios: An Explorer's Guide,* (https://www.shell.com), 2008.
- Schultz, Wendy, *A Brief History of the Future,* World Future Review, 2015-12, Vol.7(4), pp. 324-331, 2015.
- Van der Heijden, Kees, *Scenarios: The Art of Strategic Conversation* (2nd ed.), John Wiley & Sons, 2005.
- Van Woensel, Lieve, and Joseph, Vicky, *Forward-Looking Policy-Making at the European Parliament through Scientific Foresight,* European Parliament (http://www.europarl.europa.eu), 2017.
- Van Woensel, Lieve, *A Bias Radar for Responsible Policy-Making. Foresight-Based Scientific Advice,* Palgrave Pivot, (ebook and PDF downloadable from the EP library via SpringerLink), 2020.
- Wilkinson, Angela, *Strategic Foresight Primer,* Luxembourg: Publications Office, 2017.
- Wilsdon, James and Doubleday, Robert, *Future Directions for Scientific Advice in Europe,* Cambridge: Centre for Science and Policy, 2015.

Appendix 2 – Sources for evidence and reflection

1. Introduction

At the start of a study or for the preparation of a workshop, policy analysts need to conduct a preliminary investigation and consultation of existing sources. This is to avoid the duplication of already-existing work.

This appendix lists (non-exhaustively) a huge number of obvious knowledge centres (such as European research agencies). This list includes a selection of trustworthy think tanks, as well as relevant high-quality press sources. Lastly, it includes various relevant sources for exploring societal views.

Determining the inputs to the research begins with an overview of existing work on the research sub-questions, and closely related questions and includes an overview of evidence syntheses that fellow advisory services and knowledge centres, such as research agencies, have already provided. Because they are usually well-written and accessible, the consultation of syntheses of high-level think tanks can also be useful, but this requires some vigilance. Due to their nature, think tanks are not always impartial.

This appendix also lists press sources which could be relevant for preparing STOA studies, but that can be useful for any EU institution preparing a study. Finally, it includes a selection of relevant sources for exploring societal views.

2. Selection of relevant sources for finding evidence

This chapter lists the agencies and international organisations whose work is of relevance to STOA activities, and which may be useful to other EU institutions.

Studies in the European Parliament context

First, investigating what has been done at the European Parliament is strongly recommended, to avoid duplication of work. To identify what is done in-house, at the Parliament, studies published and events held or planned can be examined.

- Studies can be consulted using the database of supporting analyses. This database contains the research papers produced by various European Parliament research services. Publications from the previous parliamentary term are available at this link.
- Further relevant sources consist of hearings and workshops held or planned at Parliament:
  - Hearings
  - Workshops

Studies by other European Parliamentary Technology Assessment (EPTA) organisations

All partners in the network of European Parliamentary Technology Assessment organisations (EPTA), a network of which STOA is a founding member, advise parliaments on the possible social, economic and environmental impact of new sciences and technologies.

On the EPTA website you can:

- consult their members' project database and
- find policy advice on technology issues in reports and policy briefs.

EU agencies and joint undertakings

This section links to possible relevant EU agencies. These agencies were set up by the EU to perform technical and scientific tasks that help the EU institutions implement policies and take decisions. Some agencies answer the need to develop scientific or technical know-how that could be relevant to STOA activities, as well as research carried out by other EU institutions.

Joint Undertakings are public-private partnerships leveraging knowledge, skills and expertise. They keep ahead of the curve by delivering scientific excellence and innovation across key industrial sectors – smarter and greener mobility, innovative healthcare, improved circular economy, cleaner energy and better electronics.

- Agency for the Cooperation of Energy Regulators (ACER)
- Body of European Regulators of Electronic Communications (BEREC)
- Community Plant Variety Office (CPVO)
- European Agency for Safety and Health at Work (EU-OSHA)
- European Banking Authority (EBA)
- European body for the enhancement of judicial co-operation (EUROJUST)
- European Border and Coast Guard Agency (FRONTEX)
- European Centre for Disease Prevention and Control (ECDC)
- European Centre for the Development of Vocational Training (CEDEFOP)
- European Chemicals Agency (ECHA)
- European Defence Agency (EDA)
- European Environment Agency (EEA)
- European Food Safety Authority (EFSA)
- European Foundation for the Improvement of Living and Working Conditions (EFCA)
- European GNSS Agency (GSA)
- European Institute for Gender Equality
- European Institute for Security Studies (EUISS)
- European Institute of Innovation and Technology (EIT)
- European Insurance and Occupational Pensions Authority (EIOPA)
- European Labour Authority (ELA)
- European Maritime Safety Agency (EMSA)
- European Medicines Agency (EMA)
- European Monitoring Centre for Drugs and Drug Addiction (EMCDDA)
- European Network and Information Security Agency (ENISA)
- European Railway Agency (ERA)
- European Securities and Markets Authority (ESMA)
- European Systemic Risk Board (ESRB)
- European Training Foundation (ETF)
- European Union Agency for Law Enforcement Cooperation (EUROPOL)
- European Union Intellectual Property Office (EUIPO)
- European Union Satellite Centre (SatCen)
- Fundamental Rights Agency (FRA)
- The European Union Agency for Law Enforcement Training (CEPOL)
- Bio-based Industries Joint Undertaking
- Clean Sky 2
- Fuel Cells and Hydrogen Joint Undertaking (FCH JU)
- Innovative Medicines Initiatives (IMI)
- Electronic Components and Systems for European Leadership (ECSEL JU)

- Fusion for Energy (F4E)
- Single European Sky ATM Research JU (SESAR)
- Shift2Rail

The Joint Research Centre (JRC), a knowledge centre

The JRC is the European Commission's science and knowledge service (EU Science Hub).

Relevant JRC research areas include:

- Agriculture and food security
- Energy and transport
- Environment and climate change
- Health and consumer protection
- Information Society
- Innovation and growth
- Nuclear safety and security
- Safety and Security

Specific JRC initiatives and knowledge centres:

- JRC AI Watch
- JRC Knowledge Centre for Bioeconomy
- JRC Disaster Risk Management Knowledge Centre
- JRC Knowledge Centre for Food Fraud and Quality
- JRC Knowledge Centre for Global Food and Nutrition Security
- JRC Knowledge Centre on Migration and Demography

OECD

OECD publishes reports in many areas:

- Agriculture and fisheries
- Chemical safety and biosafety
- Competition
- Corporate governance
- Corruption and integrity
- Development
- Digital
- Economy
- Education
- Employment
- Environment
- Finance
- Green growth and sustainable development
- Health
- Industry and entrepreneurship
- Innovation
- Insurance and pensions
- Investment
- Migration

- Public governance
- Regional, rural and urban development
- Regulatory reform
- Science and technology
- Social and welfare issues
- Tax

UN-related organisations

This section lists specialised UN agencies, organisations that have a cooperation agreement with the United Nations. Some of the most relevant include:

- Food and Agriculture Organization (FAO) and World Food Programme (WFP)
- United Nations Environment Programme (UNEP)
- World Health Organization (WHO)
- World Meteorological Organization (WMO)
- International Fund for Agricultural Development (IFAD)
- International Labour Organization (ILO)
- International Organization for Migration (IOM)
- Joint United Nations Programme on HIV/AIDS (UNAIDS)
- Office of the High Commissioner for Human Rights (OHCHR)
- United Nations Children's Fund (UNICEF)
- United Nations Conference on Trade and Development (UNCTAD)
- United Nations Department of Economic and Social Affairs (UN DESA)
- United Nations Department of Political Affairs (UN DPA)
- United Nations Development Programme (UNDP) see also United Nations Capital Development Fund (UNCDF) / United Nations Volunteers (UNV)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- United Nations Entity for Gender Equality and the Empowerment of Women (UN Women)
- United Nations High Commissioner for Refugees (UNHCR)
- United Nations Human Settlements Programme (UN Habitat)
- United Nations Industrial Development Organization (UNIDO)
- United Nations Office for Disaster Risk Reduction (UNISDR)
- United Nations Office on Drugs and Crime (UNODC)
- United Nations Peacebuilding Support Office (UN PBSO)
- United Nations Population Fund (UNFPA)
- United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA)
- United Nations World Tourism Organization (UNWTO)

The following organisations have membership confirmation pending at the UNSDG, as of March 2019:

- International Atomic Energy Agency (IAEA)
- International Civil Aviation Organization (ICAO)
- International Maritime Organization (IMO)
- Office for the Coordination of Humanitarian Affairs (OCHA)
- Universal Postal Union (UPU)
- World Intellectual Property Organization (WIPO)

Top think tanks

Think tanks have the advantage of generally producing well-readable reports, synthesising evidence. James G. McGann's annual Think Tank Index Report is a useful guide for judging the trustworthiness of specific think tanks. If one carefully verifies their quality and impartiality, inputs from think tanks can help to obtain a proper understanding of a request's topic for a study or event.

3. The European Parliament Think Tank, a particular source of knowledge regarding EU policy

Valuable analysis and synthesis work is produced by the European Parliamentary Research Service (EPRS), the internal research service and the Parliament's think tank. The EPRS motto is 'Empowering through knowledge'. Its mission is to assist Members of the European Parliament and parliamentary committees by providing them with independent, objective analysis. Moreover, EPRS publications are very valuable for anyone dealing with European policy, inside and outside the EU institutions.

What think tanks are thinking

In addition to information from individual think tanks, it could be useful to obtain an overview of what think tanks write about certain topics. EPRS author Marcin Cesłuk-Grajewksi regulary compiles notes offering links to recent commentaries, studies and reports from international think tanks on issues relevant for EU policy. These are a useful resource, available online in his blogposts 'What think tanks are thinking'.

Global Trends reports

Analyses conducted at the EPRS go beyond strictly European matters. The 'Trendometers' compiled by the Global Trends Unit (TREN) at the European Parliamentary Research Service, are global trends reports focusing on geopolitical issues and identify, track and analyse trends across social, economic and political fields. The trendometers are accessible on the EP Think Tank via blog posts on Global Trends.

European Parliament Publications (EPRS and Policy Departments)

EPRS and Policy Department publication are available on the European Parliament Think Tank website, where they can be browsed per policy area or by theme, by Committee or by type of publication (At a glance, Briefing, In-depth analysis, Study). There are also very informative Fact Sheets on the European Union.

The EPRS is the European Parliament's in-house research department and think tank. Its mission is to assist Members of the European Parliament and parliamentary committees by providing them with independent, objective analysis. These include research for individual Members, production of a wide variety of general analytical publications on EU issues for the Parliament as a whole, and specialist studies in ex-ante and ex-post policy evaluation for the Committees of the European Parliament.

The five policy departments at the European Parliament are responsible for providing – both in-house and externally authored – high-level independent expertise, analysis and policy advice, produced upon the request of committees and other parliamentary bodies. They are closely involved in the work of Parliament's committees, which they support in shaping legislation on, and exercising democratic scrutiny over, EU policies.

4. Selection of relevant high quality press

The European Science Media Hub (ESMH)

An excellent tool for European Parliament policy analysis is the European Science-Media Hub (ESMH), part of the Scientific Foresight Unit. The ESMH provides evidence-based information on a wide range of topics. It offers information on new scientific developments as well as scientific topics that attract media attention, focusing on trustworthy information. These address the scientific and technological issues shaping our future from many angles. Therefore, this is a very good starting point for exploring technology related topics.

- The European Science-Media Hub (ESMH)
- A wide range of topics: AI, Health, Robotics, Environment, Agriculture, Energy, Industry, Security, Space, Transport, New Technologies, Food and COVID-19.

Relevant press

- Politico
- EurActiv
- BBC News
- The Guardian, including special dossiers such as on Environment, Science and Technology

5. Selection of sources which can help in exploring societal views

This section includes sources for exploring societal views from various perspectives. It includes parliamentary questions, the World Economic Forum and a selection of non-governmental organisations (NGOs), including the most prominent all-purpose and environmental NGOs.

Parliamentary questions

First consulting the database of parliamentary questions asked by Members of the European Parliament could be helpful for acquiring a view on politicians' ongoing interests and concerns.

Eurobarometers

Eurobarometers are public opinion surveys which are conducted regularly on behalf of the European Commission and other EU institutions. The European Parliament public opinion surveys in the Member States are a means for Parliament to keep in touch with people's perceptions and expectations of its work and that of the European Union generally. These Parliament Eurobarometers are a source of insight into citizens' views.

In addition, the European Commission Eurobarometers offer insights into citizens' views on a diverse range of areas, conducted in different formats.

World Economic Forum (WEF)

The World Economic Forum 'engages the foremost political, business, cultural and other leaders of society to shape global, regional and industry agendas'. Exploring their activities is useful in investigating a topic from the economic and industrial perspective. They have **interesting infographics**, which help explore the bigger picture of a topic. Examples of their useful infographics include those on AI, or Global Risks. The forum (amongst other things) includes a Centre for Cybersecurity and a Centre for the Fourth Industrial Revolution.

NGOs

For all NGOs, the Transparency Register could be consulted for more details, as well as for their contact persons dealing with the European Parliament. Some relevant/influential NGOs include:

- Corporate Europe Observatory (CEO)
- Friends of the Earth
- Greenpeace (European Unit)
- World Wide Fund for Nature (WWF)

Policy analysis examines and assesses problems to determine possible courses for policy action (policy options). In highly complex or controversial contexts, evidence-based policy options might not be socially acceptable. Here, policy analysis can benefit from a foresight-based approach, which helps investigate the issue holistically and assess considered evidence-based policy options against societal concerns. This is especially important in a parliamentary setting, as it enables analysts to consider stakeholder views and geographical concerns/differences when assessing policy options.

This manual establishes the methodology for the foresight process and foresight-informed policy analysis. It offers a conceptual clarification of foresight and foresight-based technology assessment, helps enhance the transparency of foresight processes and the quality of policy analyses, offers four general guidelines for conducting trustworthy policy analysis, and, finally, provides a practical framework with six basic components for foresight-based policy analysis.

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