European Parliament

A framework for foresight intelligence

Part 2: Online stakeholder engagement

IN-DEPTH ANALYSIS

Panel for the Future of Science and Technology

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A framework for foresight intelligence

Part 2: Online stakeholder engagement

The European Parliament's Panel for the Future of Science and Technology (STOA) has expressed the need for a framework it can use to watch and explore technological trends, and monitor information around the latest developments and their impacts on society. This framework needs to include a trends knowledge base as well as engagement tools for obtaining insight into stakeholder and citizen concerns and opinions on the various impacts of new technological developments.

Against that backdrop, this methodological in-depth analysis – 'A framework for technology foresight intelligence' – investigates ways of strengthening STOA's toolkit, in particular for scientific foresight activities aimed at tackling issues characterised by uncertainty, a high level of complexity, or controversy.

Dedicated to stakeholder engagement, the paper analyses online engagement methods and tools and their suitability for brainstorming meetings, for technology assessment (TA) and foresight projects. It also assesses the efficiency of online alternatives for foresight brainstorming meetings with colleagues, MEPs, experts and selected stakeholders. These alternatives include surveys to ascertain societal concerns about possible future technology developments and also simple variants of Delphi-type surveys.

AUTHORS

This in-depth analysis has been conducted at the request of the Panel for the Future of Science and Technology (STOA) and managed by the Scientific Foresight Unit within the Directorate-General for Parliamentary Research Services (EPRS) of the Secretariat of the European Parliament. The author, Andrés Garcia Higuera, seconded national expert in the above unit, was supported by Lieve Van Woensel, Nera Kuljanic, Carl Pierer and Virginia Mahieu, all from the same unit at the time of writing, as well as by Bjørn Bested and Nicklas Bang Bådum (Danish Board of Technology Foundation).

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http://epthinktank.eu (blog)

Executive summary

The main objective of this part of the 'framework for foresight intelligence' project, is to assess online engagement methods and tools, and their suitability for brainstorming with stakeholders in technology assessment (TA) and foresight projects. The study assesses the efficacy of online alternatives to foresight brainstorming meetings with colleagues, MEPs, experts and selected stakeholder representatives. These alternatives include surveys (to assess societal concerns about possible future technological developments) as well as simple variants of Delphi-type surveys.

Online methods and tools for engagement were implemented in one ongoing STOA project in order to gain insight and experience. For this purpose, STOA selected a typical foresight study, 'The role of gene-editing in mitigating 21st century challenges', requested by the STOA Panel. This study investigates a complex issue that is the subject of controversy: gene editing techniques for the future of farming in Europe. Experts from the Danish Board of Technology Foundation guided the STOA team in setting up and running the procedure for this project.

The project applied the STEEPED approach, a systematic way of conducting an initial review of existing and emerging opinions (hopes and fears) concerning the topic under discussion, and assessing their associated impacts. This approach is described in detail in the 'Guidelines for foresight-based policy analysis', a STOA study published in July 2021.[1] The STEEPED scheme can be used as the basis for the development of several explorative scenarios, in which existing and emerging technological solutions are put into action. Hypothetical scenarios – fictional stories about future possibilities – are a useful tool to guide foresight brainstorming in order to explore the possible impacts of the various alternative routes to take while discussing any specific topic. Scenarios help identify the potential consequences of various imagined situations, including extreme ones.

Once the scenarios for the gene editing study had been defined (in this case adapted from a report by the Rathenau Instituut), a variety of actors belonging to different interest groups – stakeholders – were invited to participate in the process. The stakeholder analyses conducted by STOA to select the participants in these online engagement exercises were also based on STEEPED. This process ensures coverage of a broad spectrum of opinions from representatives of all stakeholder groups concerned by the issue under investigation. It was found that the stakeholder selection process became richer and more reliable by asking the participants initially selected (defined as the core group) to name additional actors (the snowball group) to join and broaden the input. Different activities were subsequently set up to enable the stakeholders to join in the analysis of the scenarios envisaged. Guided by the evidence available, the participants in the brainstorming exercise then explored a wide range of possible impacts of each option, including extreme ones, and including positive and negative, intended and unintended consequences.

Importantly, by requesting online statements as an initial step, participants could work independently of each other. This had the advantage of giving them ample time to review the introductory information provided on the topic and to look for additional sources themselves, and ensured that they were better prepared and had assimilated sufficient background information to feed into the ensuing interactive sessions properly. This document will describe the activities used in the engagement process for this project. This stakeholder engagement methodology was found to be useful for obtaining an overview of societal concerns surrounding a controversial issue, and for producing a report with all results and their analysis, including the broadest range of opinions that will inform

[1] Lieve Van Woensel, Guidelines for foresight-based policy analysis, EPRS, European Parliament, Section 5.2, Figure 2.

policy-makers in subsequent political discussions. The conclusion of this work was that this method is a useful tool for controversial or sensitive issues, and could be added to STOA's methodological toolkit.

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1. Introduction

The foresight process requires a study of the societal context with qualitative inputs from stakeholders. STOA analyses the opinions expressed by participants of different types, including MEPs, technical or scientific experts, and a wide range of societal groups. To date, for all its scientific foresight projects, STOA has investigated societal concerns related to possible future technological developments by organising (physical) brainstorming workshops – to facilitate foresight conversations. In an increasingly digital world, STOA needs to expand its foresight capabilities and use online platforms for engagement with experts, Members of the European Parliament (MEPs) and wider stakeholders. The intended outcome of the present study was to find new ways for STOA to obtain comprehensive summaries of stakeholder inputs in engagement processes dealing with controversial subjects discussed at the European Parliament.

1.1. Scientific foresight: Foresight-based policy advice

Technology assessment (TA) is the study and assessment of the effects of new technology on society. Scientific foresight reaches out wider. It is the study and assessment of the effects of new technology on society, including the capacity to be prepared for what may happen or be needed in the future. It goes beyond the assumptions made by the experts involved in the study of the state of the technology, challenging evidence-based assumptions with the views of people from different backgrounds (interdisciplinary as well as multi-stakeholder backgrounds). Essentially, scientific foresight goes beyond conventional TA by putting an emphasis on anticipating the possible (including the less likely) impacts of technology-related evolution. As such, it is an explorative foresight method.

A foresight approach, including collecting insights into the concerns of societal stakeholders, is essential for assessing and balancing evidence-based policy options in the light of their societal acceptance. Exploring the concerns of societal stakeholders provides crucial information for policy-makers when making policy decisions.

1.1.1. Stakeholder analysis

In a context of uncertainty, complexity or controversy, science may not always provide clear-cut answers for policy decisions, as science is not the only relevant aspect. Solutions for bridging this gap between science and policy should take additional elements into account, such as social acceptance. This information can complement the scientific evidence with insight into societal concerns, so that policy-makers are better informed and can consider the wider picture.

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

A stakeholder[2] can be any person or group with an interest in the issue and/or who stands to gain or lose from a possible course of policy action (a policy option). Special attention is given to groups beyond the developers of the technology, i.e. societal stakeholders, including anyone affected by the issue (a technology or its application). Broadly, these actors include non-governmental organisations, such as those involved in environmental and consumer protection or humanitarianism, and other civil

[2] D. Slunge, O. Drakenberg, A. Ekbom, M. Göthberg, Å. Knaggård U. and Sahlin, Stakeholder Interaction in Research Processes – a Guide for Researchers and Research Groups, 2017.

society organisations, as well as other interest groups, including services, industries and other special interest and pressure groups.

Stakeholder engagement can be defined as the activity of involving and communicating with actors who are potentially interested in, or affected by, a policy issue. It can happen in different phases of policy analysis. One way is to incorporate it at the outset of a study, in the design phase. Within STOA activities, at the outset of a project, STOA sometimes organises a workshop to get a clearer picture of what is at stake for different actors in society. Such engagement can help design a study including the identified societal concerns.

A second method of stakeholder engagement consists of a workshop assessing evidence-based policy options or a set of diverse scenarios developed based on the analysis of relevant evidence. Conversations during the workshop are used to formulate arguments from diverse actors in society in favour of or against certain policy options, and to acquire insights into societal concerns regarding scientific evidence, including beliefs and opinions, and hopes and fears. The ensuing lists of arguments in favour of or against options, or concerns regarding certain developments, are then used to assess evidence-based policy options with regard to the broader societal context (hopes and fears, public acceptance of new technologies and their applications or other developments, attitudes about policy measures, etc.). These options assessments are incorporated within the reports STOA delivers to the European Parliament.

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

1.1.2. Stakeholder selection

Determining the types and sources of scientific and societal inputs for the research question is an important step in the foresight process. The stakeholders, experts, policy-makers and policy analysts together shape the so-called ecosystem. As such, the preparatory analysis of the ecosystem needs to include a stakeholder analysis. A stakeholder analysis results in a list of relevant actors including scientists, policy-makers, industry, data companies, end users, non-governmental organisations (NGOs), and any other special interest, pressure and vulnerable groups affected by the issue at hand. The list is drawn up in a broad manner and involves determining who is or may be affected by the technology or its applications. The STEEPED scheme (explained in Section 3.2) is useful for listing potentially relevant stakeholders, particularly when used in preparatory brainstorming sessions.

2. Description of the overall approach

2.1. The purpose

The main objective of this part of the study on 'A framework for foresight intelligence' is to assess the suitability of online engagement tools for brainstorming meetings involving MEPs, experts, and selected stakeholders; including surveys to collect societal concerns about possible future developments of technology (such as simple variants of Delphi surveys, which are a type of foresight survey in which successive questionnaires are progressively adapted to the experts' responses[3,4]). To explore the efficacy of online engagement tools, a typical STOA foresight study investigating a complex issue that is the subject of controversy was selected as a test case. This study was: 'The challenges of genome editing in plants, with a focus on crops', about the policy considerations surrounding gene editing techniques for the future of farming in Europe.

2.2. The stakeholder engagement platform

STOA used the EngageSuite platform, set up and managed by the Danish Board of Technology Foundation, an organisation with experience in running similar engagement processes at EU level.[5,6] They provided training, technical assistance, and support related to the platform and, more importantly, to the methodology itself. The platforms and methods used comply with the precepts of the General Data Protection Regulation (GDPR), in particular those concerning privacy by design and by default, and may not collect data about users, beyond the scope and duration of the foresight exercises performed for STOA, nor make use of third party cookies.

2.3. The DBT, a partner with experience in citizen engagement

The Danish Board of Technology Foundation (DBT) is a non-profit corporate foundation working for the common good. The foundation's mission is to ensure that society's development is shaped by informed and forward-looking cooperation between citizens, experts, stakeholders and decision-makers. To this end, DBT performs and facilitates technology assessment and foresight, public engagement, responsible research and innovation (RRI), and new forms of governance. DBT has sound experience as a TA body and in citizen engagement.

DBT is recognised as a global frontrunner in participatory technology assessment, participatory foresight, and public participation more broadly. In 2010, it was awarded the Jim Creighton Award by the International Association for Public Participation (IAP2), which recognised its 'enduring and significant contribution to the practice of public participation and for innovative and creative approaches'. DBT initiated the development of the World Wide Views (WWViews) methodology and has coordinated its application on three occasions to facilitate citizen participation in UN decision-making on global warming, biodiversity, and climate and energy. DBT has experience and provides expertise in areas of research and innovation policy, such as ICT policy and ICT usage in the public

[3] G. Aichholzer, 'The Delphi Method: Eliciting Experts' Knowledge in Technology Foresight', in A. Bogner, B. Littig and W. Menz (eds.), *Interviewing experts*, Palgrave Macmillan, 2009.

[4] Description of a Delphi Survey, Involve – UK public participation charity.

[5] The Human Brain Project.

[6] EU strategic foresight study in support of the Commission proposal for Horizon Europe, Beyond the Horizon: foresight in support of future EU research and innovation policy (BOHEMIA), European Commission.

sector, energy policy, climate change mitigation, land use planning and infrastructure, and health policy.

3. Scenario development

A scenario is a possible future situation presented in narrative form. Typical characteristics of scenarios are that they are hypothetical and fictive futures, and that they include uncertainties. Scenario work allows the comparison of alternatives that could shape the course of events. Scenarios are distinct from prognoses because they do not set out to predict the future.[7]

3.1. Envisioning possible future developments

Foresight conversations or brainstorming sessions seek to challenge assumptions of possible future developments from the evidence base and to assess the scenarios; they should involve stakeholders in a representative manner. To date, 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 survey, including Delphi-type ones, provide alternatives to physical face-to-face group sessions. Such surveys are based on evidence-based work and inform the stakeholders about the expert findings; stakeholders are presented with a first set of scenarios, which they can challenge.[8,9]

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 possible future developments, which are elaborated in the set of scenarios, and consider the stakeholders' views. Every member of this 'panel' can air their judgments as well as the reasons behind them. The purpose is not to convince other members of one view, but rather to enable a broader understanding of what may happen or be needed in the future.

The concerns collected in this manner – the 'hopes' and 'fears' of the societal stakeholders – yield valuable input for the assessment of the policy options in the final policy briefing. This guarantees that the possible impacts of the options on society are broadly assessed. Thus, the briefing can support Parliament in future-fit decisions and, overall, in its preparedness for likely future developments.

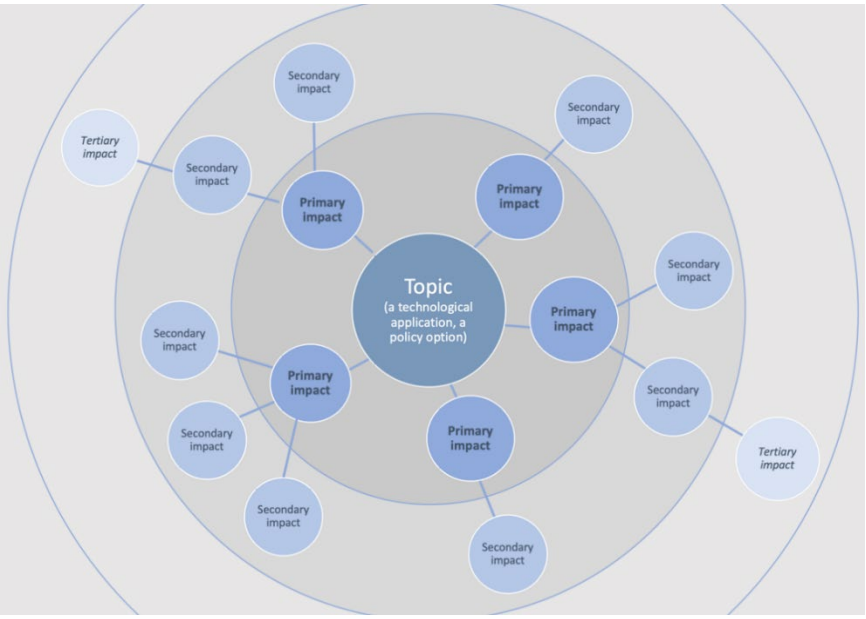
One practical brainstorming method for assessing possible futures is the 'futures wheel' (Figure 1). This is a visual method to anticipate the direct and indirect future consequences of a particular change or development. It is a way of thinking about the future – and questioning it – in a structured manner. This futures wheel is also useful for the assessment of cross-policy impacts, which comes as a later step.

[7] S. Mienert, Field manual – Scenario building, European Trade Union Institute, 2014.

[8] The Bohemia study, European Commission.

[9] Shell, Scenarios: An Explorer's Guide, Exploring the Future, 2008.

Figure 1 – The futures wheel, a tool for assessing impacts



Source: adapted from Jerome C. Glenn (1994).[10]

3.2. Scenario building

For possible futures to be explored, a set of fictive but believable future scenarios incorporating possible societal concerns should be considered. These scenarios should be diverse, including unlikely and disruptive scenarios, and present an acceptable narrative of the future. Exploring disruptive scenarios helps the final outcomes be more robust and resilient. Examples of such disruptive scenarios are 'a world without agrochemicals' or 'a six-metre rise in sea level'.

It is important to communicate clearly to participants that these scenarios are fictive, to avoid the false assumption that they are proposed policy measures. It should be clear for all involved that the scenarios are not forecasts but images of possible future developments. Their purpose is to envision what might happen; a set of diverse scenarios allows possible futures to be explored. Therefore, scenarios should be sufficiently thought-provoking, internally consistent and plausible. Each scenario should be fundamentally different from the other, and it is very helpful if extreme scenarios are considered.

Scenarios can be drafted by drawing on an 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 some external participants, such as experts or stakeholders, and possibly with the help of a scenario-method expert. Usually, they are the result of a '360-degree envisioning' exercise that uses the STEEPED approach and explores possible hard and soft impacts (Figure 2). STEEPED organises the assessment of technologies along seven perspectives:

- Societal
- Technological
- Economic
- Environmental
- Political/legal
- Ethical
- Demographic

[10] J. Glenn, The Futures Wheel, The Millennium Project, Futures Research Methodology - .

STEEPED helps to study a topic and related policy issues holistically, thus ensuring that their corresponding impacts are analysed in all areas of concern. Areas investigated along different dimensions may overlap, but that is not a problem; the aim with STEEPED is to prevent the project team from overlooking relevant impacts, not to organise areas into mutually exclusive categories. Not all perspectives are necessarily relevant, but the overall scheme guides 360-degree thinking.

Figure 2 – The STEEPED scheme

A possible approach for scenario development is the one used by Shell,[11] who were pioneers in scenario-based foresight work in the early 1970s and published good reports on it. It follows six steps:[12]

- **Defining the problem:** to decide on assumptions and drivers of change, as well as a time horizon
- **Defining the framework:** to bring these drivers together in a viable context, identifying both major familiar facts and uncertainties as key factors. Identifying these factors helps to reduce the set of potential influencing elements to a set of top priorities.
- **Outlining the scope:** once the list of key factors has been established, different 'projections' for each key factor can be identified and described based on 'perspectives' relating to specific time horizons (e.g. 2030). Consistent 'bundles of projections' can then be used to construct scenarios and identify a range of alternatives using the process based on STEEPED, as described above.
- **Selecting scenarios:** the number of scenarios to analyse can be reduced by selecting the most representative covering the full scope or the desired range. This selection is based on likeliness and/or the level of risk involved in the situations being described. A typical set of scenarios might include:
- keeping the status quo: where things stay as they are, although the environment may evolve as usual;
- different scenarios (usually two) involving gradual or incremental adaptation;
- one (or more) disruptive scenarios where drastic measures are envisaged.
- **Creating the scenario narratives:** for each chosen scenario to be analysed, the key characteristics describing it can be expanded in more detail. These descriptions help make

[11] Shell, Scenarios: An Explorer's Guide, Exploring the Future, 2008.

[12] S. Mienert, Field manual – Scenario building, European Trade Union Institute, 2014.

the scenarios understandable and provide the information needed for their use in policy development. Alongside these descriptions, a narrative storyline can be developed for each scenario to 'bring the scenario to life'.

- **Exploring scenarios:** once the scenarios have been developed, they can be used to perform the corresponding analysis aimed at extracting policy options by following the methods described below.

4. Scenario exploration: appraisal of the societal concerns identified

Once a diverse set of scenarios has been defined, a well-balanced variety of actors belonging to different groups of interest are invited to participate in the process. These actors are encouraged to envision a large number of consequences of the range of possible future scenarios provided, including extreme ones. Thus, the diverse scenarios serve to explore possible futures and ensure that stakeholders envision a wide range of impacts from the available options. They can help establish an open state of mind for understanding the concerns of today by letting participants abstract from their own concerns connected to the specific future scenario they usually envisage. In this way, participants can reflect more freely about concerns related to the issue. The sequence of activities used in the engagement process is described in Section 4.2.1.

Scenario exploration usually takes place in a second brainstorming round, following an initial survey to collect individual 'hopes and fears' related to the proposed topic that may also have been used to inspire scenario building. The team performing the study (in the case study below this would be STOA administrators, together with DBT) then propose explorative scenarios for participants to investigate those concerns in more detail. These investigations uncover key societal issues that the policy must address.

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

4.1. Engagement methodology

This section analyses a variety of options for online engagement exercises, then proposes a combined methodology, which is implemented in the case study below.

4.1.1. Options for online engagement exercises

Engagement tools are used in general surveys and for academic purposes. The usual method consists of collecting inputs from the participants in the form of answers to the questions posed and processing the information afterwards, to provide feedback in due course. For other engagement processes in which interaction and discussion among participants is desirable, being able to collect and present feedback during the actual discussion can be useful. In general, collecting input from participants in the engagement exercise can be done in two different ways.

Synchronous or 'live' exercises

Participants provide their answers during an online session while they are connected and within a pre-fixed time limit. They can interact to ask questions and receive additional information and clarifications during the process. In principle, any engagement tool can be used for live online exercises (e.g.: Slido).[13] However, some extra dedicated services may be required to manage the engagement tool as the process usually requires additional work and expertise. There are different ways to proceed depending on how the results are presented, reviewed and discussed:

[13] Slido website.

- Discussions in real time: the use of engagement tools makes webinars more dynamic, provided that the results can be compiled, duly presented, and discussed during the meeting. It makes it possible to see how the participants are reacting to the questions, which helps feed the discussion. This is certainly an asset, but it entails a significant amount of extra preparatory work that STOA may not be able to manage in most cases and may require a dedicated team – a change in the way STOA prepares online events. Webinars cannot be moderated by a single person: several people need to manage the tool, but also select the questions posed by attendees and process the answers, while someone else moderates the meeting and gives the floor to the other members of the team when the gathered results are ready to be presented.
- Deferred discussion: inputs from participants are collected during the introductory session. This can be followed by an individual or collective reviewing session to discuss the results with participants.

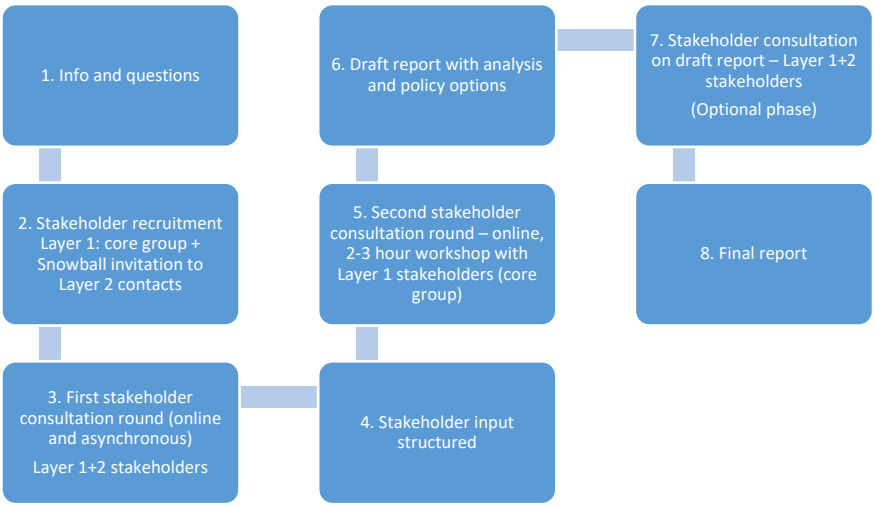
Asynchronous or 'deferred' exercises

As in a conventional survey, following an explanatory session with the required information and instructions, participants can provide their answers at leisure against a pre-arranged deadline that gives them ample time to fit this task into their agendas. They can use different methods to contact the organisers of the survey (or other participants) if clarifications are required.

4.1.2. Proposed engagement procedure

After analysing the options above, and in the context of the present project, the corresponding discussions between the Foresight Service at STOA and DBT made possible to establish a complete engagement process as follows (Figure 3):

Figure 3 – Generic engagement process



Information and questions

This initial phase is intended to focus the discussion. A preliminary study is required in this phase to collect the most relevant information available on the topic and the scenarios covering the broadest possible spectrum of choices. These scenarios can be hypothetical, are usually related to the implementation of different political options, and follow the principles established in Section 3.

Stakeholders recruitment + 'snowball' invitation

For this step, several actors are invited to respond to the survey as stakeholders from different groups. The selection of these actors is performed following the principles elaborated in Section 1.1 and constitute the 'core group'. Furthermore, each member of this core group is also asked to nominate three other representatives of their field to complete the survey, these new participants constitute the 'snowball group'. This snowball method makes it possible to reach a broader variety of stakeholders.

First round of stakeholder consultation

A first asynchronous consultation is conducted, where stakeholders reply to a survey prepared using the 'EngageSuite' online platform with their views about the different proposed scenarios. The invitation to this consultation is extended to all participants (core group and snowball group).

Input analysis and structuring of consultation results

The results of the first consultation are compiled in a structured document by the foresight service of STOA. Responses are duly analysed and structured in clusters, collecting clarifications and adding further justifications when required.

Second stakeholder consultation – online workshop

An online workshop is organised to prepare a collective, synchronous revision of the initial working document prepared by STOA in the previous phase of this process. Usually only members of the core group are invited to this exercise. However, actors not able to attend can delegate one of the members of the snowball groups they proposed in phase two.

Analysis of results

After a revised document has been obtained, an edited version is prepared with the results of the process that has been described. This document is prepared by STOA to properly reflect all the contributions and collect as rich and varied information as possible in a properly structured way.

Stakeholder consultation of final report

A second asynchronous exercise can be prepared where all participants (core group and snowball group) are offered the opportunity to review the version of the document resulting from the previous phases. However, existing opinions/options are not meant to be modified in these successive revisions, the purpose of which is to keep adding opinions that may have been missed before and clarify those already collected.

Final report

The engagement process described above helps to prepare information reporting on as many arguments as possible in favour and against the broadest possible range of approaches to the topic of discussion.

The result of this structured process is the corresponding STOA report, gathering the broadest possible scope of stakeholders' views and their analysis regarding a wide range of possible future scenarios: the 'action phase'. The final document thus obtained will serve to inform policy makers about the societal concerns regarding gene editing in subsequent political discussions.

5. Case study: genome editing in plants, with a focus on crops

To gain insight and experience in the use of online methods and tools for stakeholder engagement, it was decided that these methods and tools should be applied in practice to one ongoing STOA project. To that end, STOA selected a typical foresight study carried out by its Scientific Foresight Unit. This foresight exercise investigated a complicated issue that is the subject of controversy: exploring 'the challenges of genome editing in plants, with a focus on crops'.[14] The ultimate purpose was to gain insight into the concerns (hopes and fears) about the issue present across a range of fields. This was achieved through discussion of the arguments in favour and against a selection of hypothetical policy options. The results are expected to help inform the deliberations taking place in the European Parliament.

Experts from DBT guided the STOA team in setting up and running the procedure for this project. This section reports on the engagement process used by the Scientific Foresight Unit for the elaboration of the chosen study.

5.1. Stakeholder analysis

This exercise started with a stakeholder analysis as described in Section 1.1.2, establishing the following list of relevant parties:

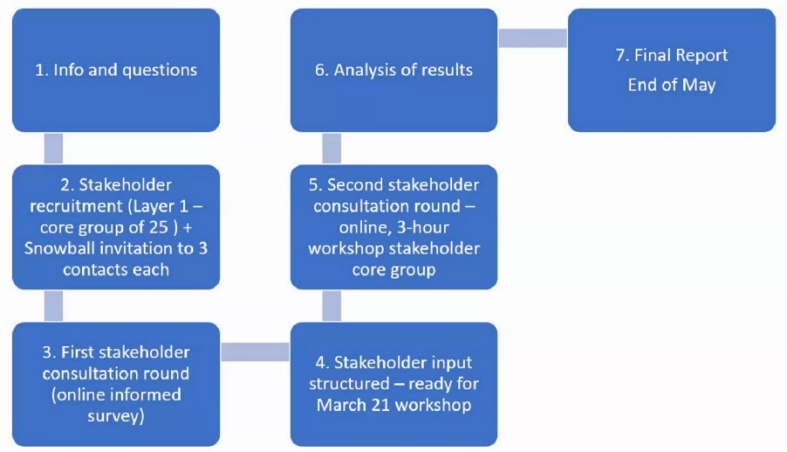
- Agrarian industry and research
- Administration policy
- Consumers and lobby watch
- Farmers and environmental NGOs
- Trade and food science
- Behavioural Scientists

5.2. Stakeholder engagement process

The next phase was an engagement exercise consisting of different steps aiming to collect as much information as possible about the different opinions on the subject held by all parties as determined in the stakeholder analysis. The process was performed as follows (Figure 4).

[14] The challenges of genome editing in plants, with a focus on crops (online event).

Figure 4 – Engagement process used for the case study



5.2.1. Information and questions

In the case of genome editing, a study[15] on the subject already produced by the Rathenau Instituut ('Genome editing in plants and crops. Towards a modern biotechnology policy focused on differences in risks and broader considerations') provided a useful starting point for this foresight exercise. A brief introduction to the subject was prepared based on this study to inform the stakeholders participating in the discussion. The study presents and discusses four policy options for the governance of plant genome editing in response to the new scientific developments in the area:

- **Policy option 1:** no revision of the European GMO Directive. If the European Commission does not amend the GMO Directive, genome-edited crops will be subject to GMO legislation, including mandatory risk assessments and monitoring of these new products.
- **Policy option 2:** amendment to the European GMO Directive. The European Commission could amend the GMO Directive to exempt genome-edited crops and plants without any foreign DNA present in the product. No risk assessments or monitoring of these new products would occur. As formulated in the study used as reference, all other applications of genome-editing techniques would still be subject to the GMO Directive.
- **Policy option 3:** a level-based policy including broader considerations where the level of risk assessment is, based on genetic changes. The EU could opt for a new authorisation approach that considers not only risks and safety, but also broader societal and ethical aspects as well as the need to encourage socially responsible innovation. This approach addresses the concerns and arguments described earlier in relation to options 1 and 2 and is based on adjusting the risk assessment to the expected risks.
- **Policy option 4:** a level-based policy including broader considerations, where the level of approval system is based on societal values. Like the previously described approach, this policy option also represents a level-based policy including broader considerations. However, instead of adjusting the risk assessment to the expected risks, in this approach the risk assessment levels are distinguished by an evaluation of the policy objectives, socio-economic considerations and ethical justifiability that takes place before the risk assessment.

A survey was prepared on the basis of these options with the same simple and straightforward questions for each option:

- What are your main arguments in favour of this policy option concerning its possible effects on society, including the social, technological, economic, environmental, political and ethical aspects?

[15] Report, Genome editing in plants and crops, Rathenau Instituut.

- What are your main arguments against this policy option concerning the effects of this choice on society, including the social, technological, economic, environmental, political and ethical aspects?
- If there is anything else you would like to mention concerning this policy option, you can write it here.

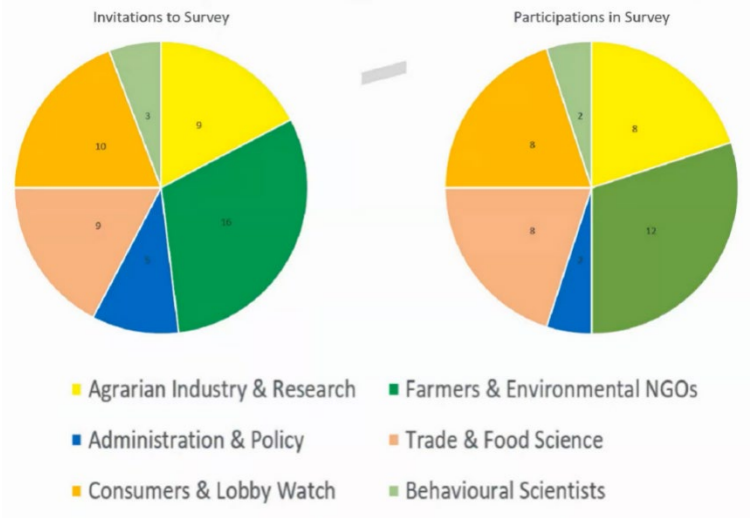
5.2.2. Stakeholders recruitment + snowball invitation

For this step, STOA invited a core group of 25 key stakeholders from different fields to respond to the survey. The members of this core group were also asked to nominate three other representatives of their field to complete the survey (snowball group).

5.2.3. First round of stakeholder consultation – survey

A first consultation round was conducted where the stakeholders replied to the survey prepared using the 'EngageSuite' online tool as described above. 52 stakeholders were invited to complete the survey, and 40 did (see Figure 5).

Figure 5 – Breakdown of stakeholder participation in the case study per field



5.2.4. Analysis of input and structuring results of the consultation

The results of the first consultation were compiled into a set of structured documents by the Scientific Foresight Unit. The resulting documents – one per policy option – presented an overview of all the arguments expressed by the stakeholders for and against each policy option and their corresponding explanations.

5.2.5. Second stakeholder consultation – online workshop

To clarify the various arguments, the documents thus produced were then edited during a three-hour workshop by a group of 18 stakeholders representing all different positions. These participants were divided into four mixed groups, each including as broad a variety of positions as possible. All groups worked on one initial document, adding their comments to the phrasing of the arguments in the initial version proposed by STOA and introducing any original arguments and opinions they felt had been left out or not represented. The four groups then rotated three times for a total of four different sessions, so that each group analysed each of the four political options. In each session they edited the documents and added to the comments already introduced by the other groups in the previous sessions.

The intensity of the debates within the groups attested that sufficiently diverse opinions for and against the different options were represented. This even led participants to include comments in the feedback survey that a three-hour workshop was too short. However, the purpose of the sessions was not for the participants to convince each other of their opinions, but to help each other and STOA clarify all arguments for and against the four policy options.

The end result of this workshop was a complete document that was revised successively by the different groups, ensuring that no opinions were missing and all were as clearly described as possible. Thus, the final document was a collaborative effort of all stakeholders in all groups.

5.2.6. Analysis of results

A final analysis was made of the workshop outcome, improving the overview of arguments for and against the four policy options.

5.2.7. Final report

A STOA report with all results and their analysis was prepared including the broadest range of opinions it was possible to collect through this structured process. The arguments collected, reflecting all possible wishes and concerns, were taken into account in drafting a report, sorting them according to the committees in Parliament with the corresponding competences.

6. Results and remarks

The outcome of a 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. It is essential to build a list of societal concerns (hopes and fears) expressed during the exercise. The hopes and fears are then categorised according to the EU's policy areas and parliamentary committees, making them easily accessible to MEPs and committees.

The final result of this structured process is a STOA report collecting the broadest possible scope of stakeholders' views and their analysis regarding a wide range of possible future scenarios. This document reflects all the contributions and collects as rich and varied information as possible in a properly structured way to be communicated to the relevant parliamentary committees to support their decision-making. This is an example of a process whereby advisers gather insights into society's collective policy preferences and aversions, which are then taken into consideration in the assessment of policy options.

The Scientific Foresight Unit made use of the expertise of DBT through a collaboration in performing a complete engagement process applied to the proposed case study. DBT provided two types of support in the engagement process. The first was the provision of the engagement tools to the STOA team. The second was the methodological support and assistance in using these engagement tools for this STOA project. This experience has made it possible to assess the method as explained below.

6.1. Assessment of the implementation process

During the exercise described above, the tool used for implementing the process was managed mainly by DBT. It was noted during this analysis that the platform has to allow the most common question types, such as like multiple-choice, prioritisation of options, written answers, ranges for ratings (for instance from 'not important at all' to 'very important') and use separate participant types (e.g. predefined lists of countries, stakeholder groups, age groups). The tool also needs to be compliant with the General Data Protection Regulation (GDPR) and provide privacy by default.

The proposed engagement exercises require the commitment of participants to activities that are time consuming and demand intellectual effort. Such effort needs to be duly acknowledged and rewarded with access to at least some information regarding the results. In the same way as students expect to receive marks for their work after introducing their contributions online, the participants in an engagement exercise are usually keen on receiving feedback. Therefore, engagement tools ideally include a feedback feature.

It was ascertained that no matter the tool used, there is extensive preparatory work involved in the engagement process as well as for processing the results. Engagement exercises require specialised staff.

6.2. Assessment of the methodology

The process described above and its application to the selected case study made it possible to extract some conclusions on the adequacy and efficacy of the proposed methodology for engagement exercises.

A crucial step in the foresight process is the selection of candidate participants to be invited as stakeholders from different groups, who must provide as broad a range of perspectives as possible. The

selection of these actors using the 'snowball method' explained in Section 1.1 is an efficient and reliable way to multiply relevant contacts, using the pre-existing networks of the stakeholders themselves. The overlap and variety of the new participants proposed also helps to ascertain whether a broad enough range of actors had originally been covered.

Invitations had to be sent sufficiently in advance to allow an ensuing phase of additional exchanges with the participants. At this point, it was necessary to introduce clarifications in response to a variety of questions posed by participants. Depending on their previous degree of knowledge on the subject, some participants might require a longer time to review the information provided than initially allocated for the process.

It was found that preparation of the initial information, introducing the topic and describing the scenarios with their corresponding policy options, is key to the process. The scenarios to be presented have to include sufficient variety to feed into the discussion and help participants focus on alternatives different from their pre-conceived choice. This phase has to take into account the type of actors being recruited for the engagement process, since the information has to be presented according to the needs of the participants, depending on their previous degree of knowledge.

The first round of stakeholder consultation (the survey) made it possible to collect arguments in favour and against the proposed scenarios from all participants. During the subsequent phase of analysis, it was noted that additional ways of limiting the length of the responses were required, as some participants copied complete extracts from reference texts as part of their replies. It was found that this format of online surveys tended to produce less spontaneous answers than was usual for physical exercises such as Delphi-type surveys. This made the process of preparing the initial version of the document compiling all inputs obtained from the stakeholder consultation more demanding than initially envisaged. Therefore, sufficient time had to be planned between the end of the survey and the online meeting to ensure that the participants had received the outcomes of the survey well in advance.

Once the initial compilation documents had been prepared, they were revised in a subsequent workshop involving a selected group of participants. This group included members of the core group or their proposed substitutes from the snowball group. To ensure a 360-degree approach, the selection of attendees and delegates, the preparation of the corresponding invitations and the registration process had to be performed with the greatest care. The workshop itself ran very smoothly once all attendees had understood that the objective was not to convince other participants, but to collect as many views and opinions as possible to feed into the subsequent political discussion. The general opinion of the attendees was that the event was too short to allow them to express all their opinions and elaborate their reasons sufficiently to convince others. Existing opinions/options were not meant to be modified in these successive revisions, only clarified and added if missed.

7. Conclusions

To conclude, the most important lessons drawn from the process described in this report can inform similar future stakeholder engagement activities.

The STEEPED approach provides a systematic way of conducting an initial review of existing and emerging opinions (hopes and fears) concerning the topic under discussion, as well as an assessment of their associated impacts. The resulting overview can be used as a basis for the development of several explorative scenarios, in which existing and emerging technological solutions are put into action. Guided by the evidence available, the participants of the ensuing brainstorming exercise will then envision possible impacts, both positive and negative, intended and unintended.

Hypothetical scenarios – fictional stories about future possibilities – are a useful tool to guide foresight brainstorming to explore likely impacts of various possible alternatives. Such stories help to envision possible consequences of various imagined situations, including extreme ones, by establishing an adequately open state of mind for understanding the concerns of today. They also help participants avoid focusing only on their own concerns for the single specific future scenario they might picture. Scenarios can be used as a tool to enable dialogue with and between different stakeholders, and for reflection on policy options from a long-term perspective.

It was found that the stakeholder selection process became richer and more reliable by asking the participants initially selected (the core group) to name additional actors (the snowball group) as stakeholders to join and broaden the input. The analysis of the variety and overlap of actors in this additional snowball group made it possible to identify whether any relevant stakeholders had initially been missed and made it possible to compensate by adding names to the snowball group. This snowball effect greatly helped with avoiding gaps and reducing biases in the stakeholder selection process.

Requesting online statements as an initial step in the engagement process, after providing some initial information, allowed participants to work in advance in an asynchronous way. This gave them time to review the introductory information provided on the topic and look for additional sources themselves, which ensured they were better prepared and had assimilated sufficient background information to feed properly into the ensuing interactive sessions.

This process was not intended to replace the ongoing political discussion in Parliament, but to feed into it. The overall methodology was found to be useful for obtaining a comprehensive report with insights into a broad range of opinions of a diverse group of societal actors affected or concerned by the topic of the study (in this case genome editing of plants, with a focus on crops). The final document will serve to inform policy-makers in subsequent political discussions.

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The second part of the STOA study, 'A framework for technology foresight intelligence', this report deals with horizon stakeholder engagement for the strategic and practical purposes of the STOA Panel's activities. It analyses online engagement methods and tools and their suitability for brainstorming meetings, and for technology assessment and foresight projects.

To gain insight and experience in the use of online methods and tools for engagement, these were implemented in one ongoing STOA project. For this purpose, STOA selected a typical foresight study, investigating a complex issue that is the subject of controversy: gene-editing techniques for the future of farming in Europe. Experts from the Danish Board of Technology Foundation guided the STOA team in setting up and running the procedure for this project.

This paper assesses the efficiency of online alternatives for foresight brainstorming meetings with colleagues, MEPs, experts and selected stakeholders. These alternatives include traditional surveys (to ascertain societal concerns about possible future technological developments) and simple variants of Delphi-type surveys.

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