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Foresight for post-growth research: Integrating horizon scanning and scenario building for a sustainable future

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ABSTRACT

Post-growth research focuses on the possibilities of creating a flourishing human civilisation that respects planetary boundaries, following the concept of strong sustainability. As this endeavour aims to uncover interventions that lead to an unprecedented world, foresight is a crucial part of this scientific field. The post-normal times and metamodern thinking environment encourage the implementation of integrated foresight methodologies. This methodological study aims to showcase an integrated foresight process both to post-growth researchers and – due to its innovative approaches – to foresight experts. An organic connection between Horizon Scanning (HS) and Scenario Building (SB) was established, synergistically exploiting their advantages and applying them in a fully online environment. The paper aims not just to argue that this combination is suitable for pursuing out-of-the-box research like post-growth, but also to present this foresight process in sufficient detail, due to its innovative approaches, so that they can be reproduced in other research projects.

1. Introduction: conducting post-growth foresight research in post-normal times with a metamodern mindset

As human civilization has overshot six out of nine planetary boundaries (Richardson et al., 2023), radical measures are required to ensure that the ecological systems sustaining the very conditions that make our planet habitable are not further compromised. However, as decoupling promises are failing (Vogel & Hickel, 2023; Haberl et al., 2020), this does not seem possible without overcoming the growth fetishist mindset and the built-in growth imperatives of our economies (Keyßer et al., 2025). Post-growth, subsequently, is a research field that seeks alternative pathways to achieve wellbeing within the regenerative capacities of our ecological systems while removing the lock-in effects of growth pressures (Kallis et al., 2025). Post-growth research hence not only focuses on uncovering the critical failures of our economies to protect human and more-than-human entities but aims to map out what the alternatives could look like and how this transition can be achieved (Kallis et al., 2025). And for this, it needs to overcome the imaginaries of our current times and utilise foresight to establish transitional paths (Köves, 2025).

Sardar (2010) claims that we are living in post-normal times in the first half of the 21st century, as nothing in our world works the same way it did in the early to mid-20th century. Complexity, chaos, and contradictions characterize our times, and rather than moving backwards to normality, we must move forward in response to these challenges, seeking solutions to overcome them. To do this, we

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need to move beyond postmodern thinking and the delineation of multiple, equally possible futures, and arrive at a, transmodern or metamodern renewal, both in terms of social and individual value systems and placing human civilization and societies on new foundations (Sardar, 2010).

Much of post-growth research is being conducted along ecological economics (Daly & Farley, 2011) principles, and most ecological economists perform research within post-normal science (Funtowicz & Ravetz, 1994). In post-normal science, research considers the high stakes and the uncertainties involved and conducts policy-relevant investigations that engage diverse knowledge holders and perspectives (Funtowicz & Ravetz, 1994).

Visions of the future need to be built on new lifestyle values emerging at individual and collective levels, and the development of initiatives to change individual lifestyles, communities, and social institutions should be more strongly linked to the futures we want, while the role of foresight is to develop recommendations for policy interventions that effectively reflect on humanity's existential crisis and whose implementation is subject to strict control by citizens (Fergnani and Cooper, 2023; Kahan, 2020; Sardar, 2021). Hence, both post-normal science together with the emergence of the post-normal era, and the metamodern intellectual trend requires foresight processes to ensure a broad participation of individuals, their communities, and social institutions in the development of possible futures. It also needs to incorporate the results of foresight into the practical shaping of the future, both in terms of policy and the development of individuals' future orientation and future literacy. For this, it needs to create a system of interrelated foresight methods and procedures that can be organised into a practical process.

This study showcases how foresight methods can be integrated in practice into such a process by presenting post-growth research focusing on potential futures. In this research, we integrated Horizon Scanning (HS) and Scenario Building (SB) methods. The paper is organised into three main sections. In the first part, we briefly describe the two methods and show the key elements that enable the integration of these methods into a foresight process. In the second section, we describe in detail the process planning and implementation through the presentation of an ongoing research exercise. In the discussion section, we compare our own procedure with the method integration efforts tried by others, provide arguments for why this integration works well for post-growth research, and outline the limitations of the process.

The integration of foresight methods is particularly fitting to the strongly emerging field of post-growth as its developing concepts predominantly require the constant interpretation of the future. This interpretation can only be performed respecting its immense uncertainty, its diverse and intersectional perspectives, its complex dimensions. During this research, it was clear to all participating researchers that a post-growth future is one that treats the wellbeing of people and planet equally, and hence ultimately serves the survival of human civilization and cultures.

2. The main characteristics of HS and SB methods and their integration

Horizon scanning emerged at the beginning of the 21st century and has since then, in its imperfectly defined state, enjoyed great popularity as an important tool and first stage of the foresight process (Habegger, 2009; Sutherland and Woodroof, 2009). It has been and continues to be shaped by practice, although it also had methodological predecessors. Such predecessors include Dator's methodological proposal and practice of what he calls emergent issues analysis (Dator, 1996), and the so-called 'environmental scanning' was also widely used in the 1990s as a foresight process that looks for and explores changes in the natural environment (Gordon & Glenn, 2009). The third antecedent or subfield is the recognition of the importance of weak signals (Ansoff, 1975) and the recognition of the need to handle them in foresight (Hiltunen, 2008).

Currently several definitions of HS exist. In the UK, the Department for Environment, Food and Rural Affairs (DEFRA) (DEFRA, n.d.) first carried out HS research in 2002 and declared its aim to "improve the robustness of DEFRA's policies and evidence base," defining HS as a structured review of emerging risks, opportunities, and potential future developments that lie outside the scope of current strategies and thinking. They believed that it could uncover both new and surprising issues, as well as long-standing challenges and trends. Later, Sutherland & Woodroof (2009, p. 523) provided a similar, short and to the point definition: "a systematic search for potential threats and opportunities that are currently poorly recognized." The UK government in its portal devoted for experts in the Horizon Scanning Programme (UK government, n.d.), established in 2014, that "horizon scanning is about exploring what the future might look like to understand uncertainties better." Lavoix (2010, 2019) emphasised that HS is not supposed to be about predictions but about systematically looking at arising new meta-issues and issues, new trends, weak signals and unexpected turns that might come around in the future.

HS is widely considered as the first phase of foresight, preparing the ground and proving the basic information for the use of other foresight methods and procedures that deal with possible futures in more depth and detail, and for developing scenarios and strategies (Schultz, 2006). HS is not simply a method, but a targeted process in which several simpler methods are applied and combined to explore the selected event horizon in a multifaceted way over which the future is perceived. In addition to literature review, HS uses brainstorming, questionnaires and workshops, often conducted with the participation of different stakeholder groups and experts. The HS process also requires a systematic approach to the choice and interconnection of the simple methods used. A further requirement is that the whole process of HS should be bottom-up, i.e. the futures are revealed based on the perceptions of the people (Cuhls, 2020; Könnölä et al., 2012).

HS researches the whole future horizon looking for continuing trends (established and ongoing trends), new trends (themes that are already discernible and will shape the future), signs of important changes (weak signals), low-probability factors that could trigger extraordinary change (wild cards) and trendy, up-and-coming, so-called hype events. At the same time, the procedure should go as far as classifying the different types of futures under these terms (Amanatidou et al., 2012) and evaluating them according to the expected strength and desirability of their impact (Hideg et al., 2021).

Scenario building has been in use since the 1950s and as prominent players in the field, Kahn & Wiener (1967, p.6) summarized the SB method as a future exploring activity unpacking multiple possible futures: 'Scenarios are hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision points.' In her 1993 book on SB, futurist Masini emphasized that it is a forward-looking process assisting decision-makers by providing context and new knowledge about potential future developments, 'lowering the level of uncertainty and raising the level of knowledge' (Masini, 1993, p.90). Schwartz as a corporate strategist emphasized that SB is a tool for exploring possible responses to alternative future environments. He said that SB is 'a tool for ordering one's perceptions about alternative future environments in which one's decision might be played out right.' (Schwartz, 1991, p. 45). Chermack and Lynham (2002) highlighted its significance in learning about the possible behaviours of complex systems. Retek (2023) gave a comprehensive definition of SB being 'a process of developing possible futures, in which possible futures range from probable futures to a wider range of possible future alternatives, considering the specific processes of SB procedure. SB is a process in which possible future alternatives are formed in sequential steps. The outcome of the process is a set of scenarios' (Retek, 2023, p.21).

The definition shows that – similarly to horizon scanning – SB is also a set of procedures rather than a simple method. There are several types of SB procedures. The first and original one is the forward-looking SB developed by Kahn and Wiener (1967), which results in three possible futures: the business as usual, the best case and the worst-case scenarios. This approach is still used widely. Rhydderch (2009) presents three newer and regularly used SB procedures. These are the two axes method, the branch analysis method and the cone of plausibility method. The two axes method focuses on the creation of four types of scenarios that can be formed from two axes of high impact and low probability social, technological, economic, environmental, political, legal, ethical and demographic (STEEPLED) changes. This SB is also often used in current foresight activities (Wack, 1985; Glenn & Gordon, 2009). The other two SB methods mentioned by Rhydderch (2009) are rarely used and fall beyond the limits of this paper to be discussed at length.

In this paper, when we refer to SB, we henceforth refer to the two axes method. Its additional advantages include that in a rapidly changing environment; the behaviour of open and complex dynamical systems could change significantly if large impact STEEPLED changes affect them. Even if these so-called drivers have a low probability of occurring as we currently understand them, it is important to uncover their potential influence. Complex thinking about the future requires not only the work of a futurist team, but also the thinking and cooperation of stakeholders or expert groups. This collaboration is effective when each SB team is composed of members with different backgrounds as dialogue and mutual learning can advance the developing scenarios. Each SB team should also be assigned a visioning facilitator to assist in the professional implementation of the SB process. This SB process can also be implemented in an interactive, online format (Retek, 2021; Retek, 2023).

It can be concluded that both HS and SB methods can be understood as complex processes that consist of several simple forward-looking methods and can be built up differently depending on the required outputs and emphases. Both methods can be used in a participatory way so that different kinds of stakeholders can be involved.

The theoretical and methodological foundations of integrated foresight provide the theoretical basis for combining the two methods. Integrated foresight was brought about by increased social demands for sustainability, democratic participation, and knowledge integration (Hideg, 2009). Integrated foresight therefore focuses on making rapidly changing environments and complex foresight topics manageable (Slaughter, 2008). According to this school of thought, practical foresight research should be developed into a set of future-exploring activities including feedback and connections between methods that can deal with sudden and complex changes and that can involve a wide range of experts and stakeholders (Hideg, 2013; Hideg, 2015; Gidley, 2017).

Integrated foresight does not directly create ideas and visions about the future along a timeline but rather generates knowledge of how stakeholders perceive the future in the present time and space, and how their understanding of reality indicates them the dangers, the problems and the tasks to be solved, and the diverse quality visions of the future (dangerous, acceptable, neutrally possible, desirable). Besides, they are in contact and cooperate with experts, other stakeholders, social organizations, decision-makers, futurists, and non-human factors that shape the future (the natural environment, infrastructure, the functioning of socio-cultural relationships, and their impact on current living conditions and knowledge levels). Along the integral foresight paradigm, the latter factors are considered to be external and uncontrollable conditions that must be included in shaping and forming the future along the time axis, as non-human factors/actors themselves shape the future that will emerge. In the scientific literature supporting the theoretical development of futures studies, this co-developmental or collaborative cooperation is referred to as the coevolutionary (Hideg, 2015; Leydesdorff, 2001) or Collaborative Developmental Action Inquiry paradigm or approach (Torbert, 2021).

The development of integrated foresight procedures in practice is supported by several recommendations. Treating complexity and the subject of foresight as an open and complex system is common to all supporting materials. Complexity can be expressed by assuming that the subject of foresight is an open and dynamically interacting system, and by formulating the future-shaping trends and changes affecting it in the STEEPLED dimensions (Geels, 2005; Leydesdorff, 2001).

The so-called Foresight Framework recommendation, which is widely used in North America and was developed at the University of Houston, recommends a complex and dynamic approach to the subject of research and the following interrelated phases in the organization of foresight activities: framing, scanning, forecasting, visioning, planning, and acting (Hines and Bishop, 2013; Hines, 2020). The most important of these is the first phase, framing, which defines the context appropriate to the research objective, which is why this integrated foresight process organization was named the Foresight Framework. It can be concluded from the description of the procedure that it has been developed to serve the needs of institutional clients and that the process is carried out by foresight professionals who help in planning.

In contrast, the UN foresight handbook clearly regards integrated foresight activities as a process that provides information for the development of policy alternatives. It identifies two important methodological units of this service activity. One is HS, which involves exploring and identifying important issues for the future, trends, and various types of change. The other methodological unit is SB,

which involves exploring possible, feasible, and desirable complex visions of the future and alternative scenarios (Foresight Manual, 2018; Global Sustainable Developemnt Report, 2016). This is complemented by the so-called Concurrent Design Foresight model developed in the European Union. It also suggests that in the integrated foresight process, different types of stakeholders must also be continuously involved, and the entire foresight process must be closely linked to policymaking and the development of the foresight and future-shaping knowledge of stakeholders and civil society (Concurrent Design Foresight, 2015). A recent study Jabbour et al. (2025) that drew conclusions from the UNEP's Foresight Trajectory expand this approach by arguing that building a wider and stronger foresight community within the international entities would contribute to an enhanced ability to dynamically imagine and realize futures.

With regard to the possibilities for linking the two methods, based on recommendations in the literature on the organization of foresight activities and our own previous research in this area (Azimi et al., 2017; Gáspár et al., 2023; Hideg et al., 2021; Sacio-Szymańska et al., 2016), we have developed the view that integrated foresight that is feasible in practice must combine several methodological characteristics. These include complex problem solving and treating the subject of foresight as a system in multifaceted dynamic interaction with its environment that can be ensured by incorporating the STEEPLED framework into the entire foresight process. We accept the basic principle recommended by the UN handbook claiming that the backbone of integrated foresight is formed by the combination of HS and SB. However, these must be combined in a way that is accepted and embraced also by the stakeholders involved who are motivated by the practical shaping of policy and their participation in a learning process.

To truly combine the two methods rather than simply applying them one after the other, we must also examine the overlapping and differing elements. As certain elements are included in both methods, we might utilise these as subtasks and make sure not to repeat them during the integrated process. Instead, research outputs of one method serve as inputs for the other; e.g., weak signals of changes from HS are used as drivers of scenarios in SB. When it comes to the differences, sometimes a logical or methodological connection between the methods can resolve the discrepancies, but sometimes the contradictions cannot be offset and constitute as limits to the process.

The main characteristics of the HS and SB methods presented in the previous section allow for their comparative analysis. As mentioned earlier, they both include several simpler methods like literature review, brainstorming, surveys and workshops. In terms of content, both deal with the complexity of the future. HS operates with terms like trends, weak signals, wild cards, and hype events, while SB follows the STEEPLED dimensions of the future. Both methods can be used by a foresight team, but they can also be applied in a bottom-up manner with the involvement of various stakeholder groups and the facilitation of the foresight team. The methods can be applied both in person and online.

The methods differ in the form in which their results take shape. The result of the HS method can be a list of possible future changes, but it can also be a list of types of future changes and their evaluation. In contrast, the SB method results in narratives related to the four quadrants describing the relationship between the STEEPLED dimensions and their changes over time in different scenarios. The individual narratives represent alternatives to each other according to the chosen axes.

The similarities and differences between the two methods make it possible to link and build on each other. The similarities lay the foundation for the establishment of a close relationship between HS and SB. On the other hand, the differences allow the SB, which builds on the results of the HS to an extent, to expand and steer HS towards qualitatively new futures. The key to linking them is that the HS should end with the various possible types of futures and their evaluation included in the results to be used to select the driving forces for SB. The theory of the two-axis SB method emphasizes that it is not the continuous future that is important, but the new quality of futures, so the SB must also start from the elements that generate new quality futures that were scanned in the HS phase. These will be the new input values, i.e., the low-probability but high-impact weak signals and wild cards that may come into play. If these are fulfilled, it is possible to integrate the two methods.

Our method integration was planned to be tested by using a Delphi method. Its task was to prove the broader acceptability of the scenarios elaborated and selected by post-growth experts. The realisation of this task was conducted in a wider circle of experts who even though belong to the network of post-growth researchers and work with sustainability perspectives, not directly considered post-growth experts.

The integration of the two methods can be facilitated using online software (Hideg, 2025): a platform that contains multiple types of software and is also suitable for using simple methods applicable in each phase online and linking their results on a single platform. Online Delphi surveys, multi-purpose and multi-stage online workshops, or narratives to be created in SB also enable broad and participatory involvement (Gordon, 2009; Retek, 2021; Retek, 2023; Futures Platform). In the following section, we provide a detailed example of such an integrated process in a post-growth research.

3. Integrated foresight process in a post-growth research

'Models, Assessments & Policies for Sustainability' (MAPS) is an international Horizon research project that aims to broaden the range of post-growth policy options and assessments for strong sustainability. It uses a diverse range of research methods including participatory processes to develop policy packages and scenarios that transcend our growth oriented economic *modus operandi*. It also applies state-of-the-art simulation models, drawing on recent work in the interdisciplinary field of ecological macroeconomics to advance our understanding of such policies and scenarios. The foresight activities were planned for the first part of the project in order to be able to build on its results and insights in later stages. The time horizon of the process was set at 2050.

The process intended to engage all researchers involved in the MAPS project. This meant 55 researchers from 8 different countries with a wide range of expertise but all focusing on the importance of post-growth. The first phase consisted of the integrated HS and SB methods (Fig. 1). We insisted that at least three people from each of the six work packages participate in the three workshops we

organized with at least one junior and one senior member representing the WP. At the second (ongoing) phase, we invited a wider range of experts from many fields to enrich the scenarios in an eDelphi process.

For the horizon scanning, MAPS researchers were invited to brainstorm by filling in a Qualtrics survey. They were asked to identify at least 3 future issues relevant and important to their research background and then to briefly explain their social, technological, ecological, economic, political, legal, ethical, and demographic (STEEPLED) dimensions. These statements were then cleaned and filtered to make sure that each statement is condensed into a single sentence. This resulted in 567 future statements from 28 participants.

The future statements were then anonymised and filtered by the foresight team based on the literature review of already covered thematics in existing HS research or widely discussed in post-growth research. This was meant to make sure that our research covers topics that are not already widely available. This reduced range (60) of statements were also ranked according to its novelty, so that in workshop 1, the most novel ones were to be classified (finally 32 statements).

The participants (14 researchers and 6 facilitators) discussed the statements one by one and applied the Osgood classification and rating scale (Hideg et al., 2021). They classified each statement into one of the following categories:

- Trend focused on Europe,
- Megatrend focused on the environment globally,
- Wild card focused on unpredictable events or situations; events that have a low probability but a high impact,
- Weak signal focused on early sign of currently small changes that can presage a strategic discontinuity, and
- Hype focused on something that seems more exciting or important but only in the present.

In parallel with the classification, each statement was assessed along the direction – positive, negative or neutral, based on the respondent's current values and expectations – and strength of their future impact. Thus, the scale consists of −3, −2, −1, 0, +1, +2, and +3 values. The classification and impact assessment together determine the quality of the future statements collected in the HS

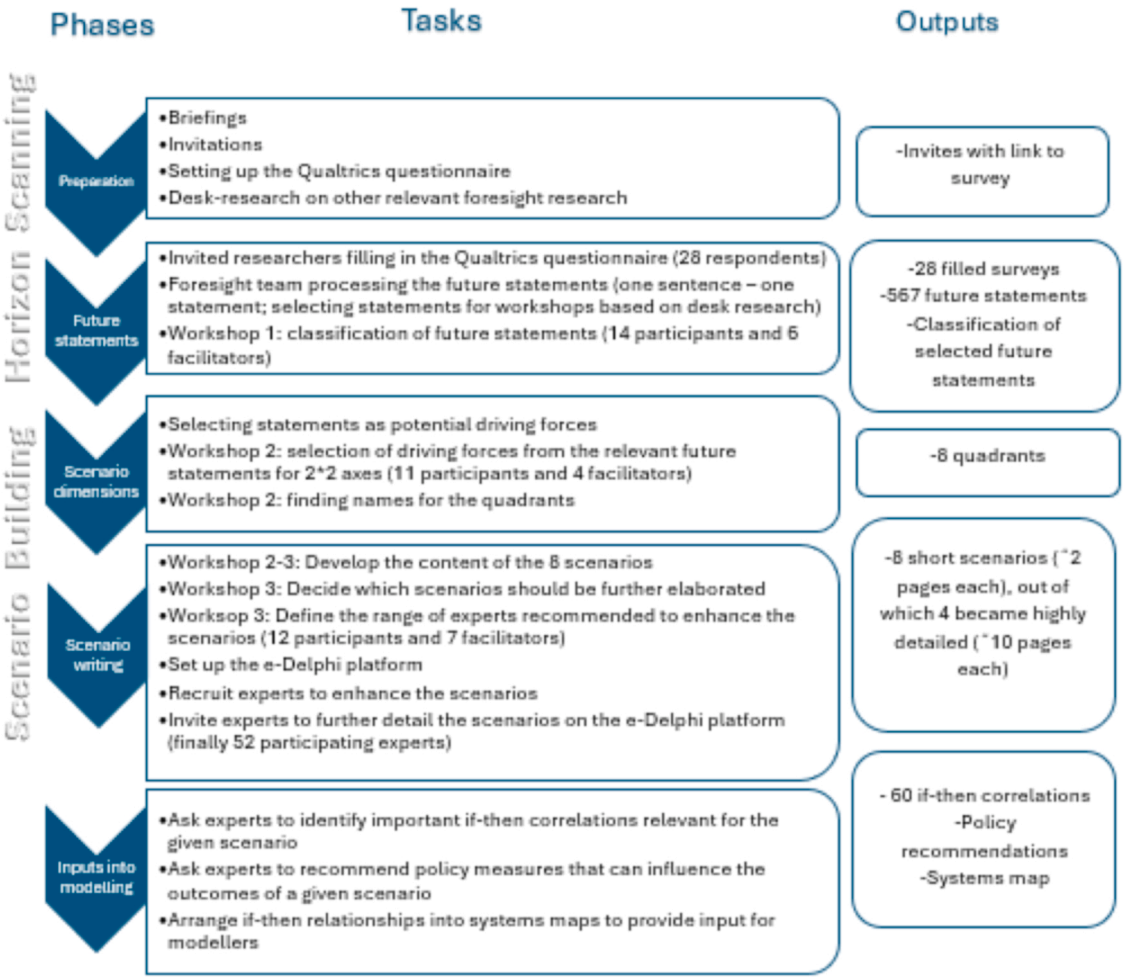

Fig. 1. Research process. Source: authors.

process for further research. (See examples in Table 1.)

The SB was based on the results of the first workshop. 16 statements out of the 32 were classified as either wild cards or weak signals with their impact rated as + /-2 or + /-3. The participants of workshop 2 (11 researchers and 4 facilitators) discussed the statements in detail, focusing on how to connect those to make meaningful pairs of axes for scenario building. The discussion resulted in the selection of 4 driving forces (see Table 1), after which participants were divided into two breakout rooms where they interpreted the two extremes of the driving forces and started to build the scenarios in the four quadrants (Figs. 2 and 3). Finally, the groups rejoined and shared the results with each other, reflecting on the various aspects of the STEEPLED framework (Fig. 4).

The first narratives of the scenarios were sketched by the foresight team based on the draft versions created by the participants during workshop 2. The resulting texts were then further reviewed and expanded by the MAPS experts in workshop 3 (12 researchers and 7 facilitators). The STEEPLED dimensions were used also in this phase (see Fig. 4) to enable the experts to think about the scenarios from different perspectives potentially covering the widest range of subjects.

In total, 8 complex scenarios were prepared, covering the range of futures that are possible, new, creative, and that are different from the consequential futures or those described in the scientific literature. Participants then selected 4 scenarios from the 8 to be further developed by a wider circle of different stakeholders in an eDelphi process: 'autocratic collapse', 'democratic caring for nature', 'ecological autocracy', and 'elitist green bubble.'

The facilitators of the online workshops were appointed from among the foresight team on a pre-defined professional basis, considering their experience in facilitating participatory research and their availability for continuous involvement in the organisation of the workshops. In most cases, two facilitators were necessary for each breakout room as one was making sure that the discussions were running smoothly, while the other made notes and filled in the preplanned online tools simultaneously to enable participants to see the developing consensus. The total time frame for the three online workshops was 9 h which was used very purposefully. The tasks to be solved were given at the beginning of each workshop and their outlines available to the participants at any time during the workshops, thus, the presentations proved to be useful and sufficient. However, it is important to note that participants were researchers themselves with high knowledge capital.

After the final scenarios were chosen, the intention was to enrich the scenarios with experts outside the MAPS consortium. The Delphi study (Linstone & Turoff, 1975) was applied to obtain expert assessments, primarily in areas characterized by significant uncertainty and complexity (Niederberger et al., 2024; de Loë et al., 2016). 52 experts from academia (30 experts), government (8 experts), industry (4 experts), and civil society (10 experts) with an average of 14–15 years of experience and coming from 29 countries convened to assess four distinct scenarios in a two-phased Delphi. The process consisted of two parts and was managed online on the eDelphi platform. The first round was conducted from May to June 2025, with the main aim of enriching the four future scenarios by identifying the selected topics' evaluation, interconnection, and the primary factors driving them. The second phase took place in September 2025 to fine-tune the results by validating 'if-then' correlational statements and identifying policy interventions to provide input for modellers. The collected data is mainly qualitative, but it also includes some quantitative elements. For example, participants were asked to rate how likely, or desirable they consider different futures to be. As the eDelphi platform facilitates knowledge exchange between experts, we also encouraged the participants to comment and engage in collaborative discussions.

The entire research process was organised exclusively online. Technically, the survey on the future statements was conducted in Qualtrics, the workshops were run on the Microsoft Teams platform, and the Delphi process was implemented using the eDelphi platform developed by Finnish future research institutes (eDelphi.org). During the workshops, some parts were organised using Mentimeter, some using Whiteboard. Recorded audio of the workshops was processed with Perplexity. Content analysis was performed using NVivo and Atlas.TI.

Table 1
Examples for outputs in the HS phase. Source: authors.

Examples for Future Statements	
Because of environmentally forced migration crisis and decreasing liveable areas, scientists and engineers test new forms of living underneath of earth.	
Eco-anxiety and -depression will lead to young generations blaming the previous generations for the ecological decay.	
The moral imperative to protect marine resources not only for current populations but also for future generations who depend on these ecosystems will grow.	
Examples for high impact weak signals that could be used to establish driving forces	**Osgood rating**
Due to Generation Z and consecutive generations not buying into the "work-based society" narratives, work-life balance will be a central issue at companies.	+ 2
As the fashion industry is polluting, tracing the life cycle of a pair of jeans becomes possible.	+ 2
Through the ethical imperative for equitable energy access and its consecutive legal measures, communities will insist on policies to include this perspective, making energy services accessible for all, in particular marginalised communities.	+ 2
Examples for high impact wild cards that could be used to establish driving forces	**Osgood rating**
As people rely mostly on AI, they do not find education useful or beneficial any more.	-2
Social uprisings abolish capitalism.	+ 3
As the fashion industry is polluting, commercials are banned and new business models are quickly growing in the field of second-hand shopping.	+ 2
Selected final four driving forces for the two axes	
The rate of participation in society	
Intensification of ecosystem use and fragmentation	
Respect for human and non-human diversity	
Ethicality in business	

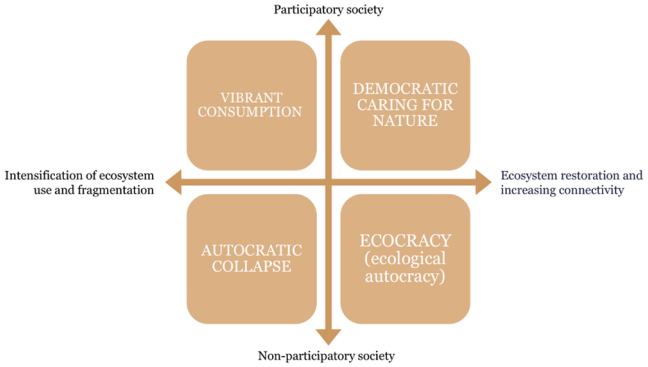

Fig. 2. Two-axes scenarios 1. Source: authors.

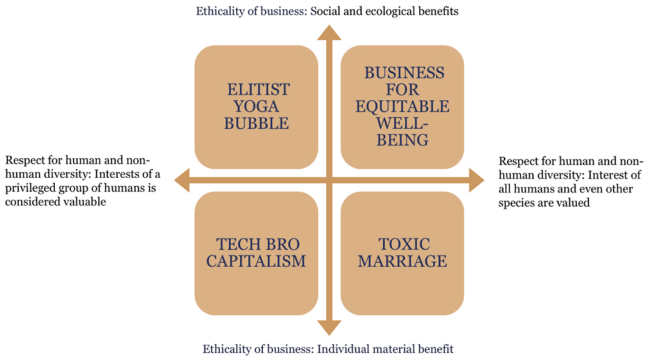

Fig. 3. Two-axes scenarios 2. Source: authors.

We employed a pre-trained deep learning model based on RoBERTa (Liu et al., 2019) for sentiment analysis and emotion identification on the future statements. Prior research has shown that RoBERTa consistently outperforms several alternative methods in fine-grained emotion classification (Zhang et al., 2024). Compared to BERT, RoBERTa incorporates key modifications to its training procedure, such as removing the next-sentence prediction objective and using larger mini-batches with higher learning rates. These adjustments enhance the model's robustness and overall performance.

RoBERTa estimates the probability distribution across three sentiment categories: negative, positive, and neutral (Barbieri et al., 2020). It can also detect the prevalence of eight common emotions: joy, confidence, fear, surprise, sadness, anticipation, anger, and disgust. For each input text, the category with the highest predicted probability was selected as the overall sentiment or emotion label.

In this study, we used the cardiffnlp/twitter-roberta-base-sentiment-latest model (Barbieri et al., 2020) for sentiment analysis and the j-hartmann/emotion-english-roberta-large model for emotion classification (Table 2).

When we performed the sentiment analysis, both manually and programmed, we found only one single statement of 567 where we could detect positive emotions. It could be argued that it is the job of scientists to remain neutral towards the future. And neutral feelings were certainly dominating the sample. However, our analysis detected fear, anger, disgust, and sadness, especially when it came to the ecological dimensions (Fig. 5 and Table 2).

4. Discussion

Few attempts have been made to date to integrate the HS and SB methods. The HS method is typically used to set research and development priorities. Garnett et al. (2016) report on how the results of the HS method were used to identify strategic risks affecting the future of food production. They also used the traditional HS method, but in practical application, they determined the order of priority of the expected risks. However, this form of application is only a small step forward in the practical application of traditional HS and its results.

In our previous HS research, when we developed the HS method extended with future categories and the Osgood scale (Hideg et al., 2021), the practical results obtained were also used by ecologists and biosphere restorers to set research priorities. According to the results of the research, this extended HS method was able to provide much more and sensitive foresight information than if they had worked with an undifferentiated future horizon and unevaluated future statements in the priority setting application (Csákvári et al., 2021).

Rowe et al. (2017) argued that HS should be applied after outlining the raw scenarios obtained with the SB method and so the two

Fig. 4. Excerpt from a blank Whiteboard to be used for participatory scenario-building (top left quadrant). Source: authors.

Table 2
Number of participants in the foresight process by methods. Source: authors.

Method	Internal experts (project members)	External experts	Total number of participants
Collection of future statements	28	-	28
Horizon scanning (Workshop 1)	6	14	20
Scenario building (Workshop 2)	4	11	15
Scenario enrichment (Workshop 3)	7	12	19
Method validation and reflection (e-Delphi)	-	52	52

methods could be integrated into a single unit. Accordingly, HS is only an early warning system in this approach that alerts decision-makers as to whether their scenarios are still valid or need to be updated (Rowe et al., 2017). This hierarchic integration method, in our opinion, can be used rather in management or when the time span of the analysis is short. However, we used a longer time span so that the results could be used for policy shaping even after the MAPS project timeline, and this approach combines the advantages of the two methods better.

Pace et al. (2023) also found that the SB method could be effectively applied after the HS method. Their research focused on key

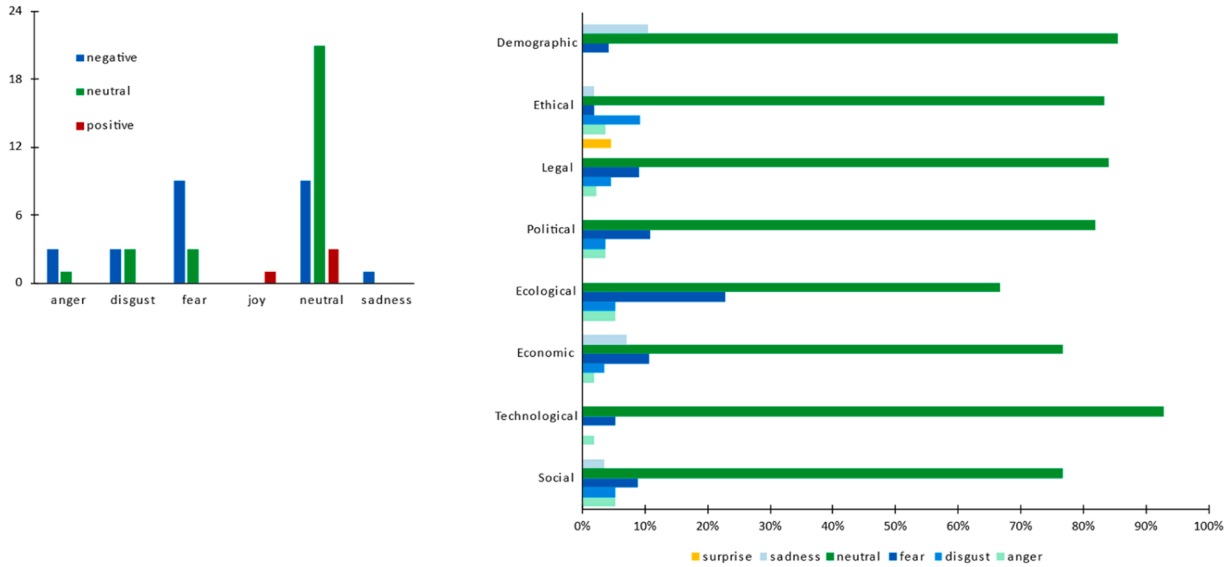

Fig. 5. Sentiment analysis of the future statements. Source: authors.

issues of marine ecosystem sustainability using a very thorough HS process conducted with international participants, and they suggested that the results obtained in this way would be useful for decision-makers in the form of scenarios (Pace et al., 2023). This study also implied that the HS and SB methods should be used sequentially and that their integration should be sought in the direction of combining the two frameworks on equal footing, but unlike in the case of our research, the integration of the two had not been performed in practice.

Experience in previous foresight projects proved crucial in developing our integration method. Some members of the foresight team participated in foresight research to organize the social process of water distribution in Iran, in which an online futures survey was combined with an online futures workshop, and recommendations were prepared for decision-makers (Azimi et al., 2017). Other projects included exploring business opportunities of the Visegrad countries and the trend changes until 2030 after COVID-19 by combining two types of SB methods (Sacio-Szymańska et al., 2016). When studying the post-COVID-19 outlook, we took the results of an official online Delphi survey to a workshop with European foresight experts, where we discussed ways to strengthen or weaken the positive or negative effects of emerging trends, and then collected policy recommendations for the Visegrad countries (Gáspár et al., 2023). In that case, the Delphi method was used to further develop the complexity of policy recommendations. However, it the current case – building on the flexibility of the Delphi method-, we used it for a different purposes. Namely to test the acceptability and refine the results of our method integration by experts who are working with sustainability issues but not necessarily on post-growth topics. Hence, the four selected post-growth scenarios were further developed to support the policy recommendations and strengthen their prospects for realisation in practice. Furthermore, a combination of forecasting and e-Delphi was also tested in a more traditional form during a former study, where the method resulted in the integration of participation and deliberation with various policy-oriented foresight approaches, finding that it can enhance the comprehension of the values that support decisions for the common good (Szathmári et al., 2024)

According to the participating experts from various fields of sustainability research, the different tasks could be solved with great attention and a willingness to learn. Facilitators have a significant role in these processes to make the collaboration and dialogues effective. Organizing the process online was a cost-effective and eco-friendly solution, and dialogues and discussions quickly developed in small groups among researchers exploring sustainability from different perspectives. The foresight team and the post-growth experts gained a better understanding of each other, and thus the work proceeded in a manner that mutually respected each other's opinions. Both the experts and the foresight researchers considered the procedure to be effective and productive, but also very intense and mentally exhausting.

This research design is time intensive and requires sustained engagement from participants, which complicates recruitment; and involving the project's own researchers can only partially mitigate this challenge. In addition, certain foresight and post-growth specific terms (e.g., within the e-Delphi phase) may be difficult for external experts to interpret, potentially affecting the consistency of contributions. A further limitation is the lack of guarantee that horizon scanning will yield the full set of drivers required for scenario building. This risk is heightened if experts are not sufficiently open or imaginative about qualitatively different futures, and by the early exclusion of numerous items during the literature screening stage. While some of these drivers can later be reintroduced from the literature, the gap remains a methodological vulnerability. Conducting the participatory components online may also have constrained group dynamics, reduced openness, and increased distraction compared to in-person formats. Finally, expert participation in shaping the research design was intentionally restricted by the study's methodological rationale. Although higher levels of participation—particularly in validating results—were possible in principle, they were not fully realized in practice.

Regarding the relevance of this methodological integration in post-growth research, it is important to consider that post-growth itself is a vision. Capitalist realists cynically say that it is easier to imagine the end of the world than the end of capitalism (Fisher, 2009). For any post-growth future to become feasible, we as a society desperately need to be able to imagine one (Köves, 2025). Our sentiment analysis presented in the previous subsection showed that when post-growth researchers scan the future horizon from the present, they seem to see a bleak future. However, to determine what can, should, or must be done to address the polycrisis, accepting this future is not the way forward. An internal ethical review focusing on 'intersectional justice' was conducted during the workshops with a dedicated guideline supported by the specially established working group.

From a management and political science point of view, there are essential advancements in social and strategic planning how post-growth could possibly be operationalized in actual systems. Savini (2024) e.g. states that post-growth still lacks a theoretical basis in management sciences, but a paradigm shift towards the satiation of the society through the reduction of consumption should be a central element in a more decentralized (regionalized) approach of spatial planning. Ambitious and forward-looking his ideas are, it requires significant time to change the mindset of political and strategic decision makers to make more radical changes (Rydin, 2024), especially because of the dynamics of the "top-down-top" approaches. The challenges are even more articulated when focusing on degrowth (Barlow et al., 2022): plural strategies, abandoning capitalism (which is considered by many as the engine of competitiveness), regionalization instead of globalization would need a long transition, though time is of the essence. The findings presented in this paper harmonize with the abovementioned arguments in emphasizing the importance of a democratic, future-oriented, collaborative, and open-minded society, along with strategic planners and politicians with similar mindsets.

The method integration developed by us worked efficiently and achieved the desired results because the research consortium itself involved internationally qualified foresight and post-growth expert researchers, who were also part of other expert networks.

The uncertainty of the developed method integration lies in the fact that the expected results can only be achieved in the case of competent and long-term participants capable of multi-round cooperation and collaboration, as well as facilitators who are well trained in the organization and management of online futures workshops. However, these conditions are difficult to guarantee in advance, especially if the competence and reliability of the participating expert researchers involved in the process and the experts in their networks who are familiar with practice are unknown.

Despite the results and potential weaknesses, this method of integration can be recommended to be used by foresight experts in other fields as well. One reason for this is that the method integration we designed and implemented performed well in exploring possible futures of new quality. Each scenario explored includes possible futures that are qualitatively different from both the continuation of the present, from the simple trend extrapolation, and from each other. The other reason is that if more and more case studies were available to develop method integration, the experience gained from the results of comparative meta-analysis of case studies could make method integration even more effective in foresight processes.

5. Conclusions

Our research results in terms of methodology show that it is possible to combine the HS and SB methods effectively based on theoretical grounds and practical realization, which helps us move forward with implementing integrated participatory foresight using online technologies. The connection between the two methods can be made by involving experts to the elaboration and classification of future statements and perform their impact analysis as part of the HS phase. From these classified and assessed statements, the participants selected the axes of the scenarios during the SB exercise, focusing on weak signals and wild cards, and prepared eight scenarios. The combined HS and SB process was easy to informatise. There are two conditions for the smooth implementation of the online process. First, at the beginning of each work phase, expert participants must be given accurate and detailed information about the tasks to be performed in that work phase. Secondly, the work process must employ well-trained and highly experienced facilitators and IT experts who are able to work well together.

The research team will continue its work in four directions. One of these is the publication of the results of the integrated foresight process concerning the subject of research, i.e., the possible post-growth futures. The second is to further shape the results obtained from the integrated foresight process so that they can help decision-makers take political and practical steps towards realizing a post-growth future. The third direction is to present and discuss the refined and feasible post-growth vision of our research team with the wider public. Those interested in further details of the methodology as well as the raw results of the research can access the Post-growth Futures Report from the MAPS project's website. The fourth direction is to test the acceptability of some of the key policy recommendations deriving from the scenarios through participatory processes like citizens jury (Smith & Wales, 2000), backcasting (Robinson, 2003), systems-mapping (Király et al., 2016) with a diverse range of stakeholders. This also shows that further foresight methods like backcasting can be further built on refining understandings around integrated HS and SB results.

The combination of the HS and SB methods showed that we can accept certain problems, but we need to go further and understand that influencing just one driving force (e.g., participation in society or respect for diversity of human and non-human entities) can result in completely different futures. This is a convincingly strong message to both policymakers and the wider public to act.

CRediT authorship contribution statement

Hideg, É.: Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization; **Márton, A.:** Writing – review & editing, Writing – original draft, Resources, Methodology, Formal analysis, Data curation, Conceptualization; **Csuport, Zs.:** Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization; **Ding, J.:** Writing – original draft, Software, Resources, Methodology,

Investigation, Data curation, Conceptualization; **Fischer, M.:** Writing – original draft, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization; **Fodor, Sz.:** Writing – original draft, Visualization, Software, Investigation, Data curation, Conceptualization; **Gáspár, J.:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization; **Hirvilammi, T.:** Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization; **Kiss, G.:** Writing – original draft, Supervision, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization; **Szathmári, A.:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization; **Köves, A:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability

Data will be made available on request.

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