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The enrichment of post-growth future alternatives for Europe using an online integral foresight methodology

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Abstract

The article explores trends, weak signals, and possible pathways for the feasibility of the post-growth concept in Europe, based on an integrated foresight process. The proper formulation of comprehensive future alternatives or scenarios depends on the ability to identify visible and perceptible changes on the horizon and the possible futures that can be derived from these elements. The integral foresight method combines the processing of literature on possible futures from a post-growth and from a sustainable development perspective with horizon scanning and scenario building methods. The main features of the methodology are online interactivity, a multi-round discussion and learning process between the researchers, experts and futurists working in different fields and dealing with the topic of post-growth or sustainability. The result of the future-shaping collaboration process is a list of filtered, refined, and categorized futures statements covering different STEEPLED dimensions and scenarios in which the vision of post-growth was developed under different assumptions. The findings show that according to the experts' expectations, many of the current trends hinder European society to achieve strong sustainability, but there are opportunities for intervention, the desirable alternatives are not out of sight, and humanity's flourishing within planetary boundaries can be reached through the democratic caring for nature.

Keywords Horizon scanning, Scenario, Integral futures, Sustainability, Post-growth

Introduction

The concept of post-growth urges humanity to develop qualitatively within planetary boundaries rather than pursue economic growth at all costs [1]. It includes various “alternative” economic models such as doughnut economics, wellbeing economics, and especially degrowth,

which emphasizes democratic transformation toward an economy that minimizes environmental impact and inequality [1]. These ideas have precedents in sustainability-oriented futures literature. The earliest work, *The Limits to Growth* [2] argued that humanity must shift to zero growth to avoid resource depletion and ecological crises, though it faced strong criticism at the time. The fifth report [3] further stressed that solving global problems requires changes in social values and worldviews—a core message of post-growth thinking. The work of Meadows et al. [4] after 30 years of analysis emphasizes that humanity is in a precarious state of overshoot. The authors express an even greater level of pessimism than they did in 1972 and outline the underlying economic structures that contribute to these issues.

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Another key concept in futures literature is sustainable development, defined in *Our Common Future*, prepared under the leadership of Gro Harlem Brundtland for the United Nations. Its main contribution is a future-oriented perspective, arguing that the needs of future generations can only be met if current generations limit consumption [5]. The report also broadened sustainability to include social goals and values, linking changes in resource use to shifting societal priorities. Based on the core idea of sustainable development, the Sustainable Development Goals have become widely accepted and used. However, in the name of equality and prosperity, economic growth remains accepted – and even necessary, particularly in developing regions – within the sustainable development framework [6]. And this concept aligns with the weak sustainability approach [7].

Post-growth thinking came to the fore in the 2010s. In the wake of the 2008 economic crisis, multidisciplinary discourse questioning the sole validity of growth-oriented economics and the accuracy of measuring social well-being and damage to the natural environment gained wider interest [8]. This also widened and strengthened the multidisciplinary research field of ecological economics and a multidisciplinary field of research aimed at reducing society's exploitation and damage to nature, while achieving ecological sustainability, social equity, and well-being through lower production since the 70s [7, 9–12]. However, currently there is still a strong need to develop complex policy proposals based on a degrowth vision that can be pursued in the foreseeable future and in practice [13]. While Fitzpatrick et al. [14] systematically analysed all policy proposals in the field of post-growth there is a strong need for a shared vision of what the desired future looks like that those policies would like to achieve.

In 2012, Cattaneo et al. already raised the need to address post-growth futures and link them to the development of democracy [15] which needed metamodern thinking. The metamodern school of thought has also begun to address the future, outlining what it considers to be the new normative social future model, both theoretically and in terms of expectations, following the decline of the postmodern worldview. This model is an image of a society that is sensitive to transcendence and spiritualism and capable of creating complex sustainability, including post-growth. The social vision of the future is not formulated by futurists, future experts, or policymakers, but futurists observe and incorporate new initiatives into their future-oriented research that arise and prove successful at the micro level in all areas of life [16, 17]. Those involved in metamodern social theory believe that, in addition to futurists, it is also necessary to encourage individuals and local communities to make efforts to this end and to get involved in shaping the future [18, 19]. The

authors' position on the metamodern approach is that the theoretical and methodological results of integrated foresight [20–22] and its practical experiences [23–25] already enable integrated foresight to meet the requirements formulated by representatives of the metamodern school of thought with a continuously improving participatory methodology.

The necessary elements of pathways to futures through sustainable development are widely researched in the literature which is closer to the traditional economic approaches and not questioning the existing growth-oriented economic thinking. In the future studies on sustainability, horizon scanning (HS) is a particularly frequently used method for detecting emerging issues, weak signals, wild cards, hypes, and trends shaping sustainable futures, especially in the early phases of foresight processes either before the deployment of other methods such as scenario planning for early detection [26] or after them to proliferate alternative future signals [27]. Some of the research scan sustainability overarchingly in a participatory manner (see e.g. [28]), but the majority focuses on key issues by expert groups (see e.g. [29]). Healthcare is one of the areas where HS is a common technique for conducting foresight e.g. on telemedicine and digital health [30], or patient involvement and patient-centered decision support [31]. Vogler [32] found that some countries in Europe even integrate HS into their medical decision-making systems, and there has been stable funding for yearly horizon scans for 17 years in the topic of biological conservation in the United Kingdom [33]. However, HS is rather deployed occasionally at projects to enhance the collection of early signs of the futures and establish other foresight methods [34].

The most common HS applications in the field of sustainability usually tackle one of its aspects: environmental, social, or economic. It is used to explore environmental dimensions such as biodiversity [35] and water management [36], to address social issues including food systems [37] and labour market or skills needs [38], as well as to examine economic topics like risk assessment [39], transportation and automation [40], and consumer behaviour [41]. Though some review papers have already been published on the diverse applications and methodological variations of HS across countries and organizations (see e.g. [34, 42]), the authors of this paper scrutinized the previously cited and predominantly sustainability-related HS publications and collected their results in a database to compare with the primary results in a later step of the research (see next section).

As the research field of sustainability futures rarely engages with future visions of alternative economic models, such as post-growth, there is a research gap on how to create such visions by questioning the growth-oriented economic operations and models and building

an alternative way of thinking. This paper fills this gap by offering new insights into the intersection of post-growth and futures studies, focusing on the farther future and the elaboration of untouched alternatives. The enrichment of the scenarios was achieved by an extensive horizon scanning exercise building on the participants' interdisciplinary and post-growth-centered mindset, and a multidimensional framework, STEEPLED (social, technological, ecological, economic, political, legal, ethical, and demographic elements), which helped in describing the post-growth future of Europe in a systematic and interconnected way. This way, the results detailed in this study strongly focus on alternative sustainability futures with a post-growth mindset.

In developing various post-growth futures, our initial goal was to explore how the future can be perceived from the present and to gather as many visions as possible using the Horizon Scanning (HS) method. To create an authentic vision of a post-growth future, we invited a community of post-growth researchers to participate in this participatory process. These members come from diverse disciplines and European regions, but all share a strong academic background in post-growth research. The rationale for their involvement is that post-growth researchers are more likely to identify elements of the future that do not appear in other sustainability research, helping us avoid simply replicating familiar concepts and arguments.

Additionally, to avoid repeating previously created sustainability visions (partly presented above), future statements related especially to green growth, sustainable development, or other aspects of the weak concept of sustainability have been filtered out.

The research results presented here focus on exploring the various signals that are emerging in European practice, including particularly post-growth and secondarily sustainability visions for the future up to 2050, and on comparative analyses of their content. The resulting post-growth visions that are based on the participatory foresight project contribute to the wide scale of research in the field of ecological futures, as well as the sustainability endeavours of the continent by identifying key trends and emerging issues to comprehend in political discussions and decision making.

The methodology of the HS in the integrated foresight research

The research goal was to conduct exploratory horizon scanning (HS) as the first phase of the integrated foresight task within the MAPS project,¹ with the aim of

later using the scenario-building (SB) method based on the concepts of degrowth and sustainability. The results could then be further elaborated in subsequent phases of the MAPS research through complex future modeling and participatory processes, and the development of feasible policy recommendations. The developed integrated foresight methodology implemented the integration and mutual interconnection of different methods of future exploration, evaluation, and formation, with the involvement of the project member ecological economists specialized in post-growth who were involved from the beginning of the project. The fundamental characteristics of such an integrated foresight methodology are complexity, participation, and interactivity, as well as the integration of different future exploration methods into a unified foresight process system that allows for feedback. The integrated foresight process was not only organized online but also included learning and teaching, as well as feedback from participants [43].

As this paper deals with the results gained from the integrated HS and SB methods, the context of the first research phase is therefore to explore the future as broadly as possible to collect a set of signals of different types (trend, megatrend, weak signal, wild card, and hype) that was a basis for a set of feasible and complex scenarios for 2050. The HS was the first phase during which brainstorming was carried out to explore the possible STEEPLED dimensions of sustainability and degrowth concerning the future. After that, these future statements were filtered in literature review to select future statements that can generate new content components of sustainability and degrowth. After that, an SB was carried out. HS and two-axes SB were planned to be built on top of each other. The interconnection was ensured by the fact that the axes of the scenarios were selected from the total of 16 high-impact weak signals, wild cards, or trends explored and selected in HS, and the scenarios were built from a total of 60 future statements of STEEPLED dimensions explored, filtered, selected, and evaluated in the HS process.

Research results

Results of the HS process

The HS process began with an online brainstorming survey involving 23 experts in sustainability, degrowth, and futurists from the eight countries participating in MAPS: Austria, Denmark, Estonia, Finland, Hungary, Italy, Spain, and the United Kingdom. A total of 596 future statements formulated in STEEPLED dimensions were collected. These were filtered by the foresight expert team to retain only those statements that do not appear, or appear only rarely, in the literature on the research topic. The aim of the filtering was twofold. First existing future statements on sustainability and sustainable development

¹ The MAPS project is funded by the European Union as a Horizon Europe project under grant agreement number 101137914. MAPS is short for Models, Assessment, and Policies for Sustainability.

were filtered, which were already included in other European future visions to make a clear distinction between the weak sustainability approach and the strong, post-growth-oriented approaches. The second filtering was based on the existing postgrowth literature to achieve novelty and new insight for the postgrowth futures.

The original future statements varied greatly in topics and depth, but were all satisfactorily elaborated to compare to findings from the literature. Statements like “Economic theory needs to take environmental considerations into account if we are to achieve a sustainable economy,” “As the impacts of climate change on ecosystems worsen, the effects may drive migration,” or “Increasing possibility of climate catastrophe, several types of climate catastrophes are also happening” were sorted out as these are often explained in previous studies (see e.g. Marshall et al. [28] for the first and third, and Cuhls et al. [37] for the second). Similarly, statements such as “Rethinking our economic priorities requires a shift in political discourse away from the blind pursuit of economic growth,” “Massive regulations will be implemented to stop the deterioration of the ecological circumstances but it will come too little too late,” or “The ecological dimension will be part of all projects by default” were also filtered since these are common topics in the degrowth literature (see [1, 8–11, 13, 14]). Some statements have been re-written to ensure consistency and textual uniformity without changing its content.

After filtering, 96 STEEPLED future statements remained that can be considered future considerations unique to the experts and the research topic. These were interpreted by the participating experts in an online workshop, categorized into future categories – trend, megatrend, wild card, weak signal, hype –, and their impact on the future was estimated using the 7-point Osgood scale. Since the participants of the workshop were the various stakeholders of the MAPS project, they were all aware of the research goal of creating post-growth future visions and inputs for the later stages of the project. All future statements and their categorisations can be accessed through the research report [44].

As a result of the workshop, 60 future statements have been discussed, categorized, and evaluated. This represents only 10% of the collected future statements, but it is 10% for which the experts provided a detailed and consensus-based interpretation, classification, and impact assessment in connection to degrowth and sustainability in Europe. Only 4 future statements were not clearly classified, and 4 future statements were also assessed as having zero impact by the experts. Due to time constraints in the workshops, the experts did not address the remaining 36 future statements. However, it is important to mention that both the experts’ excluded statements and the data collected in the literature have been utilized in later

foresight activities as secondary drivers or supplementary information, enriching the narratives that are shortly presented in the next section. Therefore, data was not lost, only prioritized. The 60 statements and their detailed evaluation can be found in [Appendix 1](#).

The grouping of future statements by the STEEPLED dimensions reveals that the focus of the expert group's research is on technological (13), economic (10), social (9), ethical (9), and legal (7) issues, in the sense that these are to be highly relevant from post-growth perspective. The complexity of the experts' approach is demonstrated by the fact that demographic (5), political (4) and ecological (3) dimensions are also included in their vision, with a combined share of 21,4%, indicating that these dimensions together are of approximately equal importance to the technological dimension.

Having a look at how each of the STEEPLED dimensions are distributed among the future categories, it appears that two thirds of future statements in the social dimension are present or future trends (weak signal). Half of the technology-related statements are considered global megatrends, while nearly a third are hypes. Statements in the economic dimension were rather equally distributed; only a slight majority were categorized as hype. The environmental, political, and demographic issues were mostly voted higher in likelihood to develop further, being megatrends or trends, and a few of them weak signals. Four out of seven legal statements were put in the weak signal category; the rest were trends or megatrends. The participants believed about one third of the ethical issues to be ongoing megatrends, and another third is weak signal.

The highest proportion of future statements in the social dimension were trends, while the highest proportion of statements in the technological dimension were megatrends. In the wild cards category, the experts found only five statements, two of which belonged to the social and economic dimensions each, the last one to the ethical dimension. Most of the weak signals were in the legal dimension, followed by the ethical dimension, and the rest belonged to the other dimensions equally (except for the one political statement). Among the hypes, the most frequent were statements from the technological and economic dimensions, and only one of them were part of the social, ethical and demographic issues.

Analyzing the future statements by their expected impacts in all dimensions, it can be concluded that the statements in the economic and political dimensions were the most diverse with approximately equal numbers of statements with positive and negative impacts. While most of the social, technological, demographic, and ecological statements were perceived as negative by their impact, the expectations on legal and ethical issues are rather optimistic.

Table 1 Number of statements in the STEEPLED dimensions

STEEPLED dimension	Number of statements
Social	9
Technological	13
Ecological	3
Economic	10
Political	4
Legal	7
Ethical	9
Demographic	5

Source: Authors

Table 2 Number of statements in the different future categories

STEEPLED dimension	Number of statements
Trend	15
Megatrend	20
Wild card	8
Weak signal	21
Hype	13

Source: Authors

The sum of statements is over 60 because there was no consensus on some statements, and the votes were added to each relevant category

Table 3 Number of statements with the different levels of impact

Level of impact	Number of statements	Codes in Annex 1
Strongly positive (+3)	3	S.8., L.4., L.6
Moderately positive (+2)	11	S.5., T.2., T.8., Econ.2., Econ.3., P.1., P.3., L.5., Eth.2., Eth.7., D.2
Slightly positive (+1)	11	T.1., T.10., Ecol.3., Econ.6., Econ.10., L.1., Eth.1., Eth.6., Eth.8., Eth.9., D.4
Neutral (0)	4	T.9., Econ.1., L.2., Eth.4
Slightly negative (−1)	7	T.6., T.12., T.13., Econ.5., Econ.8., D.1., D.5
Moderately negative (−2)	13	S.1., S.3., S.4., S.6., S.9., T.3., T.5., Econ.4., Econ.9., P.2., L.3., Eth.3., D.3
Strongly negative (−3)	11	S.2., S.7., T.4., T.7., T.11., Ecol.1., Ecol.2., Econ.7., P.4., L.7., Eth.5.,

Source: Authors

Regarding the impact assessment, apparently the experts were able to clearly and consensually judge the outcome of 56 statements as either positive or negative, with the exception of 4 future statements which were voted as neutral to the future of degrowth in Europe. Each of the 4 future statements that were evaluated as ineffective fell into a different dimension, therefore these do not change the overall assessment significantly. The extremes, however, are of concern: there were only two legal and one social statement having a very positive impact (+3), and all dimensions but one (demographic) had at least one statement (11 in total) with a very

negative impact (−3). There were 7 slightly negative and 11 slightly positive statements in the list, showing that the experts have identified pregnant impacts for most of the future statements.

A summary of the future statement statistics can be found in Tables 1, 2 and 3.

Overall, it can be stated that the participants could formulate more technological and economic statements (23/60) that were relevant from a degrowth or sustainability point of view and not covered previously by the HS literature. Besides, the experts could name numerous trends (15) and megatrends (20) in this field, but still many weak signals (21) were identified on the horizon. Yet it may be of concern that a slight majority of the discussed future issues will have a negative impact on our future (31/60) or on our chances to achieve sustainability. It is even more troublesome that the sum of negative and positive impacts is −23, meaning that the participants see more significant dangers to our future than opportunities to flourish.

Results of the scenario building process

Serving the complex design of the foresight procedure, the two-axis method of scenario building was selected and applied for exploring scenarios for degrowth futures in parallel to the analysis phase of HS. This scenario logic is determined by the impact and uncertainty of the driving forces. The driving forces themselves were transferred from the results of HS. Future statements categorized as weak signal, wild card or trend and simultaneously having strong impact on the future were selected for potential axis formation, while the other statements were preserved for later implementation. This process was especially effective since many of the original writers of the future statements were present in the online workshop, so the foresight experts could clarify some statements, a more punctual evaluation was possible, and a consensual selection of key driving forces was achievable. When it was relevant, the facilitators (the authors of this paper) could also recite connecting statements from the literature. Thus, the integration of these methods provided a more reflective foresight process than a sequential application.

Since there are 16 driving forces among the HS results with the abovementioned criteria, those were divided into two groups at random in a way that each group contains statements relating to the widest possible range of dimensions. In order to preserve as much of the diversity of the original statements as possible, drivers from the various dimensions of STEEPLED were picked (see Annex 1.): social uprisings abolish capitalism (S.8.); eco-socialism does prevail, but without public support (S.9.); people do not find education useful or beneficial anymore (S.1.); buying fast fashion cloth become culturally

undesirable (S.5.); Integration of decentralised renewable energy sources (T.8.); tracing the life cycle of a pair of jeans becomes possible (T.2.); ecosystem loss and fragmentation occur (Ecol.2.); new business models are quickly growing (Econ.2.); work-life balance will be a central issue at companies (Econ.3.); making energy services accessible for all (P.3.); everyone will have the same rights of living (L.6.); nations have the right to take goods and resources from individuals (L.4.); human life is prioritized over other species life (Eth.5.); indigenous communities are consulted (Eth.7.); cultural diversity and openness in thinking (D.2.); humans develop towards transhumanism (D.3.). During the workshop, the participants reformulated the statements into driving forces to make them more appropriate for scenario building.

The first group of experts discussed the options in detail and selected the two axes after reaching consensus. The selected axes were “participatory vs. non-participatory civil society,” (derived from statement S.9.) and “ecological restoration vs. further intensification of the use of ecosystems” (based on Ecol.2.). Although the individual quadrants defined by the axes are planes, they also express the imaginable, conceivable social space

through their STEEPLED dimensions, the content of which was co-created by the experts during the collaborative work. Fig. 1 shows the resulting scenarios.

In the second group of experts, participants also selected the two axes after discussion and mutual agreement. These were the following: “interests of every living being is valuable vs. interests of a group of privileged humans is valuable” (reformulated from statement D.2.); “individual material well-being vs. social and ecological benefits” (based on Eth.5.). Fig. 2 shows the resulting scenarios from these quadrants.

All participating experts ranked the scenarios individually and independently, after they had reviewed them and agreed to evaluate each one based on its feasibility, desirability, plausibility, and novelty. The ranking was as follows: 1. Democratic Caring for Nature, 2. Autocratic Collapse, 3. Ecocracy, and 4. Elistist Green Bubble. Based on the previous findings of the HS and scenario workshops, the short narratives of the four selected scenarios are as follows, connecting and completing the numerous future statements from the earlier signal spotting and signal scanning steps.

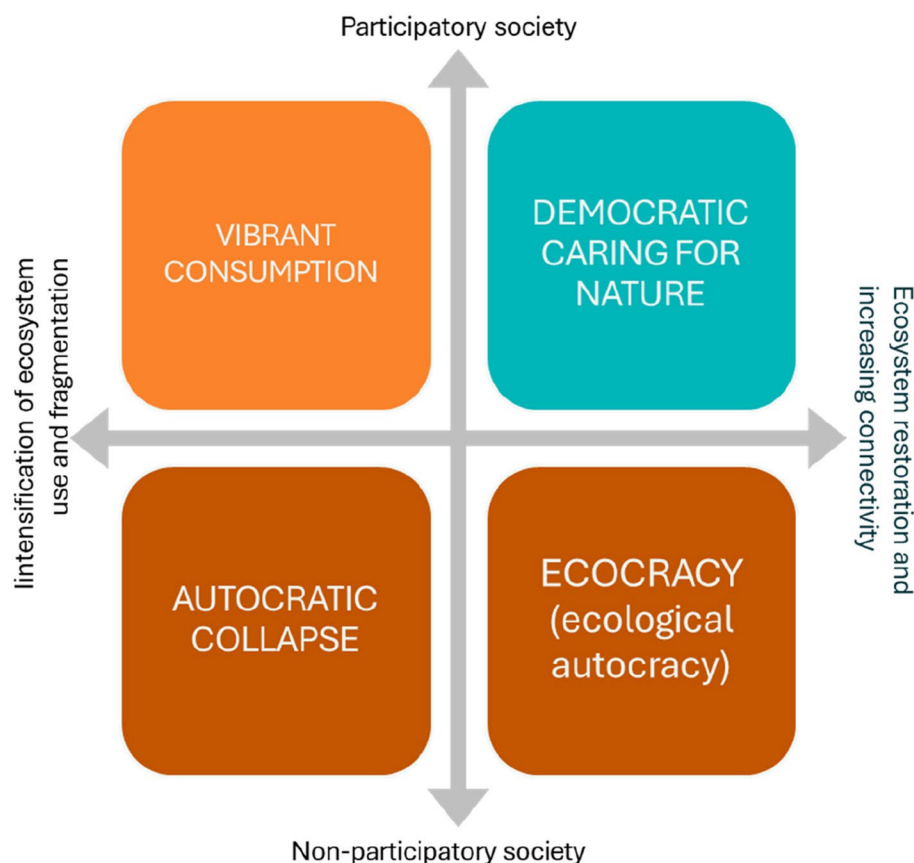


Fig. 1 Resulting scenarios in group 1. Source: Authors

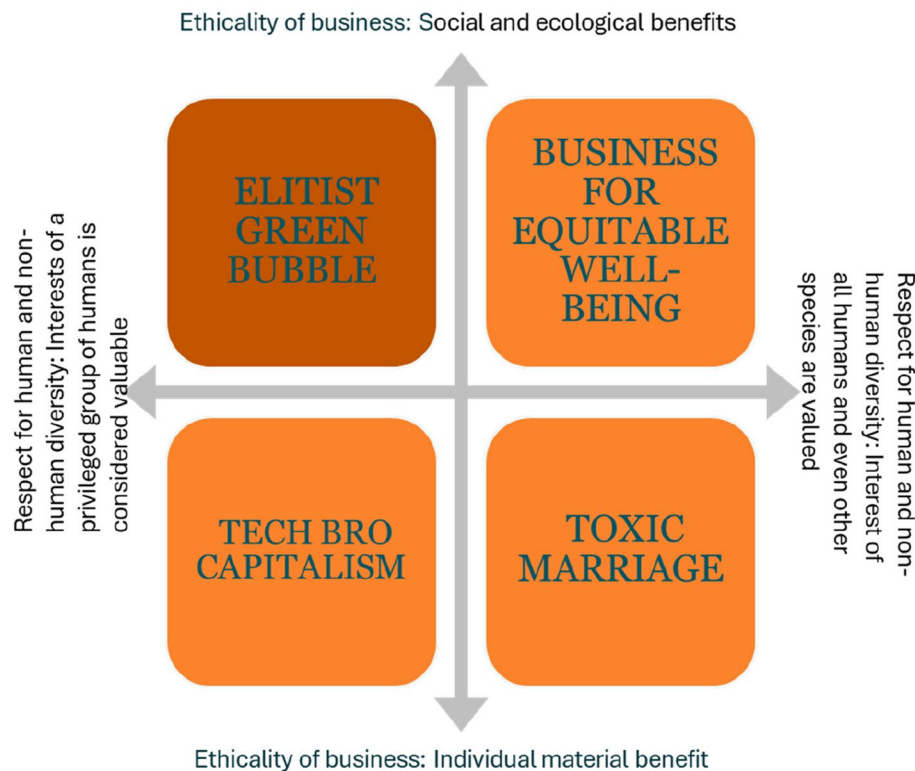


Fig. 2 Resulting scenarios in group 2. Source: Authors

Democratic caring for nature

This scenario emphasizes ecosystem restoration, ecocentric ethics, and participatory governance. Social value is based on contributions to ecosystem health, including care from non-human beings. The economy is de commodified, with cooperatives replacing corporations and sustainable welfare ensuring needs are met within planetary boundaries. Technology supports conservation efforts, while agroecology and expanded protected areas thrive. Voluntary population regulation and equal rights for humans and non-humans reflect deep ecological awareness.

As a result of a positive-positive outcome of two driving forces (the restoration of ecosystems and high level of democratic participation in society), this scenario is the most normative and aspirational, but it is not purely utopian. Its key elements like restoration, sufficiency, democratic provisioning and participation, and the redefinition of labour, care and work has been on the post-growth research agenda for decades [1, 14]. Evidence of decades of post-growth research shows that it is scientifically plausible to improve well-being while reducing environmental pressure, especially if people are able to deliberate on these issues, understand the trade-offs through stronger participatory processes. This scenario is a reflection on that. Future statements that collectively informed this scenario were the ones relating to the commons, redistribution, sufficiency, participatory governance, and ecological ethics.

Autocratic collapse

Ecosystem exploitation intensifies with no ecological reforms, prioritizing present gains over future sustainability. Society is autocratic, with limited public participation and restricted access to information, favoring the ruling elite. The economy is consumption-driven, marked by deep income inequality. Technology, controlled by private capital, enables surveillance and censorship. Pro-fertility policies are promoted amid population decline, while lobbying distorts legislation, and the legal system marginalizes vulnerable groups.

This scenario is a dystopia based on the negative-negative outcome of the two driving forces: ecosystems are overused and people are excluded from meaningful participation in social decisions. Even being fully dystopian, 63% of participating experts considered this a likely scenario [44] not without scientific evidence backing up this possibility. The prospect of the full ecological collapse driven by extractivism has been on the radar of Earth systems science for decades now [45]. Political ecology literature underscores how burdens of collapse in “sacrifice zones” are being borne dominantly by marginalised communities [46]. Research on democratic backsliding has long shown global tendencies that systematically weaken democratic controls such as the media, the judiciary or civil liberties and even in places where elections persist, democracy is being hollowed out [47]. This scenario a true

warning on how environmental crises combined with inequality can accelerate authoritarian governance patterns. Future statements emphasising collapse, extractivism, labour exploitation, institutional breakdown, consumption, and ecological degradation added to considerations reflected in this scenario.

Ecocracy

An eco-aristocratic elite drives ecosystem restoration without democratic participation, leading to major income disparities and marginalized resistance. Green priorities dominate politics, suppressing social objectives and dissent. Citizens are compelled into unpaid ecological labor, while financial elites profit from new green markets. Surveillance technologies enforce resource control, and demographic processes are tightly regulated. Climate colonialism rises as the Global North exploits Indigenous ecosystems under restoration pretexts.

This scenario is partly dystopian as the result of a negative – positive outcome of its driving forces but it can be seen more as a warning than just fiction. It shows how the restoration of ecosystems through mere force due to urgency or misplaced power without the participation of peoples may lead to positive sustainability outcomes but can backlash in a society where circumstances are widely considered unjust and inhumane. A society where ecological goals are achieved at the expense of humans are likely to result in instability and ethical violations. Parts of this scenario, where an elite has misused power in the name of conservation has been widely researched in political ecology where in the name of environmental protection land is grabbed from the marginalised [48] or conservation efforts lead to the unjust displacement of locals [49]. This scenario draws our attention to the possibility of environmental protections leading to increased inequality and injustice if not designed together with the people keeping justice and redistribution in mind. Future statements on nationalism, technocracy, weakened democracy, elite-driven environmental policy, and coercion were the ones that influenced the shaping of this scenario.

Elistist green bubble

Despite a façade of sustainability, this society exploits human and ecological resources, deepening global inequality. A privileged elite thrives in green enclaves, while marginalized groups, especially in the Global South, face exploitation. Businesses promote social and ecological benefits superficially, with profit still prioritized. Technological innovations serve only the elite, while immigration restrictions and environmental injustice exacerbate societal segregation. Legal and economic systems entrench inequality and discrimination.

This scenario is the result of the combination of driving forces where business considers social and ecological goals as ethically desirable (positive) but lack respect for human and non-human diversity and only the interests of a privileged few are taken into account (negative). Evidence supports mechanisms that are similar to the ones described in this scenario such as greenwashing, rebound effects, technological inequality, and global exploitation [1]. Inequality research also shows how current societies are being stratified with narrow elitist groups residing over most of the wealth and resources [50] while pointing out the hypocrisy behind selling green colonialism as environmental and social protection [51]. This scenario is a realistic risk scenario of a sustainability transition that only considers efficiency, technology, and market incentives without truly reflecting on the need to address inequality and power distortions. Future statements focusing on techno-optimism, market-based solutions, efficiency narratives, weak regulation, and persistent overconsumption informed this scenario.

Discussion

Research that urges humanity to move beyond the primacy of economic growth in order to pay attention to ecological limits as well as to build a more just society has been around since the 70s [52]. It has also been widely criticized for not considering sufficiently the political implications of such drastic measures (see e.g. [53]) or the geopolitical realities of our current world [54]. In terms of methodological criticisms, the problem of normativity keeps reoccurring [55] claiming that such research is incapable of following objective scientific criteria, while it has long been argued that science is by default normative and political if it serves wider human interests [56]. While these debates are scientifically stimulating, humanity transgressing six out of nine planetary boundaries (Richardson 2023) means that we desperately need research that does not just inform us on what is factually there, but what alternatives should be there [18] regardless of their currently heuristically perceived political feasibility. And this is where foresight research is crucial not just in detecting the signals from the future but in also showing how even just minor changes in these can result in highly diverse scenarios.

The extensive review of the European horizon scanning (HS) literature produced a comprehensive collection of signals and future-oriented statements that served both as orientation and as inputs for subsequent filtering steps. While part of the reviewed literature consists of academic articles, a substantial portion is composed of research reports and project deliverables, reflecting their predominant function as preliminary studies for further research applications. Sustainability emerges as

a frequently examined topic across the reviewed works; however, post-growth perspectives—such as degrowth—remain rare within HS or scenario-based studies. As a result, the insights derived in this research align more closely with degrowth principles and incorporate fewer elements from mainstream environmental sustainability as key drivers.

In the social dimension, many of the messages and concerns identified here correspond with themes that appear in recent HS literature. Climate change is consistently highlighted as a major driver of migration, psychological anxiety, and increasing class divisions within European societies [28, 37], the latter potentially giving rise to ecological gentrification [40]. These social factors were reflected in the future statements and scenarios developed in this study. Nevertheless, more radical themes also surfaced, such as the potential abolition of capitalism and the emergence of eco-socialism, both of which could accelerate transitions toward post-growth futures. Participants concurred that the end of capitalism would not necessarily diminish the well-being of most Europeans; however, broad civic participation and engagement would be essential for ensuring an equitable and robust democratic system.

A further barrier to socially oriented post-growth prosperity is the increasing number of military conflicts and geopolitical tensions [37]. These tensions have had substantial recent impacts on Europe, posing new challenges for institutional and social systems. At the same time, such challenges may simultaneously intensify the demand for deeper European integration and collaboration to enhance the resilience of the European Union.

Digitization, smart technologies, and artificial intelligence appeared most prominently within technological future statements. This prominence aligns well with current research, particularly studies highlighting technology's transformative effects on society [41], its role in green energy transitions [28], and its contributions to sustainable mobility [40]. Other technologies frequently cited in the scientific literature – such as blockchain, 3D printing [37], and cryptocurrencies [57] – were not discussed in detail by participants, suggesting either bias or limited expertise within the group.

Most economic issues identified by the experts relate to the persistent monetization of societal values and the dominance of competitive, top-down economic mindsets. At the same time, bottom-up perspectives emphasizing work–life balance, sustainability, and reparability as part of circular economic models provide important counterforces to capitalism. These themes also appear in the literature [37], including explicit references to post-growth [28] as a strategy to mitigate climate breakdown and biodiversity loss.

Political and legal aspects gained greater attention among research participants than within the degrowth-related literature. Participants anticipated that regulation could play a constructive role in supporting equal rights and strengthening environmental protections. However, they also foresaw potential increases in populism, nationalism, and the concentration of political power, trends that could enable elites to disproportionately benefit from technological innovation and improvements in well-being. The literature presents conflicting perspectives on these political dynamics: some studies emphasize the positive effects of legislation on supply chains [37], food security [39], and peace [36], while others forecast declines in stability due to ethnonationalism [28] and reduced resilience [38].

Ethical considerations are comparatively underrepresented in sustainability-focused HS studies or appear only indirectly within discussions of social issues. In contrast, the present research engaged extensively with themes of morality, human dignity, minority rights, and fairness, which were embedded throughout the future statements and scenarios.

Interestingly, two topics were notably absent during the signal-scanning phase – health and sports – resulting in their underrepresentation in the future statements. Both topics are closely connected to well-being and social sustainability, and health in particular is frequently discussed in the broader literature (see [Introduction](#)). Nonetheless, workshop discussions and stakeholder dialogues did touch upon these themes, and the more detailed scenario narratives ultimately integrated healthcare as a central dimension of sustainability.

The scenarios developed in this study offer creative and innovative pathways from a degrowth perspective. Scenario planning is an even more widely used foresight tool than HS, and numerous organizations and international institutions apply it. Within the European Union, the Joint Research Centre developed four scenarios structured along two axes: “competitive and individual vs. collaborative and collectivist,” and “policy mixes supporting vs. not supporting sustainability” [58]. These scenarios bear resemblance to those produced in the MAPS project (e.g., Glocal Eco-world and Democratic Caring for Nature, or Eco-states and Ecocracy). However, the JRC scenarios appear more optimistic regarding the attainment of sustainable development without major social or economic sacrifices and incorporate fewer driving factors than the MAPS scenarios. Stoknes et al. [59] adopted a different approach using the Earth4All integrated systems model, which applies system dynamics to simulate interactions between natural and human systems. Their “Too little, too late” scenario describes a business-as-usual trajectory marked by environmental deterioration, while the “Giant leap” scenario explores the effects of strong

political and economic commitments to sustainability. This model-based approach aligns more closely with traditional simulation methodologies, producing results informative for policymakers but less actionable for direct decision support.

From a methodological standpoint, the integrated foresight approach employed in this study proved effective [43]. Other research designs vary, with some using HS to identify signals that inform the interpretation of pre-existing scenarios within foresight processes [27, 60], while others apply the methods sequentially [26] without integrating them methodologically. Washida and Yahata [61] argue that scenarios derived from HS outcomes are more reliable, reinforcing the validity of the integrated approach applied here. In practice, comprehensive methodological combinations have contributed to major socio-economic transformations, as exemplified by the macroeconomic transition and eventual success of Singapore [62].

Other foresight processes combine a variety of tools – for example, scenarios, the three-horizon method, and roadmapping [63], or public visioning exercises, dialogues, and scenario building aimed at fostering diverse conceptualizations of sustainability and improving participatory governance [64]. These approaches can reveal factors overlooked in HS or scenario building by expanding participation to non-expert stakeholders. However, given the conceptual complexity and novelty of degrowth, as well as the methodological sophistication of HS, laypersons would likely struggle to formulate signals across all STEEPLED dimensions or analyze them from a post-growth perspective with sufficient depth for subsequent research activities such as model development.

Conclusion

The purpose of the study was to fill the research gap on sustainability future studies by creating such visions by questioning the growth-oriented economic operations and models and building an alternative way of thinking. As the research field of sustainability futures rarely engages with future visions of alternative economic models, such as post-growth, this paper examined how the future can be perceived using the Horizon Scanning (HS) method and building scenarios with an integrated foresight approach. Thus, this research aimed to establish a comprehensive list of signals on the future horizon which may and will be included in models and action plans supporting equitable policy decisions.

The originality of the study lies also in the integrated foresight method and the strong focus on the post-growth lens of sustainability futures. Integrating horizon scanning with scenario building strengthens the

analytical depth of foresight by linking weak signals to systemic future narratives. In this study, post-growth concepts were successfully operationalized within foresight methodologies through structured signal identification and filtering. This could make a valuable theoretical contribution to future sustainability studies by integrating the strong sustainability approach into the existing field of research on sustainable development.

The results show that the curated set of 60 high-relevance future statements, derived from an initial pool of 596 expert-generated inputs, indicates that a slight majority of identified signals carry negative expected impacts, suggesting that experts perceive more risks than opportunities in the transition towards sustainability. At the same time, 21 weak signals and several high-impact drivers suggest the presence of transformative pathways not yet dominant in mainstream discourse, focusing on the weak sustainability approach. The integration of HS into scenario building enabled the development of eight qualitatively distinct and internally consistent futures, illustrating how combinations of ecological conditions and governance patterns shape divergent post-growth trajectories. The findings emphasise that moving toward post-growth futures is not solely a technical or economic challenge but also a social and institutional one, as noted by participating post-growth researchers. The results highlight the significance of participatory governance and social legitimacy in facilitating sustainable transitions. They also warn that ecological goals pursued without social inclusion can lead to increased inequality or the emergence of authoritarian dynamics.

The study's practical implication is that it clarifies key drivers for macromodeling and building. The findings provide a validated set of future-oriented drivers that can be directly used in subsequent research phases, including quantitative modelling and policy development within the MAPS project. A qualitative understanding of post-growth futures would assist in identifying suitable policy tools and packages.

The limitation of this study lies in the small sample size and the specific participant group (namely, post-growth researchers). This small expert-based sample may introduce disciplinary or conceptual biases. Future research directions can lead to the integration of the identified signals into quantitative models and policy simulations. This includes addressing the study's limitations, expanding participation in deliberations on possible sustainability futures, and including non-expert stakeholders and the wider public to capture broader societal perspectives on alternative future imaginaries for ecologically sustainable and socially just futures.

Appendix 1

Table 4 Distribution of future statements on STEEPLED dimensions, future categories and Osgood's scale evaluation

Future statements	Trend	Mega-trend	Wild card	Weak signal	Hype	Osgood's scale
S. Social dimension						
1. As people rely mostly on AI, they do not find education useful or beneficial anymore			x			−2
2. As ecosystem's loss and fragmentation occur due to land conversion (infrastructures, housing, farming), people become less connected with nature	x					−3
3. If fertility rate decreases interests of future generation are marginalized	x					−2
4. Growing urbanization will rely on the proliferation of AI					x	−2
5. The fashion industry is polluting and buying luxurious/fast fashion cloth become culturally undesirable or even despised				x		+2
6. As labour markets are precarious and over-competitive, working people work harder and longer	x (75%)			x (25%)		−2
7. The social security system collapses and instead of finding new ways of providing for the many, healthcare is increasingly privatized and now only serves the richest 5%		x				−3
8. Social uprisings abolish capitalism			x			+3
9. Degrowth (or eco-socialism) does prevail over growth-based capitalism, but as the approach is not participatory and is implemented without public support, public unrest increases and public support decreases				x		−2
T. Technological dimension						
1. Social justice is abandoned as a guiding principle of healthcare, and the majority of people try meeting their healthcare needs by means of cooperation and commons		x				+1
2. As the fashion industry is polluting, tracing the life cycle of a pair of jeans becomes possible				x		+2
3. The mental health crisis spreads		x				−2
4. So much hope is placed in the potential of markets and technologies to enable us to overcome ecological limits that socially imposed limits are not considered needed and have no political resonance		x				−3

Future statements	Trend	Mega-trend	Wild card	Weak signal	Hype	Osgood's scale
5. Because of geopolitical and economic competition, technological development, especially risky geoengineering, will evolve towards protecting prosperity from increased climate damages	x					−2
6. Biotechnology becomes a leading technology, demanding new legislation, influencing many parts of life (like human fertility due to its capacity to correct or prevent disorders before birth)		x				−1
7. Because of digitization and advances of AI, people can live almost forever (superlongevity)					x	−3
8. Advanced smart grid technologies will revolutionize how energy is distributed and consumed, optimizing supply and demand in real time, allowing for more effective integration of decentralised renewable energy sources into the grid				x		+2
9. Advancements in carbon capture and storage technologies will play a crucial role in managing emissions from energy production enabling energy-intensive production to mitigate their environmental impact					x	0
10. Future advancements in materials science will lead to the creation of highly energy-efficient products designed for durability and recyclability		x				+1
11. Because of belonging to the broader web of life in the technological space, people cannot distinguish between the newest AI personas and the biological humans, and between true information and the false one		x				−3
12. With AI use spreading, the driving force of technological innovation will be experimental knowledge instead of scientific knowledge					x	−1
13. The spreading mental health crisis will be mitigated by new technology that can help remotely and safely, causing ethical and legal problems of data protection	x (25%)			x (25%)	x (50%)	−1
Ecol. Ecological dimension						
1. Because of belonging to the broader web of life in technological space, people become disconnected from how ecosystems create life and their life conditions	x					−3

Future statements	Trend	Mega-trend	Wild card	Weak signal	Hype	Osgood's scale
2. Ecosystem loss and fragmentation occur due to further land conversion (infrastructures, housing, farming)		x				−3
3. The transition to renewable energy sources will transform landscapes, with an emphasis on creating multi-use spaces that combine energy production with agriculture and conservation				x		+1
Econ. Economic dimension						
1. As both the far right and the far left will start blaming big corps for the ecological problems, profits of some large companies significantly drop as societies will start treating them more like enemies rather than allies			x			0
2. As the fashion industry is polluting, commercials are banned, and new business models are quickly growing in the field of second-hand shopping			x			+2
3. 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				x		+2
4. Because of environmentally forced migration crisis and decreasing liveable areas, scientists and engineers test new forms of living underneath of earth					x	−2
5. Increasing eco-anxiety and -depression will make a good medical business	x (50%)				x (50%)	−1
6. Due to Generation Z and consecutive generations not buying into the "work-based society" narratives, environmental burdens stemming from consumption pressures will ease					x	+1
7. Because of belonging to the broader web of life in the technological space, almost all aspects of personal life become monetarized		x				−3
8. A big gap in attitudes among middle-aged and young population about fashion (its polluting nature and the necessary responses) exists					x	−1
9. As labour markets are precarious and over-competitive, the societal expectations regarding parenthood significantly change due to the changing patterns of division of labour in the sphere of caring following work-life imbalance pressures	x					−2

Future statements	Trend	Mega-trend	Wild card	Weak signal	Hype	Osgood's scale
10. Because of depleting finite material resources, people will repair goods communicating and teaching new knowledges and helping each other				x		+1
P. Political dimension						
1. There is a political will to encourage keeping infrastructures operational as long as possible, influencing the expectations of people	x					+2
2. The pressure to achieve net zero and increasing climate catastrophes will lead to technologies and businesses serving national purposes		x				-2
3. 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				x		+2
4. Public policies struggle to address the root causes of conspicuous consumption, as measures to curb overconsumption will face resistance from both industries and consumers		x				-3
L. Legal dimension						
1. Due to the collapse of global care chains, people organize care work without outsourcing it and it is shifted back to the private sphere, but communized care (e.g. childcare, cooking) takes place in public spaces				x		+1
2. Climate legal cases will be won by the dozens, but their implementation will be difficult				x		0
3. The law evolves according to leading political parties, and laws and standards are continuously updated causing delays and costs in the regulatory environment	x					-2
4. Because of depleting finite material resources, excessive accumulation from individuals is prohibited but nations have the right to take goods and resources from individuals above a specific level to put them into a societal benefit				x		+3

Future statements	Trend	Mega-trend	Wild card	Weak signal	Hype	Osgood's scale
5. Legal institutions will become increasingly relevant in dealing with environmental issues and human rights discourse will become increasingly intertwined with issues of ecological deterioration	x					+2
6. Because of environmentally forced migration crisis and decreasing liveable areas, everyone will have the same rights of living				x		+3
7. Legal regulations will hardly follow the development of AI, it is rather the practice which will lead the actual use and misuse of the technology		x				−3
Eth. Ethical dimension						
1. Educational systems will prioritize teaching energy literacy, equipping individuals with the knowledge to make informed decisions about energy use in terms of responsibility and efficiency				x		+1
2. AI will also be knowledgeable about human ethics and morals, therefore, minorities, peripheral communities, LMBTQ+ and other groups will also have support from technology, and diversity will be widely accepted					x	+2
3. With the increasing possibility of climate catastrophe, the precautionary principle, related to good living conditions for all people and future generations, is replaced by a focus on good life merely for national citizens and their descendants	x		x			−2
4. The fundamental ideas of liberalism that underpin democracy will come into questions both from the conservative right and the progressive left		x				0
5. Because of (environmentally forced migration crisis and) decreasing liveable areas, human life is prioritized over other species life		x				−3
6. The moral imperative to protect marine resources not only for current populations but also for future generations who depend on these ecosystems will grow		x (25%)		x (75%)		+1

Future statements	Trend	Mega-trend	Wild card	Weak signal	Hype	Osgood's scale
7. Ethical considerations leading to greater respect for indigenous and local knowledge in energy practices will promote ethical energy solutions that align with cultural values and community needs and Indigenous communities are consulted and have a say in energy projects affecting their lands and resources. This respect for sovereignty will promote fairness and acknowledge the unique relationship Indigenous peoples have with their environments			x			+2
8. Eco-anxiety and -depression will lead that young generation blames the previous generation for the ecological decay		x				+1
9. When taking into account biophysical limits in simulation of socio-economic scenarios, collaborative ethical transition paths will be part of simulations				x		+1
D. Demographic dimension						
1. AI will become as 'unnoticeable' as electricity in the developed countries in the early twenty-first century					x	-1
2. Green and healthy urban ways of life will help accept cultural diversity and openness in thinking				x		+2
3. Because of digitization and advances of AI, humans develop towards transhumanism		x				-2
4. The fertility rates are decreasing as young adults do not want to have children anymore	x					+1
5. Eco-anxiety and -depression contribute to decrease the number of children				x		-1

Source: Authors

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Authors' contributions

AM was the leading author of the manuscript. JG supervised the writing and harmonized the content with the research reports. EH was the author of the original draft of the manuscript and supervised the finalization. ASz and GK checked consistency and contributed to the scenario section. AK supervised the process as leader of the first phase of the MAPS project.

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Data availability

The supporting data and all background information are accessible from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the MAPS Project. Informed consent was obtained from all individual participants included in the study. All procedures were performed in accordance with the ethical standards of the Horizon Europe Research and Innovation Programme standards.

Consent for publication

The participants provided informed consent for the publication of the results in an anonymized format.

Competing interests

The authors declare that they have no competing interests.

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