EYE OF EUROPE

Mapping the Course: Eye of Europe Foresight Pilot Topics

Eye of Europe Deliverable 3.1

Disclaimer: This deliverable is pending final approval from the European Commission and may be subject to further revisions

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Abbreviations and acronyms

Acronym	Description
AI	Artificial Intelligence
CSO	Civil Society Organisation
DG-RTD	Directorate-General for Research and Innovation (of the European Commission)
GDP	Gross Domestic Product
EC	European Commission
EESC	European Economic and Social Committee
EoE	Eye of Europe
ERA	European Research Area
EU	European Union
ICT	Information & Communication Technology
HE	Horizon Europe (EU's key funding programme for research and innovation)
IPR	Intellectual Property Rights
R&I	Research and Innovation
MNE	Multinational Enterprise
NGO	Non-Governmental Organisation
PU	Public
RTI	Research, Technology & Innovation
SME	Small and Medium Enterprise
STEM	science, technology, engineering, and mathematics
STI	Science, Technology and Innovation

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1 Introduction

1.1 Objectives of this report

Eye of Europe - The Research and Innovation foresight community

As a Coordination and Support Action funded by the European Union (EU), the project "Eye of Europe" aims to enhance the integration of foresight practices into Research and Innovation (R&I) policy making across Europe. Ultimately, the project envisions a more cohesive and influential R&I foresight community that contributes significantly, as a collective intelligence, to shaping and guiding policy decisions (Futures4Europe, 2024). To this end, Eye of Europe builds on existing initiatives and experiences to foster knowledge-sharing between foresight practitioners and policy makers, attract domain experts in foresight endeavours, and engage a broader audience in futures thinking. Nurturing futures4europe as the online home for the community and running various face-to-face events with different stakeholders will underpin these ambitions (Futures4Europe, 2024).

The objectives of this report

As indicated above, conceptualising and implementing participatory Foresight exercises is a core element of the Eye of Europe project. Concretely the project partners will implement a series of 11 Foresight activities some online and some face to face in different locations across Europe. In order to achieve the best benefits from these exercises for the European Research Area and its stakeholders and at the same time maximise the community building effect, it is crucial to define carefully the topics these exercises will address. Deliverable D3.1 provides the documentation and the description of the topic selection process, including a stakeholder analysis and the resulting list of pilot topics.

1.2 Approach

The EoE Grant Agreement provides clear guidance for the pilot topic selection: "Topics should be both of common interest to R&I actors across ERA and promising for inspiring Foresight exercises. This process should promote engagement of researchers, communicators, journalists, industry, policymakers and civil society. The topics will centre around major R&I challenges addressed by many countries and actors such as the triple green, digital, and just transition".

The main key points we need to address are therefore, "inspiring", "common" and "centred around major R&I challenges". In addition, we definitely need to focus on "credible" and "impacting" in order to maximise the community building momentum and to fulfil the project's ambition to "contribute significantly, as a collective intelligence, to shaping and guiding policy decisions".

The complexity of the challenges that these policy decisions are facing under the actual global scenario requires addressing the diversity of the aspects within a system approach, taking into account the past activities and lessons learnt. Therefore, as a first step, the project team developed a framework towards the definition of the topics, proposing in advance a categorization of the topics.[1] This categorization suggested that in order to address R&I challenges in an effective long-term oriented manner we need to adopt a socio-technical system perspective that is including aspects such as human nature, values and organizational structures along with cutting- edge science and technology aspects. To

[1] The full background document presenting this framework is provided in the Annex 4.1

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simplify and not linearize the process of selection, it proposed to identify transversal aspects that can enable the stakeholders to engage, discuss, and integrate their competencies towards the co-creation of satisficing (satisfying and sufficient) paths. In particular, the analysis revealed two key areas of intervention new economic models and questions around tangible vs intangible resources, quantitative vs qualitative assets.

Guided by this overarching framework we designed the topic identification process that comprised three main elements. The first was a document analysis looking at official ERA R&I policy documents from both a EU and national level. This analysis served to discern key aspects from the dominant discourse on ERA priorities, which served as a canvas for the topic identification process. Secondly, we conducted a series of interviews with ERA stakeholders form diverse backgrounds. These interviews were designed to extract perspectives beyond established viewpoints, to challenge linear assumptions and to introduce novel, transversal, long-term and sometimes provocative perspectives. Thirdly, the whole selection process was embedded into a discourse among the partners of the EoE consortium all of which are experienced Foresight actors and familiar with the requirements of ERA stakeholders and R&I policies within their respective countries and on EU level. In the following section, we present methodology and outcome for each of these steps up to the final integration into the 11 topics that the EoE Team finally selected.

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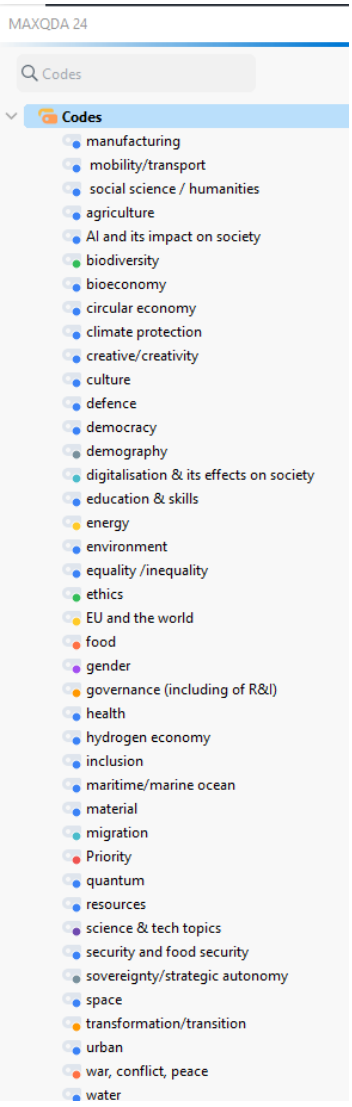
2 Pilot topic development

2.1 Document analysis

2.1.1 Methodology

The document analysis served to investigate the official national and EU level perspective on "topics of common interest in ERA". To this end, we analysed 18 documents listed in Table 1. All documents deal with RTI strategic priorities and stem from the last five years mostly from 2022/23. The majority of documents stems from the ERA-LEARN project that provides in-depth analysis of national RTI priorities and engagement in ERA activities for several EU countries. The nine country reports currently available were included in the analysis. The national level perspective is complemented by two original national level documents stemming from Greece and Germany respectively - the only two countries where English language documents were readily available. The EU level perspective is mainly represented by the current *Horizon Europe Strategic Plan 2025-2027, the EUROPEAN RESEARCH AREA POLICY AGENDA* and the *2023 Strategic Foresight Report.* The latter is complemented by an opinion of the European Economic and Social Committee (EESC), which provides an important additional perspective. Finally, we included the two currently available industrial technology roadmaps. These two documents provide a sectoral perspective into the analysis which of course introduce a certain bias into the results as other sectors are not represented. On the other hand, these roadmaps are « core actions » in the current European Research Area strategy so their inclusion seems justified as long as the resulting bias is accounted for in the analysis.

Figure 1: Codesystem used for document analysis



All documents were subjected to a qualitative content analysis using the software MAXQDA. To assess the core topics in the corpus of documents we applied a combination of an inductive and deductive approach. We first went through the documents marking aspects that were explicitly mentioned as priority. From these aspects, we generated a set of codes shown in Figure 1. This code system was then used for an automatised coding of all documents. The code "Priority" was used to mark aspects that were explicitly mentioned as priority except for the two industrial technology roadmaps and the strategic foresight report, as these documents do not outright formulate ERA priorities. Finally, we checked all codings manually for errors. A full list of codes and keywords is provided in the Annex. From the results, we generated two types of analyses. First, the number of documents where the topic was mentioned and secondly, the total number of times the topic was mentioned in all documents. The latter analysis is of course biased as the length of documents differs, so topics that are often mentioned in the very long documents, especially the two industrial roadmaps dominate. We also generated a word cloud providing a first insight into the dominant terms in the document corpus.

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Table 1: Documents included in the analysis

Document	Level	No of pages
Amanatidou, E., & Cox, D. (2023). *ERA-LEARN Country Report France*. https://www.era-learn.eu/documents/era-learn_countryreport_france.pdf	National	52
Amanatidou, E., & Cox, D. (2022). *ERA-LEARN Country Report Estonia*. https://www.era-learn.eu/documents/estonia_country_report	National	55
Amanatidou, E., & Cox, D. (2022). ERA-LEARN Country Report Germany. https://www.era-learn.eu/documents/country_report_germany	National	60
Amanatidou, E., & Cox, D. (2021). *ERA-LEARN Country Report Finland*. https://www.era-learn.eu/documents/country_report_finland	National	40
Amanatidou, E., & Cox, D. (2021). *ERA-LEARN Country Report Norway*. https://www.era-learn.eu/documents/country_report_norway	National	39
Amanatidou, E. (2019). *ERA-LEARN Country Report Austria*. https://www.era-learn.eu/documents/era-learn-country-report-austria.pdf	National	35
Amanatidou, E., & Cox, D. (2020). *ERA-LEARN Country Report Belgium*. https://www.era-learn.eu/documents/country-report-belgium.pdf	National	52
Amanatidou, E., Cox, D., & Marzocchi, C. (2019). *ERA-LEARN Country Report Spain*. https://www.era-learn.eu/documents/era-learn-country-report-spain.pdf	National	38
Amanatidou, E., & Cox, D. (2019). *ERA-LEARN Country Report Poland*. https://www.era-learn.eu/documents/era-learn-country-report-poland.pdf	National	28
Hellenic Republic Ministry of Development and Investments (2022). HELLAS: INNOVATION JOURNEY 2021-2027: National Smart Specialisation Strategy 2021-2027 SYNOPSIS. https://gsri.gov.gr/wp-content/uploads/2022/11/Synopsis_National-Smart-Specialisation-Strategy-2021-2027.pdf	National	4
The Federal Government. (2023). Future Research and Innovation Strategy Germany: Executive Summary. https://www.bmbf.de/bmbf/en/research/hightech-and-innovation/future-research-and-innovation-strategy/executive_summary.pdf?__blob=publicationFile&v=1	National	15
European Commission, Directorate-General for Research and Innovation. (2024). *Horizon Europe Strategic Plan 2025-2027*. https://data.europa.eu/doi/10.2777/092911	EU	140

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European Commission (2021). *A Pact for Research and Innovation in Europe*. https://www.horizon-europe.gouv.fr/sites/default/files/2021-12/a-pact-for-r-i-in-europe-5158.pdf	EU	3
European Commission Directorate General for Research and Innovation. (2021). *EUROPEAN RESEARCH AREA POLICY AGENDA: OVERVIEW OF ACTIONS FOR THE PERIOD 2022-2024*. https://commission.europa.eu/system/files/2021-11/ec_rtd_era-policy-agenda-2021.pdf	EU	25
European Commission. (2023). *2023 Strategic Foresight Report: Sustainability and people's wellbeing at the heart of Europe's Open Strategic Autonomy* (COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL COM(2023) 376 final). https://commission.europa.eu/strategy-and-policy/strategic-planning/strategic-foresight/2023-strategic-foresight-report_en#documents	EU	21
European Economic and Social Committee. (2024). *Opinion on Strategic Foresight Report 2023*. https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/strategic-foresight-report-2023	EU	28
European Commission Directorate General for Research and Innovation. (2023). *ERA industrial technology roadmap for circular technologies and business models in the textile, construction and energy-intensive industries*. https://data.europa.eu/doi/10.2777/839672	EU Sectoral	229
European Commission, Directorate-General for Research and Innovation. (2022). *ERA industrial technology roadmap for low-carbon technologies in energy-intensive industries*. https://data.europa.eu/doi/10.2777/92567	EU Sectoral	166

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2.1.2 Results

Figure 2: Word Cloud emerging from corpus of documents

Figure 2 above shows the word cloud visualising most frequent words in all documents. While this does not allow for deeper insights, it shows that the documents indeed address questions important for identifying topics of common interest in ERA.

Figure 3 and Figure 4 provide the results of the qualitative content analysis described above. The most frequently addressed topic is “energy”. This result is of course very much biased by the two roadmaps that are focussing on energy efficiency and energy intensive industries. Nevertheless, other documents such as the Strategic Foresight Report and the EESC opinion on it as well as the HE Strategic Plan place a high emphasis on energy aspects. Of the national documents especially Spain, Norway, Germany and Greece emphasise energy related topics. The second most frequently mentioned topic is circular economy, which is predominantly driven by the respective industrial roadmap, but also the HE Strategic Plan shows a high emphasis on circularity. On the national level, Belgium and Estonia are active in circular economy ERA activities, while Greece and Germany explicitly mention this topic among their national priorities. The third topic of materials is high in the ranking almost exclusively due to the frequent mentions in the two roadmaps. The fact that the most central technology roadmaps of ERA heavily rely on research and innovation in the material field should be kept in mind when discussing topics of common interest in ERA also from an industry perspective. The fourth topic of ICT, digitalisation and its impact on society is widely spread through all documents both on European and on national level with especially high attention in Finland, Greece, Belgium, France and Germany. Finally, climate protection is highly prevalent in all EU level documents (except the ERA strategy which is more focused on governance issues) and on national level in particular in Germany, Norway and France.

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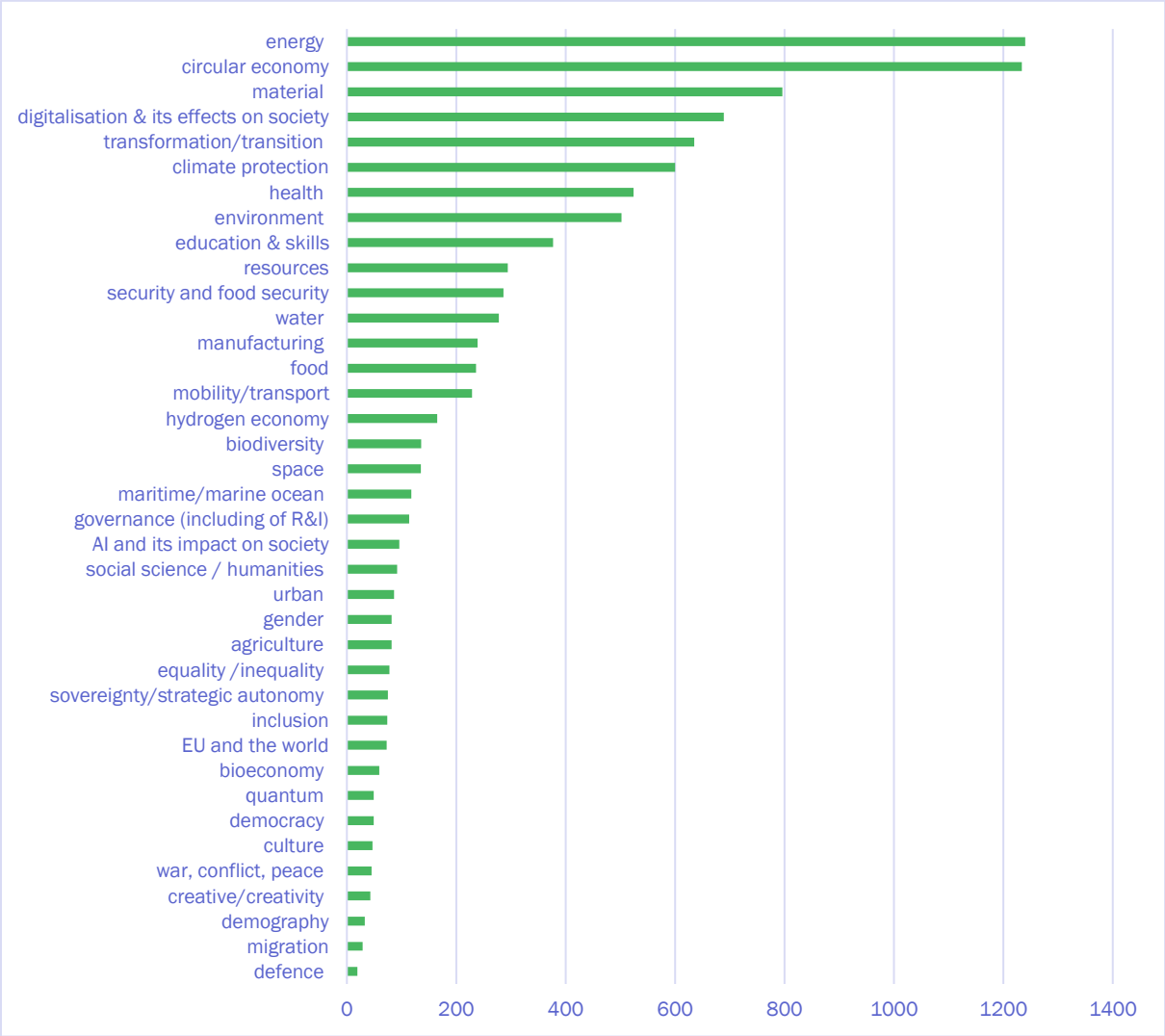

Figure 3: Histogram of topic frequency in all documents

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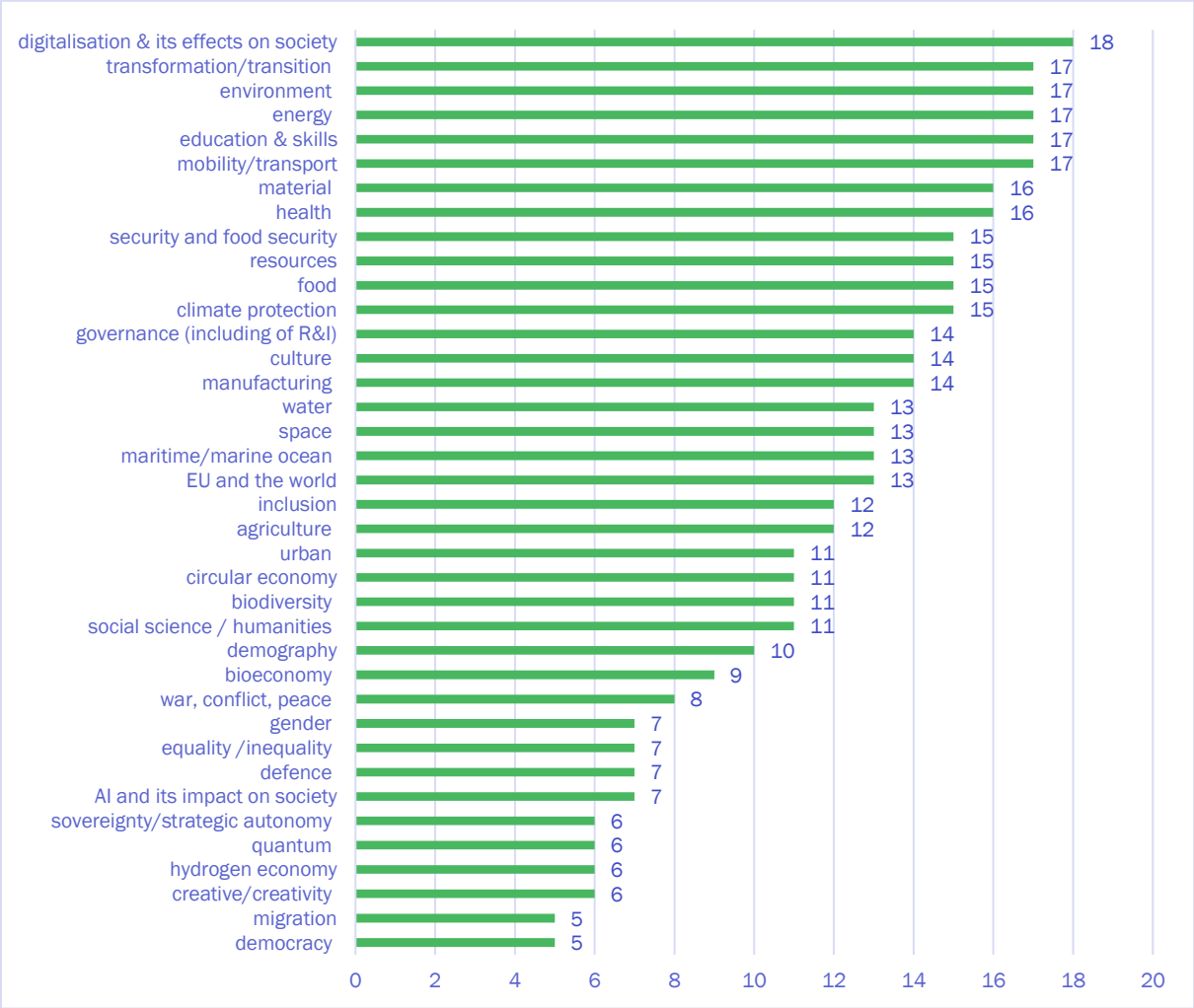

Figure 4: Histogram of number of documents (out of 18) addressing each topic

While Figure 3 provides some interesting insights as discussed above, we can draw more relevant conclusions from the analysis provided in Figure 4 - the number of documents addressing a certain topic, as this is independent from the length of documents and thereby less dominated by the two detailed roadmaps. We can see that digitalisation and its impact in society is the only topic addressed by all 18 documents. The topic of education and skills is not explicitly in the short synopsis from Greece but very much implied by the emphasis on "human resources" and "production of new knowledge" so it can safely be counted as an overarching concern in the ERA. Topics that are mentioned in 17 documents are mobility/transport, energy and the environment, which are not mentioned only in the very short document pact for research and innovation in Europe. Finally, the notion of Transition or Transformation is mentioned in all documents except for the country report for Poland. Further topics that are addressed by the large majority (>14) of documents are health, materials, climate protection, food, resources and security. The topics that were explicitly emphasised as priority (rather than just being mentioned as important) in more than 2/3 of the documents are health, digitalisation, energy, food, climate protection, environment, material, security, transformation/transition, mobility transport.

To sum up the document analysis revealed a convergence around the following topics of common interest in ERA:

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Digitalisation and its impact on society

Documents both on EU and national level emphasise the need to invest into digital transition and its contributions to solutions for societal challenges in particular the green transition but also other areas such as health and education. Another important aspect is digital sovereignty and leadership in ICT technologies. Example quotes are

> *Research to support the **digital transition** is key to Europe's competitiveness and open strategic autonomy, and to setting human-centred standards. It is also key to achieving the green transition. In 2021-2027, it is agreed to invest at least EUR 13 billion from Horizon Europe in **core digital technologies**. (EC 2024 Horizon Europe Strategic Plan 2025-2027, p. 8)*[2]

> *Programmes and Equipment (PEPR) are included in national thematic strategies that address strategic and priority investments including technologies of the future such as **green and digital technologies [...] and digital technology for education**. (ERA-Learn Country Report France, p. 20)*

> *Austria is also leading in **electronics-based systems and microelectronics and investing heavily in ICT** (see for example the Silicon Austria Labs) (ERA-Learn Country Report Austria, p. 24)*

> *Securing Germany's and Europe's **digital and technological sovereignty** and **harnessing the potential of digitalisation** (One of six missions). Future Research and Innovation Strategy Germany: Executive Summary, p. 9)*

Education and skills/creation of new knowledge

The importance of education and knowledge generation for the future of economy and society is a recurring theme across all documents. On EU level especially the EESC calls for a radical rethinking of the concept of knowledge. Several other documents focus more specifically on researcher skills in particular in STEM fields but also on specific needs for reskilling and upskilling for certain industries (e.g. Green Hydrogen). Examples are:

> *In the face of an increasingly volatile, uncertain, complex and ambiguous world, education can make the difference. **Education and training systems** need to radically transform their approaches in order to face future challenges. The exploitation of planetary resources requires intergenerational, knowledge-based support in order to promote common prosperity and wellbeing. This process will require a variety of stakeholders to be involved[16]. With an increasing deluge of data and information being accessible to the global population, the concept of knowledge will need to be revised, and skills should focus on collaboration, communication, creativity and critical thinking (usually referred to as the four c's) (EESC opinion on 2023 Strategic Foresight Report, p. 11)*

> *This vision can be further analysed into the five Strategic Objectives below: **Production of New Knowledge, Effective utilisation and diffusion of new knowledge** (Greece: Synopsis_National-Smart-Specialisation-Strategy-2021-2027, p. 2)*

[2] Full references with links to the documents are provided in Table 1

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*Creating **educational opportunities** and giving people the opportunity to gather a variety of experience and acquire expertise is what secures the future of our country (Future Research and Innovation Strategy Germany: Executive Summary p. 7)*

***Education, R&D and innovation remain paramount for Finland's future** economic and broader social development (ERA-Learn Country Report Finland, p. 4)*

*The skills mismatch and the **low supply of STEM graduates** has been identified as an important challenge that needs to be addressed in the latest RIO Report for Belgium. (Era-Learn Country Report Belgium, p. 36)*

Energy

Energy is one of the most frequently addressed topics across all documents. The focus is on transition to clean and climate neutral energy technologies on the one hand and efficient use of energy across all sectors on the other. Examples are:

*Facilitating the **clean and sustainable transition of the energy** and transport sectors towards climate neutrality through cross-cutting solutions. Ensuring more **efficient, sustainable, secure, and competitive renewable and decarbonised energy supply** (Horizon Europe Strategic Plan 2025-202, p. 10 Cluster 5 Expected Impacts 22&23)*

*Estonia's national priorities in research and innovation, as documented in the Estonian Research and Development, Innovation and Entrepreneurship Strategy 2021-2035, are: digital solutions across all areas of life; health technologies and services; valorisation of local resources; **smart and sustainable energy solutions**; viable Estonian society, language and cultural space (ERA-Learn Country Report Estonia, p. 44)*

*National priority areas specified in the revised LTP include 'seas and oceans'; 'climate, the environment and **clean energy'**; 'public sector renewal and better public services'; 'enabling and industrial technologies'; and 'societal security and social cohesion in a globalised world' (ERA-Learn Country Report Norway, p. 10)*

Mobility/transport

Transport and mobility are prominent on both EU and national level often with a focus on sustainable transport solutions. Examples for typical statements are:

*Achieving sustainable, inclusive, and competitive transport modes. Developing multimodal systems and services for **climate-neutral, smart, inclusive, and safe mobility** (Horizon Europe Strategic Plan 2025-2027, p. 10 Cluster 5 Expected Impacts 25 and 26)*

*[...] core areas of interest requiring international collaboration, in particular in energy, sustainable urban development, **transport and mobility**, ICT, production technologies, materials, space and security (ERA-Learn Country Report Austria, p. 17)*

Environment

Environmental protection is present as a topic on EU level, most notably in the strategic plan and the roadmap circular technologies but also in the EESC opinion paper. All country level documents refer to environmental aspects in

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particular Norway, Germany and Greece. Key topics are regeneration of biodiversity, reduction of polluting substances and preservation of natural resources. The latter aspect is often addressed through circular economy strategies.

> *Transforming industrial production and the consumption of goods into a circular model is critical for the future of our society, where waste and pollution are eliminated,* ***and our natural environment and biodiversity are regenerated*** *(ERA industrial technology roadmap for circular technologies, p. 13)*

> *Twelve missions have been set addressing, health and care, decent work and living standards, mobility, AI and an open innovation culture, as well as* ***environmental and sustainability challenges*** *for present and future generations. (ERA-Learn Country Report Germany, p. 18)*

> *The analysis done when drafting the new National Smart Specialisation Strategy led to the identification of eight priority areas, in which the country has advantages and on which the transition to a new growth model could be based. These areas are the following: Agro-food value chain, Bio-sciences, Health and Pharmaceuticals, Digital Technology, Sustainable Energy,* ***Environment and Circular Economy****, Transport and Logistics, Materials, Constructions and Industry, Tourism, Culture and Creative Industries. (Greece: Synopsis_National-Smart-Specialisation-Strategy-2021-2027, p. 2)*

> *Mission: Spearheading climate protection, climate adjustment, food security and the* ***preservation of biodiversity*** *(Germany Future R&I Strategy executive summary, p. 10)*

Transition

The "green and digital transition" in connection with "just transition" is at the forefront of EU strategies and therefore frequently referenced in all EU level documents. Also on national level, several countries (e.g. Germany) and regions (e.g. Flanders) frame their priorities as "transformative". A few examples are presented below.

> *The analysis confirmed the need for Horizon Europe to continue focusing on the current EU priorities in the 2025-2027 period: in particular: (i)* ***the green transition; (ii) the digital transition****; and (iii) building a more resilient, competitive, inclusive and democratic Europe. (Horizon Europe Strategic Plan 2025-2027, p. 5)*

> *Together with its twin****, the digital transition, the green transition*** *requires pivotal changes and trade-offs that will affect, among others, our economies and societies at an unmatched pace and scale. To succeed in this* ***transformation****, it is essential to recognise the links between the environmental, social, and economic dimensions of sustainability (EC Strategic Foresight Report p. 2)*

> ***Seven priority transition areas*** *for Flanders exist with a time horizon up to 2025: Digital Society 2025; Food 2025; Health and Well-Being 2025; Smart Resource Management 2025; Urban Planning, Mobility Dynamics and Logistics 2025; New Energy Demand and Delivery 2025; and Society 2025. (ERA-Learn Country Report Belgium, p. 22)*

Health

Health is a major R&I priority on EU and national level. Beyond its own particular research area, it is deeply connected to several other areas in particular environmental health and food.

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*The uptake of circular processes goes hand in hand with the Zero Pollution ambition, to improve **human and environmental health by decreasing exposure to harmful substances**. (ERA industrial technology roadmap for circular technologies, p. 38)*

*twenty-three such Priority Research Programmes and Equipment (PEPR) are included in national thematic strategies that address strategic and priority investments including technologies of the future such as green and digital technologies, **medical research and health industries**, the cities of tomorrow, adaptation to climate change and digital technology for education (ERA-Learn Country Report France, p. 20)*

*In line with the EU R&I policy, Germany gives special attention in meeting certain societal challenges including '**Health and Care**', 'Sustainability, Climate Protection and Energy', 'Mobility', 'Urban and Rural Areas', 'Safety and Security' and 'Economy and work 4.0' (ERA-Learn Country Report Germany, p. 47)*

Materials

Materials are by nature a cross cutting topic related to many other research priorities. Key aspects mentioned in the European documents are development of advanced materials and sustainability of materials including circularity aspects. In the context of increased emphasis on "strategic economy", securing access to materials for technological solutions to key challenges is a major concern. While the national level reports often list material science as research strength only few countries explicitly list material research among their priorities such as Austria and Greece as cited below.

. Achieving technological leadership for Europe's open strategic autonomy in raw materials, chemicals and innovative materials (Horizon Europe Strategic Plan 2025-2027, p. 10 Cluster 4 expected impact)

*The Materials 2030 Manifesto, signed by seven high-level representatives in the field of advanced materials, underlines that, to remain competitive and meet citizens' needs for **safer and more sustainable advanced materials**, Europe needs to strategically rethink advanced materials R&I by adopting 'a systemic approach to develop the next generation solution-oriented advanced materials which will offer faster, scalable, and efficient responses to the challenges and thus turn them into opportunities for Europe's society, economy, and environment today and in the future'. The Manifesto identifies the lack of visibility for advanced materials and asks for a technology push and market pull to **connect advanced materials developments with the upscaling to respond to market needs**. (ERA industrial technology roadmap for circular technologies, p. 29)*

*The national Austrian priorities in research and innovation based on the national Smart Specialisation Strategy are the following: i. Information and Communication Technology, ii. Life Sciences, iii. **Material sciences and smart production**, iv. Bio-economy and sustainability, v. Humanities, social sciences and cultural studies (including social innovation), vi. Climate change vii. Energy use and handling scarce resources viii. Securing quality of life in view of demographic change (including urbanisation, mobility and migration). (ERA-Learn Country Report Austria, p. 24)*

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*The analysis done when drafting the new National Smart Specialisation Strategy led to the identification of eight priority areas, in which the country has advantages and on which the transition to a new growth model could be based. These areas are the following: Agro-food value chain, Bio-sciences, Health and Pharmaceuticals, Digital Technologie, Sustainable Energy, Environment and Circular Economy, Transport and Logistics, **Materials**, Constructions and Industry, Tourism, Culture and Creative Industries. (Greece: Synopsis_National-Smart-Specialisation-Strategy-2021-2027, p. 2)*

Climate protection

The challenge of mitigating climate change is present in all documents. Especially the Roadmap for low-carbon technologies naturally places a strong emphasis on reaching carbon neutrality by 2050 with ample reference to the European Green Deal and the European Climate Law. The Strategic Foresight report also emphasises transition to climate neutrality but also the need to develop resilience in the face of climate change effects. On a national level, the German Innovation Strategy also combines climate adjustment and climate protection in one of its six transformation missions.

*The roadmap is there to help Member States to maintain their **trajectory towards climate neutrality** and to team up with researchers, innovators and the industry for concrete action. […] I am looking forward to continuing and deepening our cooperation, joint action and investments to live up to our commitments for a sustainable, fair, secure and **climate-neutral Europe**. Mariya Gabriel Commissioner for Innovation, Research, Culture, Education and Youth (ERA industrial technology roadmap for low-carbon technologies, p. 6 Foreword)*

*Boosting the **resilience to climate change** in key areas, such as transport infrastructure, digital, energy, resource storage, health, food, buildings, or manufacturing plants will also entail significant resources. (Strategic Foresight Report, p. 8)*

*Mission: Spearheading **climate protection, climate adjustment**, food security and the preservation of biodiversity (Germany Future R&I Strategy Executive Summary, p. 10)*

Food

Food is often addressed in connection with agriculture but also with climate change with an emphasis on the need to transition to more sustainable value chains. Another important connection is to health through healthy diets.

***Ensuring healthy food and nutrition security** by making agriculture, fisheries, aquaculture and food systems sustainable, resilient, inclusive and within planetary boundaries (Horizon Europe Strategic Plan 2025-2027 p. 10 Cluster 6 Impact Area 30)*

*The analysis done when drafting the new National Smart Specialisation Strategy led to the identification of eight priority areas, in which the country has advantages and on which the transition to a new growth model could be based. These areas are the following: **Agro-food value chain,** […] (Greece: Synopsis_National-Smart-Specialisation-Strategy-2021-2027, p. 2)*

*European Partnerships are used to cover the needs of the areas of expertise in a complementary mode, with the public partnerships addressing more the areas of health, **food and agriculture** (ERA-Learn Country Report France, p. 42)*

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Resources

Resources are a prominent crosscutting topic with several aspects highlighted by EU and national documents in particular the need to counteract the decline of natural resources e.g. through circular economy concepts, reduction of dependencies on critical materials to bolster strategic autonomy and more efficient use of natural resources. Typical phrases from the documents are:

> *Now more than ever, the EU must gear R&I investment towards the challenge of addressing climate change and* ***reversing the planet's natural resources decline****, while ensuring food and nutrition security (Horizon Europe Strategic Plan 2025-2027, p. 14)*

> *Bio-based advanced materials/chemicals and the integration and interaction of biological and artificial materials and components offer new opportunities to* ***reduce resource dependencies*** *and maintain sustainability. (Horizon Europe Strategic Plan 2025-2027, p. 97)*

> *In order to become greenhouse gas-neutral by 2045, we urgently need technologies and concepts for climate-neutral industry,* ***the efficient deployment of resources****, circularity, an energy and heating supply based on renewable energies, and the mobility of the future. (Germany Future R&I Strategy Executive Summary, p. 10)*

Security (including food security)

Given recent geopolitical tensions, it is not surprising that security and defence aspects are high on the agenda in national and EU R&I strategies. Related terms like war, conflict and defence also occur with high frequency. Strong requests for strategic autonomy and resilience are voices by the Strategic Foresight report and amplifies by the EESC comment. National strategies echo this turn by increasing emphasis on security related priorities. Typical examples include:

> *The EESC asks the EU and Member States to join efforts to ensure the provision of EU public goods, including by adapting the EU budget to the new scenario. Commodities and services that will safeguard* ***defence, security*** *(e.g. in food systems, water, energy supply and distribution, the economy, R&I, access to information and strategic infrastructure), health, education and well-being are crucial to enable the EU's "comprehensive resilience ecosystem" [...] to achieve and maintain sustainable and inclusive competitiveness and democracy. Recent geopolitical developments (e.g. the crisis in Ukraine and the Middle East) have worsened some external relations and put at risk the stability of the EU. Common political action and joint efforts at EU level would ensure that* ***people and companies are defended from these external threats (tangible and intangible)*** *that may threaten the EU's "comprehensive resilience ecosystem". (EESC opinion on 2023 Strategic Foresight Report, p. 4)*

> *In line with the EU R&I policy, Germany gives special attention in meeting certain societal challenges including 'Health and Care', 'Sustainability, Climate Protection and Energy', 'Mobility', 'Urban and Rural Areas',* ***'Safety and Security'*** *and 'Economy and work 4.0' (ERA Country Report Germany, S. 47)*

> *Mission: Spearheading climate protection, climate adjustment,* ***food security*** *and the preservation of biodiversity (Germany Future R&I Strategy Executive Summary, p. 10)*

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2.2 Stakeholder interviews

2.2.1 Stakeholder analysis

One key element of our topic identification process was a series of interviews with people across Europe. The selection was based on a bottom up process inviting suggestions from the highly diverse group of partners. This was complemented by a stakeholder analysis, which supported us in maximising the diversity of key perspectives on STI Futures covered by our participatory approach. This analysis was started in the interview process but will be continued for identifying participants for the actual workshops.

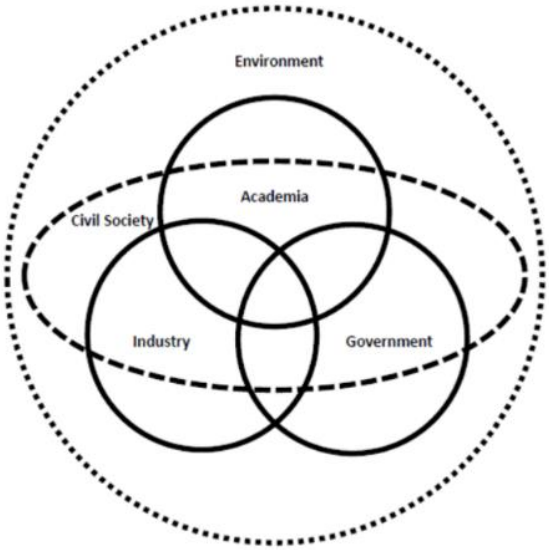

Figure 5: Arenas of influential stakeholders for R&I ecosystems (Hailu et al 2024, p.9)

Following key literature (Clausen et al., 2020; Mitchell et al., 1997; Reed et al., 2009) we define a stakeholder as *"An individual or group influenced by–and/or with an ability to significantly impact (either directly or indirectly)–the issue at stake."* The issue of stake being in our case the direction of research and innovation in the European Research Area.

We derive the key groups **influencing research and innovation** from recent concepts of opening up innovation system (Warnke et al., 2016) and quadruple or even quintuple helix approaches to knowledge generation (Carayannis & Campbell, 2021, Hailu 2024). These concepts have broadened the notion of innovation and knowledge generation systems beyond the classical triangle of university, industry and government and emphasised the role of public sector actors, users, citizens and the natural environment. They propose five actor relevant actor groups involved in knowledge & innovation systems i.e. academia, government, industry, academia, civil society and environment (Figure 5). It is important to note that in all five arenas actors actively contribute to generating knowledge and innovation rather than just passively setting framework conditions, consuming products, accepting technologies or providing/limiting resources (Warnke et al., 2016). These arenas are of course very broad and need to be refined in order to cover important influencing perspective. In each category we can define different groups with fundamentally different views towards STI orientation such as e.g. within Academia different disciplines or different types of research organisations. For Eye of Europe we suggest to start with a rather broad notion (c.f. Table 2) and to follow a stakeholder led stakeholder categorisation (Reed et al., 2009) by adding more categories according to the stakeholders' own assessments.

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Table 2: Categorisation for actively involved stakeholders

Arena	Distinguishing Aspect	Categories
Academia	Academic Discipline	Natural Sciences
		Social Sciences
		Humanities
		Engineering
	Type of Organisation	University
		Applied research organisation
		Academy
	Position	Senior researcher/Professor
		Junior researcher, PhD, postdoc
		Student
Business	Sector	Manufacturing (Consumer Goods, material Products, Automotive, Medical Devices/Products)
		Services
		Agriculture
	Company Size	SME
		Large Company
		MNE
Government	Policy Domain	STI Policy
		Environmental Policy
		Competition Policy

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(Civil) Society	Different domains of STI interests	e.g. citizen scientists, user innovators, lead/pioneer user, science enthusiast, artist,
	domain of activity/professional background	Industry, art, media, culture, care, service, NGO/CSO activist
Environment	Biosphere	aquatic, desert, forest, grassland and tundra

Regarding **affected stakeholders,** the picture is more blurred. In the widest sense one could say that all European citizens are affected by the direction of STI as they will benefit from innovations and insights or suffer harm from potential failures. At the same time the influencing, powerful stakeholder groups are at the same time affected stakeholders as every decision to take a certain direction will mean an allocation of resources to one field or type of RTI actor rather than another. We therefore decide to use the same categories for the affected stakeholders.

Across all groups, as a general principle, we would need a diversity with respect to gender identity, age, spatial context (urban/rural) and country of residence. Naturally, an important group of affected stakeholders are future generations of humans and more than human beings who cannot be directly involved today, so we will take measures to represent their voice in the subsequent process using methods such as the "empty chair for future generations" or the "Nature Future Framework" (Pereira et al 2020). Finally, it is important to note that we cannot use these categories as a strict ordering device as the complexity of socio-ecological systems defies any attempt at strict boundary setting. Rather, in the spirit of critical systems theory we acknowledge a continuously evolving nature of the system dynamics and boundaries (Achterkamp & Vos, 2007). Still the set of categories helps us to counteract biases and group think in the selection of interview partners and workshop participants.

To summarize what said as a general theoretical framework, the experts to be interviewed should be approached trying to identify and involve a large number of targets from different disciplines and experiences. This would provide a sample that could be representative of a population of relevant contributions and enable a sort of statistics of the results.

Due to the limitations introduced by the efforts that partners can dedicate to the task, the partners decided to select the experts on the base of personal relations and the expected impact. This approach has hopefully removed biases due to formality and increased the efficiency of the process. The adopted process has been therefore a fit-to-purpose one, where each of the interviews run differently, with some common aspects that were identified to facilitate the analysis of the results.

In practice, the selected experts were identified to collect messages that could be not public or difficult to access in institutional documents referring to the scientific support to decisions. The majority of the interviewed experts were selected to cover a deep experience in the science to policy interface and in knowledge of foresight process. Some experts were identified also for their deep expertise on specific scientific topics. After a check of the availability of many candidates, 20 interviews were conducted (see Annex 4.3). Their profiles span from high representatives of the EU Commission DG-RTD, European Economic Social Committee, Greek General Secretariat for Research, to Scientific Attaché to Permanent Representations to the EU, and scientists involved in foresight initiatives.

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2.2.2 Interview preparation

Partners first discussed on a structure to frame the topics to be considered relevant for foresight exercises within the project development and for the EU foresight process at large. A preliminary list of topics was proposed and they considered the starting points for further refinements and/or widening after the analysis of the outputs from the interviews (c.f. Table 3). The preliminary structure of the topics, that are general and include a variety of interconnected issues, was articulated to include additional aspects and a focus meant as a specific projection of the more general argument.

Table 3: Preliminary topic structure after first brainstorm among partners

Preliminary Topic	Focus	Additional Aspects
The future of R&I in support to policy	From information to action	AI, IPR, values, access, propaganda
Emergencies and crisis	Preparedness and resilience	Critical infrastructures, skills, extreme events, insurances
The autonomy in a globalized world	Sustainability and equilibrium	Circular economy, science diplomacy
Demography	Social contracts and transitions	Indicators “beyond GDP”, skills, aging, healthcare, food
The future of conflicts	Values and democracy	Peace keeping, space, the role of private sector, the climate war
The Anthropocene	The blue gold	Oil and gas, Deep sea mining, artificial photosynthesis

The interviews with the selected experts aimed to provide their views on the foresight process and clues for the identification of weak signals and missing aspects. Interviews are not meant to collect answers to questionnaires, usually considered boring or difficult to adapt to different personalities, but to share ideas and stimulate reflections.

Guidelines to conduct the interviews were drafted and distributed to the partners (see Annex 4.1). Briefing/preliminary information exchange with the experts were shared, also using a document drafted to facilitate the interaction. A participant information document was also prepared and asked to the interviewed to be signed. That document was meant to inform the experts on the aim and use of the results, and on the aspects related to privacy. All documents were uploaded to a dedicated directory in the repository of the project.

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Each interview was expected to require at least a full-day effort, in terms of identification of the expert, contact, briefing, organization, operational discussion, reporting. For each interview, a report was drafted, containing the main aspects identified during the interview and selected to catch the views, proposals, suggestions and provocations that emerged during the dialogue with the expert. Each report was shared with the expert for its approval and then made accessible to the task's partners.

2.2.3 Interview analysis and results

The reports have been analysed to identify the unexpected and common aspects. As a general comment, the interviews with "institutional" representatives were more in line with much discussed future topics. That is, the EU priorities (e.g. Green Deal, Digitalization) and the recent geopolitical scenario (i.e. in the Ukraine and Middle-East) mainly monopolized the discussions, with some slight differences and useful suggestions. Some inputs were out-of-the box, and all contributions provided interesting clues to rethink some topics too.

During the interviews, often at the end of them, the experts were asked to propose the R&I topics that they consider relevant for the foresight processes in supporting policy decisions.

We need to remark that the identification of R&I challenges have been often confused with challenges at large. As an example, when addressing the achievement of carbon neutrality, the reference to the development of alternative solutions (e.g. artificial photosynthesis) or theoretical advances (e.g. multi-scale analytical descriptions) are often missing. This is probably due to the typologies of experts that were selected and to a common attitude to address the problem to be solved and not the problem to be set.

In the following, we show just few extracts from some reports that can give examples of stimulating reflections.

> « When we talk about policy and science and technology, change it and talk instead about Knowledge and Technology. And Knowledge is not coming necessarily only from science: for example, religion has a big impact, formal or informal, on the way people want to live, as well as arts, culture, style of living. Books change people. So, not only social sciences, but humanities."

> *The young generation is put at the centre of the future developments, without leaving the older ones behind. Older and younger generations complement each other. The older generations can provide their experiences and maturity while the youths bring new values, fresh ideas, and mentalities. The blend of the two can provide amazing results in future-oriented activities, such as foresight exercises.*

> *The process from information to action probably requires a new approach in the mathematical description for the language of nature, encompassing what at the moment is addressed linearly by genetics, ecology, psychology, robotics etc. This is not anymore associated to the concepts of propaganda or war that can be both considered a linear approach to the process of driving collective behaviours. When only material resources are taken into account, war is a zero-sum game. War is usually approached in a frame of equilibrium of forces, that is in a concept of a field dominated by matter. Intangible assets, meant as ideas and processes, will introduce a*

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drastic transformation in the concept of values. At the moment, virtual assets are mainly associated to financial aspects, and new models for the finance/dynamics of ideas will become the next challenge of research in supporting policy.

Functional genomics, more than chemical synthetic biology and "stem materials", can support living organisms, also integrated across kingdoms of life that can behave to perform multi-purpose activities by design, in an intelligent process encompassing sensing, elaboration of information and action. It implies atomic-size manufacturing as a sort of 3D-printing self-organized system (e.g. as a bootstrap process), with internal atomic coding for adapting to environmental resources.

Foresight should complement innovation with ex-novation, especially when imagining future scenarios that are based on out-of-the-box ideas. Foresight would therefore embed ex-novation in a non-destructive process, creating safe spaces for testing new ideas and scenarios. This will pave the way for a diversity of options to avoid emergencies and to prepare eventual transformations. Forecasting (short-term) and backcasting (long-term) approaches are both needed to facilitate fair transitions.

Efforts in identifying options for new economic models should be evaluated to guarantee the sustainability at social and environmental dimensions. The identification of complementary indicators to GDP, and their translation into policy measures and specific interventions should be effectively adopted. The combination of different indicators will provide new paths for addressing the challenges and abandon the concept of a ranking of countries based solely on GDP.

The massive increase of production and access to data is exponential, but the knowledge increase is linear. An exponential increase of knowledge will impact on transformations of society and use of resources, shrinking "generation timescales" to few years. The integration with bio-robotics and global connection will generate a "hidden mind" that will result in a new system of social relation, different from the collective behaviour of humans, but as a mind field where each individual component constitutes and influence the unique, not unified, mind.

[...] ...leverage digital solutions to create a real-time pan-European intelligence space that combines digital foresight (AI solutions) with human domain-level expertise, paired with sufficient expertise on context, whether cultural, organisational, or processual. Such a European-wide intelligence space for agreeing on certain trends and developments could be helpful for a European R&I foresight community. It could effectively act as a "Pan-European socially constructed consciousness".

[...]... the perceived disappearance of elite structures clearly delineating the scientific community. This is not per sé a negative e.g. with the rise of citizen science, but it affects and reinforces the uncertainty related to futures of knowledge.

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A first analysis of the different issues referred during the interviews was conducted and the main conceptual messages were grouped as follows as a first attempt to provide interlinked aspects.

The interaction between humans and nature: climate change/ climate neutrality, environmental protection, food & water security, sustainable urban development.

The future of Knowledge, education & skills: inequalities, generational gap and integration

The interaction between humans and technology: AI, augmented reality, cognitive systems, mis- and disinformation, the role of interactions and context (regulation, ethics)

Demographics: EU ageing population and subfertility, immigration, sustainability of financial systems (debt, taxation).

Autonomy in resources: resources, security, defence (peace and prosperity).

Public-private partnerships: public goods, industry policy, economic models and growth indicators, governance, scale-up of SMEs, EU attractiveness for investments.

Digitalization & globalization: AI, automation, social media, intangible assets, value of relations, the concept of the value: from quantity to quality, social and labour transformations, social contracts.

The future of freedom, democracy and ethics.

RTI & European Security implications of tightening security threats for RTI including dual use and its possible contribution (science diplomacy), strategic assets for preparedness to tackle crisis and emergencies (including space, communication).

The interaction between individual needs and social equilibrium/coexistence

"Purely" scientific topics: functional genomics, artificial photosynthesis, algorithmic biology, science of relations and networks, new maths for complexity and language of life, global mind, water as information channel, atomic-size manufacturing.

European Neutral Carbon Economy: hydrogen, artificial photosynthesis

The wording used and reported from the interviews when suggesting specific topics was further analysed using software based qualitative analysis (cf. Figure 6). This formed the basis for highlighting the persistence of some arguments and the interconnections between concepts that could be linked by transversal aspects

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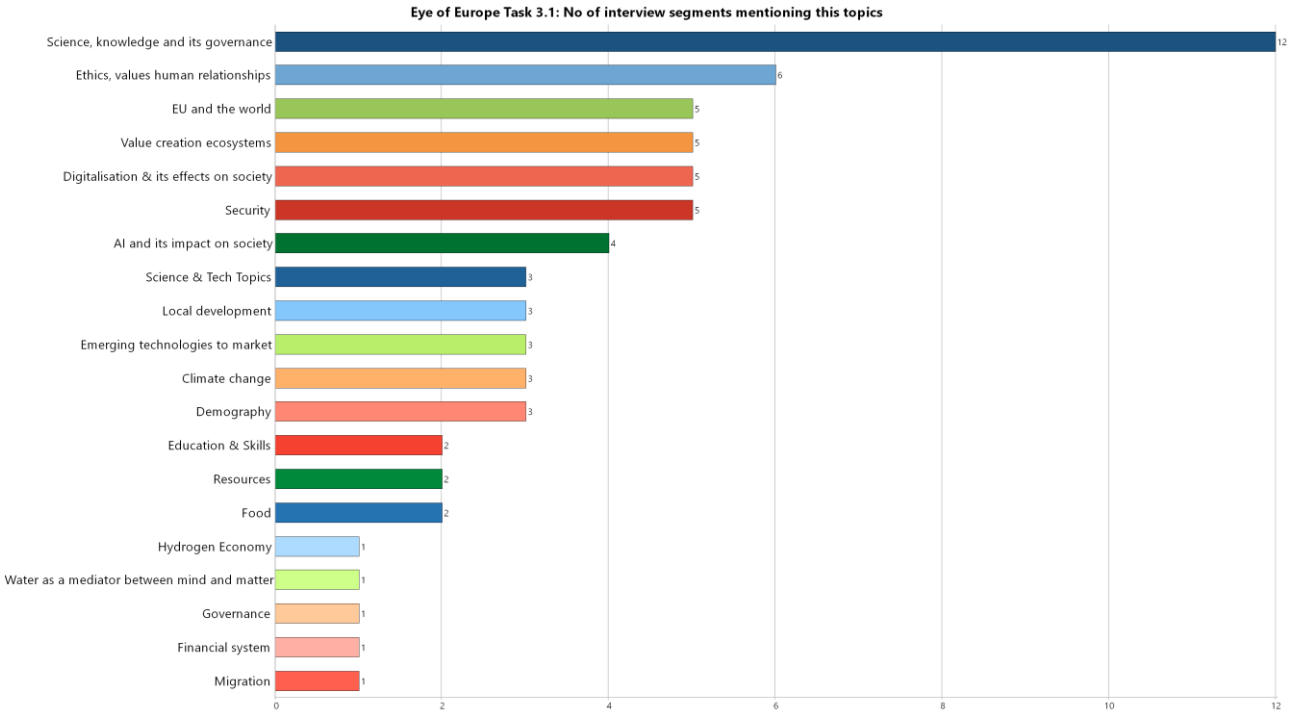

Figure 6: Histogram of counts for different aspects reported during the interviews.

According to the distribution of the competences and experiences of the interviewed experts (mainly on science-to-policy or foresight processes), we expected the majority of the suggestions on topics to refer to the "mainstream", that is on those aspects usually associated to digitalization, green deal and strategic autonomy. In this context, climate, raw materials, circular economy, and demography were very rarely referred and mainly not considered a priority. This is due probably to the approach adopted during the interviews that was to remove any bias toward the identification of weak signals, and a perceived awareness that "long-term" perspectives should address topics that are beyond what is already on the political and technological tables, and therefore considered a matter of fact (e.g. raw materials, quantum communication, AI). Some aspects are indeed looking at a neutral carbon economy (e.g. the role of hydrogen and artificial photosynthesis, that despite not yet fully developed are not considered "fiction"), or to a definitely unexpected view of the future (e.g. functional genomics, the water as an information channel for life, manipulation of the space-time geometry).

The interviews provided therefore a valuable bouquet of suggestions that can be translated in a conceptual and operational list of topics. The analysis of the outputs from the interviews allowed as a first result a revision of the first list proposed by the consortium, with widening and refinements of topics as presented in Table 4.

Table 4: List of topics after 1st review

Topic 1.0	Focus	Additional Aspects
The future of Knowledge	Support to policy and decisions	Generational transitions, education systems, collective intelligence
The role of R&I	Emergent technologies and information systems	AI, propaganda, automatization, STEM and humanities

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Emergencies and crisis	Preparedness and resiliency	Skills and phase transitions, peace and prosperity
The future of priorities and conflicts	Science of relations/networks/contexts	Social and external relations, geo-political scenarios, science diplomacy
The autonomy in a globalized world	Sustainability of resources	Circular economy and raw materials, water, food
New economic models	Social contracts and transitions	Complementary indicators to GDP, EU attractiveness for investments
Demography & finance	Sustainability of the financial systems	Aging vs. immigration, welfare, taxation
Anthropocene	The planetary boundaries	The blue gold, climate war, environmental exploitation and protection
The innovation ecosystem	The interaction between private and public sectors	Modes of governance and workplaces, public goods, quintuple helix, scale-up of SMEs in EU
The future of intangible assets	Big data and the value of quality	IPR, accessibility, cyber security
Democracy and freedom	Ethics and values	Inequalities, cultures, anthropology
Economy and society	Collaboration and competition	Dual use of technologies, strategic infrastructures
Emergent scientific challenges	From quantum technology to complexity	Artificial photosynthesis, functional genomics, the math of nature, atomic-size manufacturing
The future of the *Sapiens*	The evolution/integration of the cognitive systems	Augmented reality, robotics, AI, genetics, collective intelligence
The concept of health	Equilibrium and evolution	Good environmental status, pandemics, health systems, personalized medicine

Additional reflections suggested to identify a complementary list of topics, composed by an aggregation of the previous aspects and having in mind to go beyond the “classical views”, and stimulate foresight exercises based on long-term perspectives.

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The following revision of list of the topics presented in Table 5 is still maintaining the first structure, proposes a different grouping of social and technological aspects (e.g. “knowledge-intergenerational interfaces-cognitive systems-AI-robotics”, or “ethics-beauty-intangible assets-justice”) as well as including topics well-recognized in other ongoing foresight activities. It was generated by a core team of project partners.

Table 5: List of topics after aggregation by project core team

Topics 2.0	Focus	Additional Aspects
The future of Knowledge & *Sapiens*	The evolution/integration of cognitive systems	collective intelligence, global mind, generative AI, augmented reality, generational transitions, skills & education systems, science policy, propaganda, mind and matter
Democracy and freedom	Ethics, values, justice	Inequalities, social and external relations, IPR and accessibility to resources
Socio-economic ecosystems	Future value creation systems	Complementary indicators to GDP, EU attractiveness for investments, Public-private collaboration platforms and models of symbiosis, knowledge valorisation, Futures of entrepreneurship
The role of emotions and beauty	Anthropology, culture, art	Value of intangible assets, value of relations, future of fashion and the arts, creative AI
Demography and implications social and fiscal systems	Sustainability of social and financial systems	intergenerational interfaces/justice, aging, public goods, social contracts, taxation, welfare, pension systems
Humans and nature	Anthropocentric vision of reality and its alternatives	Environmental exploitation and protection, raw materials, planetary boundaries
Science for peace and prosperity	Science and security, international S&T cooperation	Dual use, defence, R&I security, science diplomacy, strategic autonomy and infrastructures, space, risk management, Europe in the (S&T) world
Carbon negative economy	Common infrastructures	The countermeasures of oil-based ecosystem, infrastructures' transition

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		(e.g. hydrogen, electricity), carbons sinks, nature based solutions, food, mobility
Modes of governance	Governance in the face of wicked problems	Science of complexity, relations and networks, whole of government/nation/society approaches
Emergent scientific challenges	Specific S&T topics	Artificial photosynthesis, functional genomics, the math of nature, atomic-size manufacturing, synthetic genetics, algorithmic biology
The concept of health	Equilibrium and resiliency	One health (planetary and human) Good environmental status, pandemics, personalized medicine, preparedness and emergencies

A graphical representation of the interconnection between the aspects included in the topics is shown in Figure 7. The proposed initial two frameworks (i.e. new economic models and tangible vs. intangible assets) are transformed in other two more general conceptual ones: knowledge and governance/relations. These two can be considered the structural and transversal components for the processes aiming to provide interventions to tackle the global challenges and that embed services, legislation, technologies, skills etc.

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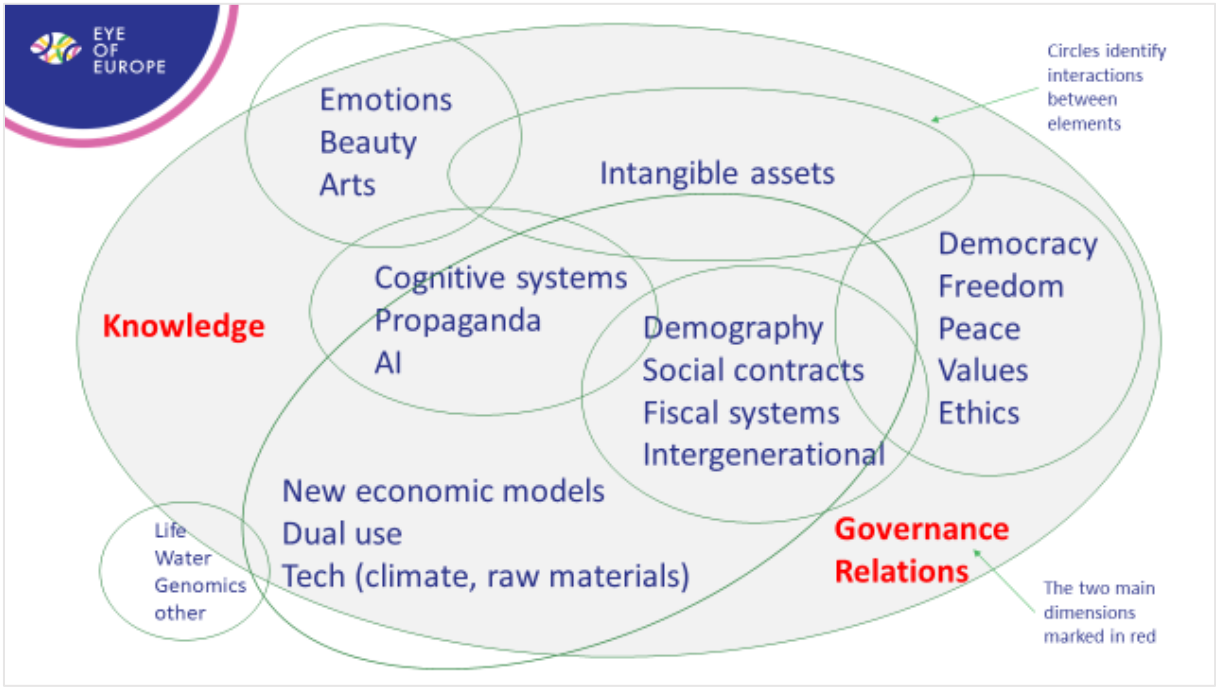

Figure 7: Graphical representation of different aspects reported during the interviews and included in the topics.

2.3 Integration and review

At the Consortium meeting held in Bratislava on 24 May 2024, the partners were asked to discuss about the proposed topics. The aim of the discussion was to reflect on what arguments were appropriate for the development of the planned events, accordingly to the consortium's competences and capacities, and matching the expected interests and possible participation of stakeholders. Partners were invited to vote their preferences in the aspects indicated in each topic, with also some refinements. Since the number of aspects differs between the topics, a threshold for each topic was set as the average for a flat distribution (that is the number of votes divided by the number of aspects), and the aspects whose preference was above the threshold were considered as the main interesting ones.

The results of this analysis is reported in the following Table 6, having in mind that the consultation can be biased by the limited time at disposal, number of participants, their personal experience and competences.

Table 6: Outcomes of topic voting in Bratislava project partner meeting

Topics 2.0	Most Voted Aspects
The future of Knowledge & Sapiens	generative AI, skills & education systems, science policy
Democracy and freedom	social and external relations, democracy
Socio-economic ecosystems	Public-private collaboration platforms and models of symbiosis, knowledge valorisation, Futures of entrepreneurship

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The role of emotions and beauty	Value of intangible assets, changing role of arts and culture,, creative AI
Demography and implications social and fiscal systems	Sustainability of financial systems, intergenerational interfaces, welfare
Humans and nature	Anthropogenic vision or reality and alternatives, planetary boundaries
Science for peace and prosperity	Science and conflicts, dual use, R&I security, Europe in the (S&T) world
Carbon negative economy	Infrastructures' transition, nature based solutions, food & mobility
Modes of governance	Science of wicked problems/complexity, whole of government/nation/society approaches
Emergent scientific challenges	Artificial photosynthesis, atomic-size manufacturing, synthetic genetics, human enhancement
The concept of health	One health, personalized medicine, mental health

2.4 The final set of pilot topics

Building on the outcomes of the discussion in Bratislava the final set of topics to be addressed in the series of Foresight workshops was generated in a joint process among the project partners in several rounds of bilateral and group discussions facilitated by a visualisation on a MIRO Board (cf. Figure 8). As indicated by the bold arrows, some pilot workshops directly address core topics from the analysis while others feed into several of the topics. Following the flow of topic generation from the topic dominating the current discourse (light blue) we can see that the final set of topics incorporates these key societal challenges but also goes beyond by focussing on more long-term underlying perspectives.

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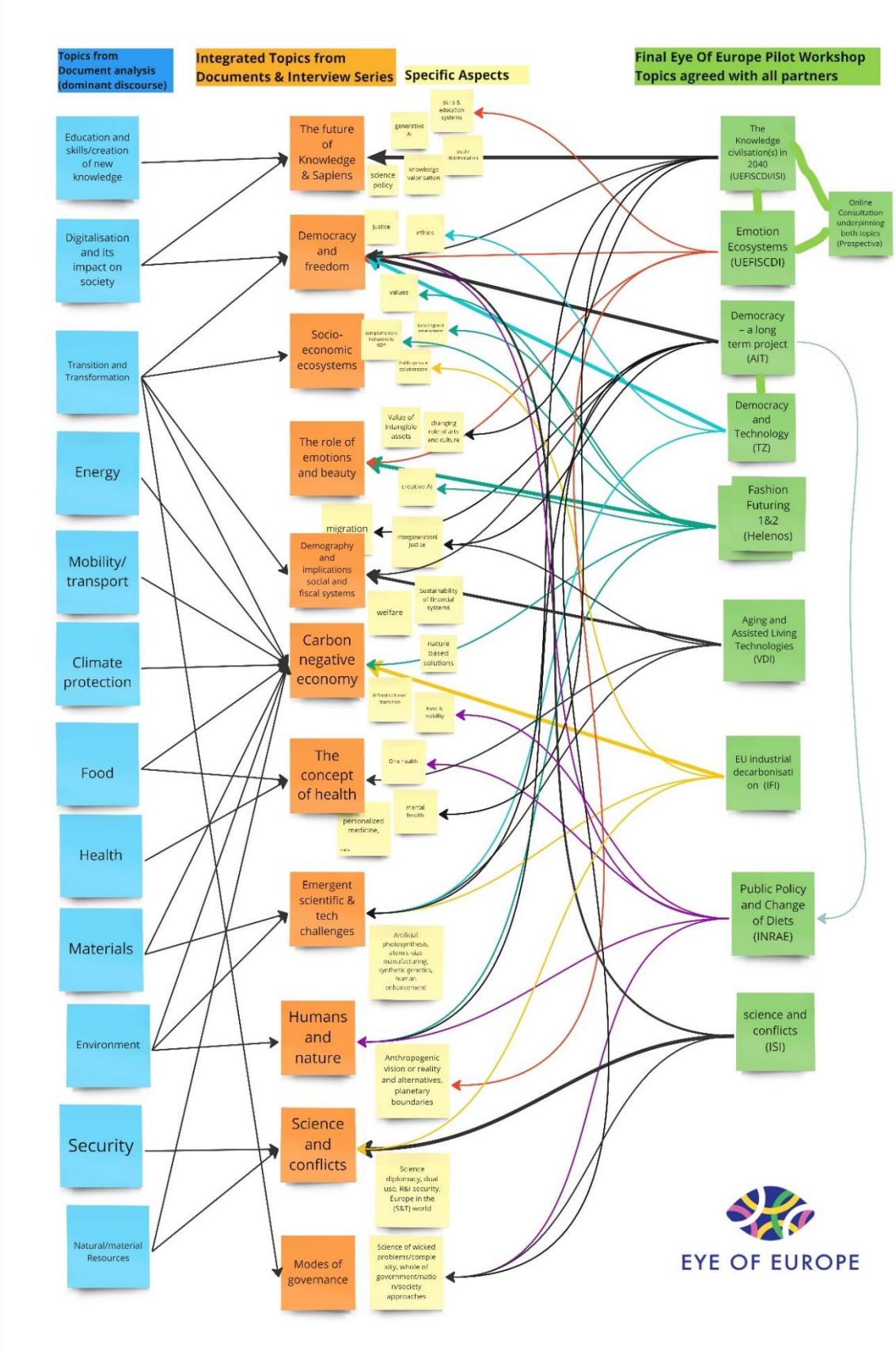

Figure 8: MIRO Board capturing final topic generation process

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Table 7 provides a more detailed description of the workshop topics envisaged, including information on the type of interaction and nature of participants. Most partners already indicated their envisaged choice of methodology. These suggestions will now again be reviewed in interaction between all partners and the core team to make sure that we deploy a wide range of approaches including both classical and novel Foresight methods while at the same time generating inspiring results and mobilising a diverse groups of stakeholders and experts into the Eye of Europe and wider Foresight community. The outcomes of the methodology refinement will be reported in Deliverable 3.2 The pilot topic handbook.

Table 7: The final set of topics for EoE pilot workshops

Topic	Aspects	Responsible Partner	Workshop type & participants
Democracy – a long term project	The workshop intends to shed light on a large spectrum of future challenges to democracy. Some of these challenges will be informative for the subsequent topics, e.g. technology & democracy, ageing, mental health, AI and the role of emotions; public policy making in delicate issues like change of diets. The long-term focus of the exploration will be supported by considering the challenges of demographic change, intergenerational justice, representation of future generations and non-human actors in policymaking.	AIT	Half-day online Workshop with 30 domain experts.
The Knowledge of our civilisation(s) in 2040	The workshop addresses the future of knowledge in human civilisation in the face of multiple drivers of change. Lead questions include: • subjectivity & objectivity, diversification of perspectives in society, social construction of reality, truth vs believes) • human & machine in knowledge ecosystems • individual & collective knowledge • knowledge & wisdom (architectures of wisdom) • scientific & indigenous knowledge • explicit & embedded knowledge • attention & intention	ISI/ Prospectiva	Two-day workshop in Berlin, with mixed experts including computing - AI, data storage, interfaces, cognition, anthropology, education, (social) psychology. In addition diverse epistemic communities, art and spiritual communities. Methodology: Horizon Scanning & Scenarios complemented by online survey

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European industrial decarbonisation and global context scenarios	Qualitative scenario work on global context scenarios and industrial decarbonisation. Roadmapping for exploring alternative pathways of industrial decarbonisation for Europe with emphasis on identifying key areas for R&I. Optionally, wind-tunneling of EU plans vis-à-vis scenarios.	IFI	Two-days face-to-face workshop in Madrid with mixed stakeholders: Public administrations in different levels (energy, environment, climate, economy, finance), Industry representatives around Europe, Energy R&I experts, Energy foresight and forecasting experts
Emotion Ecosystems	The impact of technologies like affective computing and brain-machine interface on individuals and collectives; the frontiers of psychology and neuroscience of emotions (e.g. brains' reality threshold, gut-brain connection); holistic health; collective trauma and healing; emerging emotional challenges (e.g. ecological anxiety); the increasing role of emotional intelligence in education and work; emotions in animals.	UEFISCDI	Two-day workshop in Bucharest with 40 multi stakeholders, representing - (social) psychology - neuroscience, including. BMI - anthropology - political science - animal psychology - media - art - spiritual communities.
Democracy and Technology	The focus is on interaction between technology and society. This includes potential health, environmental, ethical as well as other risks connected with new technology applications and the impacts thereof upon the various societal groups (for instance, age groups, men and women, social groups, etc.).	TC Praha	One-day face to face workshop in Prague with 30-50 citizens with a couple of relevant experts, (input from AIT workshop)
Aging und Assisted Living Technologies (AALT)	The integration of smart and digital technologies into assisted living and care for older adults has become increasingly important in recent years. The thematic focus lies on the relevance and impact of AALT both from a demography angle as well as from a technological innovation lens. The main goal of the workshop is to identify and describe the overarching effects on society as a whole, in the context of research and innovation policy.	VDI	One-day workshop in Berlin with 30 international research and policy experts from the field of gerontology, social care work, high tech engineering and business. Methods: STEEP VL framework Futures Wheel
Future of sustainable fashion in	Fashion not only reveals unique and collective identities, norms, and ethics, but is also associated with environmental issues. It is one	Helenos Consulting	Two one-day workshops in Thessaloniki. The first one with citizens and the 2nd with

interaction with values and identities	of the largest polluting industries, prompting a shift in the way we produce and consume fashion items. How might the climate crisis change our attitudes, and how does this affect the fashion industry? How can we secure sustainable value creation for economy, culture and society in the long-term future?		domain experts (including international ones). Method Fashion Futuring (speculative design)
Public Policy and Change of Diets	Change of diets is an important public policy goal in R&I and other policies for reasons of both health and sustainability. Yet, policy makers struggle to achieve changes as influencing such an intimate area of daily life is extremely sensitive. The workshop will explore possible inroads together with a diverse group of citizens.	INRAE	One-day workshop with citizens in Paris
Science and conflicts	The increase of geopolitical tensions rises a number of new questions for science. On the one hand, science may have a role to play in keeping up peaceful cooperation (science diplomacy). On the other hand, questions of dual use and research security come to the forefront. The workshop will explore possible future scenarios of science in a world characterised by conflicts.	ISI	Half-day online workshop with domain experts
Future of Knowledge and emotions	The futures survey will provide input to the two interrelated topic of future of knowledge and emotions.	Prospectiva	Online consultation, mixed group of experts and stakeholders

3 Conclusions & Outlook

Global and local challenges are addressing systems whose complexity has increased, mainly due to the multitude of different and interconnected aspects. The economic, social, political, and environmental dimensions are involving different stakeholders and instruments, resulting in the difficulty by policy makers and managers to provide sustainable, feasible and impacting solutions. Science is requested to support the decision and negotiation processes, also via foresight processes that aim to identify paths for shaping the future.

The Eye of Europe process for identification of topics for its series of foresight processed focused on R&I in its role in contributing to decisions and adoption of interventions at EU level and has resulted in an integration of different paths for the collection of suggestions. The analysis included three main elements, 1) Relevant documents on R&I priorities

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from EU and national level were analysed to extract the main common messages. 2) A set of interviews served to identify views on the foresight process and clues for the identification of weak signals, unexpected and missing aspects. Experts were identified to collect messages that could be not public or difficult to access in institutional documents referring to the scientific support to decisions. Experts were selected to cover a deep experience in the science to policy interface and in knowledge of foresight process and partly also for their deep expertise on specific scientific topics.

The outputs from the interviews were analysed to revise the first proposal of topics. Refinements and additional topics were introduced. Additional reflections suggested to identify a different representation of the topics, composed by an aggregation of the already identified aspects and having in mind to go beyond the “classical views”, and stimulate foresight exercises based on long-term perspectives.

The finally resulting list provides a wide diversity of topics. It covers many of the key concerns from the dominant R&I policy discourse such as e.g. “disinformation” and “impact of AI and digitalisation”. Furthermore, it includes questions of industrial innovations and sectoral aspects such as industry decarbonisation and textile manufacturing but also questions from the Science Policy end of the spectrum like “Science and conflicts”. Three topics relate to citizens daily life i.e. aging, diets and fashion. In all cases, the framing goes beyond the dominant discourse perspective and digs deeper into the underlying root courses and more long-term questions like the “future of knowledge”, “interaction between technology and society”, “geopolitical framework scenarios” and “values and identity”.

In retrospect, we can reflect that the main challenge of the topic identification process was to progress from directly addressing objectives or “societal challenges” and beyond immediate “R&I” topics towards the associated cross-cutting research and innovation gaps that, if filled, can support solutions. The confusion between the achievement of measurable indicators and filling research steps can be partially explained by the cross-disciplinarity of many challenges, with the consequent need for long processes allowing the experts from different domains to interact. The interviews and iterative consortium reflections enabled us to generate topics that on the one hand recognise the complexity and emergence of the socio-technical systems involved, but at the same time open up arenas for meaningful and constructive interaction that can orient R&I strategies for policy makers and other ERA stakeholders.

In the next steps, the respective partners will further refine each topic and define the Foresight methodology they will implement in the workshops. In doing so several criteria will be considered. Mostly of course, the methodology needs to enable the chosen set of participants to address the topic with a true long-term perspective, question present linear assumptions, reveal novel future oriented perspectives and derive concrete actionable implications for R&I policy. At the same time, the overall set of methodologies should be diverse including established approaches such as scenario development but also more recent ones such as speculative design to maximise the learning benefits for the emerging Futures4Europe community and the attractiveness of foresight practitioners and policy makers for domain experts and broader audience.

The outcomes of the methodology design process will be captured in Deliverable 3.2 the Eye of Europe Foresight Pilot Handbook. This internal document will guide the piloting process and ensure consistency and complementarity across the pilots. It will also include provisions for capturing the learnings in a common format and ensure linkages with the Foresight Resources generated in WP4 Futures Literacy.

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4 Annex

4.1 Background Document

4.1.1 The context of the grand challenges

Global challenges are embedded within different institutional levels, from private companies to the United Nations, and contexts, e.g. health, food, climate, energy. These challenges involve complex systems in terms of a multitude of different interconnected aspects and stakeholders. Managing complexity is therefore a fundamental issue, resulting in the appropriate governance of the processes and in the adoption of effective interventions.

In this context, the identification of spatial dimensions and timescales is crucial.

The characteristics of complex systems are 1) the inadequacy of a linear approach in understanding the dynamics of the processes and 2) the lack of accuracy in the prediction of the system evolution in the long term. Moreover, emergent properties arise from the interconnection of the constituents of the system that cannot be described as the sum of the different independent parts, and these properties can emerge in very short timescales, usually associated to the so-called tipping points. The most famous narrative of the behaviour of complex system is the butterfly effect.

4.1.2 Managing complexity

Complexity is a concept, and there is not a unique mathematical formulation for its description as it is for quantum mechanics or general relativity. For this reason, we can summarize the main “keypoints” to keep in mind when dealing with a system that is composed by a diversity of interconnected agents as: 1) no one-size-fits-all (context dependency), 2) the sum of the parts could not be representative of the whole, and 3) predictions in the long term are inaccurate and abrupt changes in the state of the system can occur (for more details, see (Badii & Politi, 1999; San Miguel et al., 2012)). There are several models for managing complex systems, mainly developed in the field of network science, that have been applied to private companies or informatics (Abubakar et al., 2019; Brafman, 2006; Hussain et al., 2018; Lo & Zhang, 2018; Toni et al., 2012). Most of the models have been inspired by the studies on the organizational structures of social communities or living organisms.

The stability of these systems, which can be interpreted as the survival of the identity of the system itself meant as species or a brand or a group, is based of self-organization and a very limited number of internal rules. In practice, hierarchical governance, cause-effect control, and consequent prediction of the future evolution are considered ineffective to fulfil the goals of the system. For this reason, resiliency and not robustness, flexibility and not procedures are the characteristics of the management that can tackle the challenges shown by complex systems.

This being said, it is well known that for the humans, hierarchical and mechanistic structures have been historically adopted and considered the most effective and efficient organizational structures. “Power” is expressed in command, control and stability. Accurate prediction of the future and certainty of cause-effect impacts of interventions are fundamental pillars identified by the governance in the past. Unfortunately, this approach is no more appropriate when dealing with the complexity of grand challenges.

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As a result, the main common aspects characterizing the approach to tackle the different grand challenges are 1) the need to approach the system as a whole (breaking the silos approach), and 2) the uncertainty of the impact of most of the interventions in the long term.

4.1.3 The role and contribution of foresight

At global and territorial scales, policy makers, public authorities, and managers are often struggling with the design of policies and identification of suitable solutions to satisfy the multitude of involved stakeholders. Sustainability of the decisions and interventions addresses different dimensions: economic, social, political, environmental. Different instruments and resources are contributing to shape the scenarios: natural resources, culture, legislation, funding, data collection and analysis, communication, training of personnel, etc.

The increased complexity of the system has imposed a revision of the strategic approach leading to decision and planning processes, nowadays no more designed on the basis of limited past experiences or action in isolation. Science and foresight have been invoked to frame the knowledge-based support to policy.

The definitions of the term “Foresight” can be multiple. As a general meaning, it addresses the process or the ability to predict what will happen or be needed in the future. The ultimate aim of foresight exercises is therefore to guide decisions in order to shape the evolution of the present towards a desired future.

In the last decades, we have faced a deluge of foresight exercises and think tanks. They have been asked to provide insights for a diversity of issues: from specific thematic (food, energy, transport, robotics, and space, to name few), to maximum systems (finance, climate, security, etc.).

The methodologies adopted for running the foresight exercises are crucial.

Particular attention has to be paid to the analysis and the implementation of the foresight activities: these in fact can be largely influenced, incidentally or on purpose, by cognitive biases (Gigerenzer & Brighton, 2009). For the sake of simplicity, we report few examples of such biases as follows, identifying some limitations in some methodologies.

Well-recognized actors or contexts (i.e., the United Nations, responsible authorities, group of eminent scientists, etc.) are usually involved. This introduces the so-called anchoring and framing biases, that is, when the analysis and the decision are influenced by preconceptions.

Selected actors or facts are involved and considered, mainly those that are likely to reinforce the desired conclusions. This is the confirmation bias, and this is a very common workaround used to promote a decision and demonstrate consensus.

Evidence is considered the main aspect to be taken into account, even if not supported by accuracy or robustness of the conclusions or methodologies. This is the representativeness bias, when a transparent description of the probabilistic frame is omitted.

Weak signals and emerging properties can drastically impact on the properties of a complex system, and consequently influence the future. The identification and management of these signals require the capacity to recognize the objectives of the actors and the resources under their control, the boundary conditions of the environment (that is, other actors and resources not under control), and the analysis of the appropriate decisions and actions to be adopted to achieve the objectives. Actors, events, and resources distributed in time and space constitute a network of interconnected agents where humans are asked to design and adopt the appropriate governance to tackle complex challenges.

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What said above, and also taking into account the characteristics of complex systems involved when tackling global challenges, clearly suggest that foresight cannot solely rely on the result of modelling or based on a standard scientific methodology. For this reason, we need to reflect on the fact that there are many, more than 30, quantitative or qualitative methods used in foresight activities (Georghiou, 2008; Popper, 2008), but all can be sorted into two main approaches: Forecasting or Backcasting.

The first one is an evolutionary approach based on data collected, both in a quantitative and qualitative fashion, and analysed in such a way to build up scenarios starting from the current situation. It is a linear approach, which implies the concept of probability of realization of the scenarios, provided some events occur or some actions are adopted.

Backcasting is a planning method that starts with defining a desirable future and then works backwards to identify policies, programs and action that will connect that specified future to the present (Brandes & Brooks, 2007). It is, in other words, an approach reflecting visionary political objectives to be fulfilled. It results in a systemic approach driven by the needs and based on the strategy to achieve them. It has not multiple scenarios, but different paths/roadmaps to achieve the desirable future.

While forecasting involves predicting the future based on current trends analysis, backcasting approaches the future from the opposite direction. Forecasting is an extrapolation method, conversely backcasting is an interconnecting method. The first is certainly appropriate for stable and closed systems, while the second is more suitable to be used in non-equilibrium, open systems.

Backcasting can be in some sense considered a model of governance: even if the system is difficult to be controlled and the future is not predictable in long-term timescales, it is however possible to shape the future by consistent and continuous adaptive decisions and actions, provided that the vision of the future to be realized is the leitmotiv behind every action. The capability of transforming dreams into reality over time is to be considered a form of governance. The EU itself is an extraordinary example of how a dream can become a reality.

The EU Founding Fathers vision is the result of a backcasting foresight approach, which has been able to inspire and to guide the construction of the European Union. To guarantee the long-term objectives of peace and welfare to the EU continent, the governance was designed and based on the dimensions of solidarity, democracy, cohesion and sharing of resources. When tackling incoming challenges, EU can shape the shape the future, navigate its dynamics, or orchestrating the different actors playing the game.

4.1.4 The recent EU strategy for the contribution of foresight

Foresight is recognized as a useful tool in decision processes and recently introduced at EU institutional level. The Vice-President of the Commission has been appointed as Commissioner for the Foresight. The EU, through the Commission, has strengthened the attention to foresight by constituting a platform involving experts, and such a process initiated in 2021 by the German Presidency to structure the participation of Member States in a joint foresight community.

The last 2023 Strategic Foresight Report of the Commission (European Commission, 2023) focus on people's wellbeing and sustainability, widening the previously proposal to shape the future towards green and digital transitions, to an EU's resilience and strategic autonomy. The report provides a detailed description and analysis of the present threads to which EU citizens are now exposed. These threads are not only associated to specific sectors (e.g., security, food, water, ageing, defence), but to transversal and structuring aspects of our society as well, e.g. democracy, well-being, and social cohesion.

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The aforementioned report identifies a new economic model as fundamental for the evolution and transition of the international scenario towards the wellbeing and sustainability at planetary level. In fact, a new economic model can induce a cascade effect on many different aspects that are reported as critical challenges (e.g. social contract, finance, education). The decoupling of economic growth from resources and the interconnection of different aspects contributing to the main global goals (e.g. CO2 neutrality, water supply, pandemic preparedness, adaptation to adverse events caused by climate change) are strongly linked to changes in citizens' behaviours and productive systems. In this context, the report suggest the identification of alternative indicators to GDP, which would result into policy measures and specific interventions to be effectively adopted to facilitate a transition to a new "sustainable pact" between economy, society, and environment.

4.1.5 Reflections and proposal for the approach of "Eye of Europe"

In this context, we report the reflections from humanities on how the future can be imagined through exploring fiction as a means of reflecting on today's Grand Societal Challenges and tomorrow's options (Bina et al., 2017).

The study highlights how fiction sees oppression, inequality, and a range of ethical issues linked to human and nature's dignity as central to, and inseparable from, innovation, technology, and science. It concludes identifying warning signals in four major domains, arguing that these signals are compelling, and ought to be heard, not least because elements of such future have already escaped the imaginary world to make part of today's experience. It identifies areas poorly defined or absent from Europe's science agenda, and argues for the need to increase research into human, social, political and cultural processes involved in techno-science endeavours.

Such "fear" to address some anthropological biases when social communities are asked to act in difficult, emergent, unexpected or undesired scenarios, is usually translated in a diplomatic approach that is often referred as the need to be "politically correct" or to avoid alarm. Wars are historically identified as options for problem solving, other options are rarely publicized if considered unpopular or "last solutions" (e.g., the solar shield to reduce global temperature and implemented by few stratospheric aircrafts, referred by IPCC).

Socio-biologists have described the challenge of humans in living their existences in a system composed by divine technologies, medieval institutions, and prehistorical emotions (Wilson 2009).[3] This categorization suggests that, when analysing scenarios and proposing interventions, then aspects as services, as well as organizational structures and human nature cannot be neglected. A deep reflection is therefore needed when developing the task to identify the topics for the Foresight pilot exercises. From the text of the proposal, "Topics should be both of common interest to R&I actors across ERA and promising for inspiring Foresight exercises. This process should promote engagement of researchers, communicators, journalists, industry, policymakers and civil society. The topics will centre around major R&I challenges addressed by many countries and actors such as the triple green, digital, and just transition".

The main key points we need to address are therefore, "inspiring", "common", "centred around major R&I challenges". From what said before, we definitely need to focus on "credible" and "impacting" too as lighthouses in analysing the appropriateness of the selected topics. There are different paths in the process of the selection of the topics.

As a starting point, we can distinguish foresight perspectives/experiences between countries, between sectors/challenges (food, energy, health etc.), between approaches (forecasting or backcasting), between innovation in science and technology or in processes, between impacts (society, economy, environment, policy etc.), and within these dimensions identify differences and commonalities, pros and cons. This approach is linear and requires a "concept-

[3] Wilson E Debate at the Harvard Museum of Natural History, Cambridge, Mass., 9 September 2009

based clustering" of the diversity of the collected information, filtered by the biases and specific processes that each past foresight experience has adopted. To simplify and not linearize the process of selection, we propose to identify transversal aspects that can enable the stakeholders to engage, discuss, and integrate their competencies towards the co-creation of satisficing (satisfying and sufficient) paths. The extraction of the relevant aspects from different experiences in foresight and from emerging trends in the global multifaceted scenarios will suggest the identification of "enabling frameworks" for the design of topics. Having in mind the long temporal perspective of foresight exercises, we propose to avoid in entering sectorial arguments that would instead need systemic approaches.

We propose these frameworks as follows.

Framework A)

New economic models

Sustainable production paradigms necessary to contribute to the ecological and digital transitions, in particular focused on Artificial Intelligence, Big Data, Complexity, Natural resources and Materials. This framework is strongly linked to the identification of indicators to complement GDP and social contract, demography etc.

Framework B)

Tangible vs intangible resources, quantitative vs qualitative assets.

Trans-disciplinarity, education, and scientific support to policy. The need to provide adequate answers to the challenges introduced by the increased complexity, also impacting on democracy, translates in the need to support policy makers and society with processes and instruments (e.g., IPR protection) enabling the access to the knowledge necessary to develop strategic visions and adopt decisions based on validated scientific methodology.

The proposed two frameworks are also interlinked (e.g., through a knowledge-based economic model) and would be articulated within three main dimensions for the development of the 14 Topics: services/legislation, structural organizations/governance, and technologies/skills.

4.1.6 Challenges for the definition of the R&I topics

The identification of the topics could be influenced by the lack of awareness about the distinction between the objectives and the gaps associated to research gaps that, if filled, can support solutions. As an example, in the documents addressing the challenge of the climate crisis, often the need of increasing the accuracy in the predictions or in the introduction of additional variables are reported; instead, seldom we see reported the difficulty in the introduction of multi-scales in the algorithms or the mathematical formulation of non-equilibrium states. The confusion between the achievement of measurable indicators and filling research steps can be partially justified by the cross-disciplinarity of many challenges, with the consequent request of long processes for allowing the experts from different domains to interact, and the communication of the R&I topics, often difficult to be understood at a glance by the majority of the recipients of the final documents. For this reason, it has to be clarified the difference between research "paths", funding priorities and policy guidelines.

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4.2 Interview guideline

Section A Overarching Aspects *These questions serve as warm up and to capture a picture of the overall interviewee attitude towards futures thinking and R&I, they can be put up in a loose conversational manner & shortened if the timing is tight*

A1. Foresight in your experience

Did you know about foresight before this interview?

Is "the future" a fundamental aspect addressed within your work activity? If yes, is it limited to your specific sector or to more general aspects?

What is your emotional state about the future: worried, curious, active, other?

What do you think is the role of the interaction between different generations, especially in guiding the foresight activities?

A2. Science & Technology Policy

How do you perceive the role of science, technology & innovation is it rather helping to improve things or more part of the problem?

Do you think policy can / should influence STI?

A3. Among the topics listed below what do you think are the *more relevant aspects* to be addressed by policy makers (3 choices)? *This is intentionally a bouquet of many different aspects (not exhaustive), without any preferential categorization, that would catch the first reaction of the interviewed person, whose answers would mainly influenced by personal experience, propaganda* etc.

a) structural reform in organisations (e.g. from hierarchic/centralized to functional/decentralized)
b) environmental protection
c) work conditions and labour market
d) defence and security
e) circular economy
f) supply of raw materials
g) secure sustainable energy supply
h) reduction of greenhouses gases
i) emergency preparedness
j) autonomy and identity
k) decoupling economy from resources
l) wellbeing
m) support young generations and education systems
n) reduce inequalities
o) reduce poverty
p) reduce consumption
q) global free access to internet
r) transformation of taxation systems
s) increase democracy and transparency
t) global free access to water
u) investments in emerging technologies
v) artificial intelligence

Section B: Foresight Pilot Topic Selection *This is the core part, suggestions to be documented as precise as possible*

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B1 What are in your opinion STI related topics where Foresight could make a useful contribution in your country/region? *(2-4 suggestions)*

B2 Do you see any topics of common interest across the European Research Area where joint Foresight would be of added value? *(2-4 suggestions)*

Section C: Closing reflection *This section also serves to round up the general attitude of the interviewee and can be introduced more loosely*

C1 What do you think are the *more relevant aspects* to be addressed by you, now or in the future, and also within your social group (3 choices for you and 3 for your social group)?

a) family & friends
b) leisure, relax, read books, spend time in nature
c) change job, go to pension, change country, save money
d) protect environment, reduce consumption, purchase eco-friendly products
e) promote and support innovative ideas
f) engage in politics, policy, charity

C2: Anything else you would like to advise the EYE OF EUROPE project to consider?

4.3 Interview partners

Name	Surname	Affiliation	Nationality	Field of expertise
Stefano	Palmieri	EESC	IT	Policy
Cristina	Russo	EC	IT	Policy
Kathrine	Angell-Hansen	JPI Oceans	NO	Science/Policy
Fabio	Bonsignorio	University of Zagreb	IT	Science
Ester	Lakos	EIT	HU	Policy
Omar	Cutajar	Ministry of Research	MT	Policy
Gabriele	Rizzo	Private	IT	Science
Rosanna	Fornasiero	CNR	IT	Science
Vasileios	Basios	Univerisite Libre Bruxelles	GR	Science
Alexandre	Quintanilha	Instituto de Ciências Biomédicas Abel Salazar	PT	Science/Policy
Konstantinos	Michailidis	GR public authority	GR	Science/Policy
Katerina	Ciampi	EIT	CZ	Policy
Vasileios	Gongolidis	GR public authority	GR	Policy
Per Dannemand	Andersen	Technical University in DK	DK	Science
Jaakko	Kuosmanen	Academy of Science and Letters	FI	Science/Policy
Sandro	Mendonça	Iscte Business School	PT	Science/Policy
Jose Manuel	Leceta	ES public authority	ES	Science/Policy

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Alehandro	Tosina	ES public authority	ES	Science/Policy
Nels	Haake	Federal Ministry for Economic Affairs and Climate Action of Germany	DE	Policy
Jorg	Körner	Federal Ministry for Education and Research Germany	DE	Policy

Surname	**Activity identified as useful for the contribution to the process**
Palmieri	Rapporteur for EESC opinion on foresight INT/1039
Russo	Acting director DG RTD International
Angell-Hansen	Former director of JPI Oceans, expert in foresight for marine and maritime issues
Bonsignorio	Expert in robotics and AI, working with chinese enterprises
Lakos	Former scientific attachè at Hu Perm Rep, now in EIT
Cutajar	Former sc attachè at MT Perm rep, gen dir of Min of Research
Rizzo	Expert in military foresight
Fornasiero	Involved in the project Reschaper.eu on Supply Chain
Basios	Expert in complexity science
Quintanilha	Member of PT parliament, OECD,
Michailidis	Gen Dir of Internal Organization and Operation (Macedonia)
Ciampi	Policy analyst
Gongolidis	General Secretariat for Research and Innovation
Andersen	Expert in technology and foresight
Kuosmanen	Expert in foresight
Mendonça	Economist, manager
Leceta	Former Director General of the Spanish Government Digital Transformation Agency
Tosina	Former Director of the Spanish Digital Economy at RED
Haake	Expert Foresight, advisor to minister sustainability transformation
Körner	Scientific officer in the Strategic Foresight department

4.4 Detailed outcomes from interview qualitative analysis

Code	Coded Segments
Science, knowledge and its governance	RTI & European Security
	European research and development landscape: mobility of knowledge, funding landscape and collaboration for a common perspective
	Knowledge valorization

	Knowledge valorization, bring research to market
	Citizen engagement in designing STI Policy
	A widened concept of the dual use
	The global governance and the role of knowledge and resources in the geo-political equilibrium.
	Futures of knowledge(s) / shifting
	Engaging the scientific community in foresight
	The future of knowledge. Science of relations and networks.
	New maths for complexity and language of life, global mind.,
	The process from information to action, the value: from quantity to quality.
Ethics, values human relationships	Ethics. more utilitarian type of ethical approach, broader discussion on the ethical implications of scientific knowledge application, in all areas, including the social sciences.
	Ethics could be related to the lack of literacy. The rise of far-right in the EU is due to lack of literacy in broader domains of knowledge, like the history of EU, with extreme political consequences (for example, Hitler, Stalin, Inquisition killing millions of people).
	The interaction between individual needs and social equilibrium: consciousness and ethics.
	Future value emergences, future cultural shifts, (love, sex, emotional topics)
	Intangible assets, value of relations
	The future of freedom and ethics.
EU and the world	Europe has suffered from a lack of wisdom with regard the East. In particular, it could be explored how in the longer run Europe could become closer to Russia, and look way beyond current conflicts.
	Foresight could also help explore the future of social progress taking into account geopolitics, e.g. GDP gaps between south and north and energy supply.

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	The future of the Arctic region (also with a security and defence component)
	Africa: How to develop together with Africa
	The rise of India
Value creation ecosystems	fashion futures
	Organizational structures for the management and sustainability of the production ecosystem. Public-private collaboration platforms and models of symbiosis.
	How to make Europe attractive for investments
	Futures of entrepreneurship / new ventures in times of 'one person unicorns'.
	Governance, public-private partnerships
Digitalisation & its effects on society	Dealing with Deep Fakes
	Exploring how to modernise public sector and the role of digital technologies, privacy regulations and impact on business and citizens and society at large.
	Digitalization and emergent technologies impacting on social and labour transformations, social contracts.
	Effects of digitalization and social media on society.
	Digitalization
Security	RTI & European Security
	A widened concept of the dual use: strategic assets for preparedness to tackle crisis and emergencies.
	Digitalization, security and dual use of technologies
	Defence and democracy.
	The future of EU, security and defense (that is, peace and prosperity)
AI and its impact on society	Artificial intelligence: visions, regulation and prevention of undesirable developments

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	The impact of Artificial Intelligence (AI) in the society AI and data business, their implications both for business and the public sector. Leveraging AI for European visions
Science & Tech Topics	Quantum computing Space, communication satellites Functional genomics, artificial photosynthesis, algorithmic biology.,
Local development	Sustainable urban development: climate neutrality, social coexistence and participatory foresight processes in local European cultural contexts Economy of regions 2050/2060 – trends, megatrends (climate change, water supply, ageing population – in Italy especially the north). Poorer regions and their future (in Italy the south, in Czechia poorer regions in the north of Bohemia etc.) – where conditions lead to ageing, extremism, migration to big towns and cities. Differences between regions in states / EU – what will EC do with lagging regions (heavy industries..). OECD can provide data on Green jobs (where Czechia has the most polluting jobs in the EU etc.).
Emerging technologies to market	Emerging technologies and lead-markets Technology transfer between academia and business, market-driven research, public procurement emergent technologies
Climate change	Innovations in the fight against climate change: Technological and social approaches to overcoming conflicting goals Sustainable urban development: climate neutrality Climate Change
Demography	Demographics: Ageing population and subfertility Demography Demography
Resources	Reuse of resources/Circular Economy

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	European Autonomy in Resources
Food	The future of agriculture/ The future of food Food abundance, safety & security
Education & Skills	Future talent requirements and braindrain (how to keep and attract talent in Spain) Skills and education system
Hydrogen Economy	Hydrogen Economy
Water as a mediator between mind and matter	Water as an informational channel for the interaction between matter and mind
Governance	Designing new models of governance
Financial system	Sustainability of financial system (EU debt, taxation and welfare systems)
Migration	Migration (both migration from outside the EU and shifting migration patterns within the EU)

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