Multi-Agency Foresight with One Health Approach

Deliverable 3: Context Scenarios with Scenario Sprint
Deliverable 3Authors

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Abstract

This report presents the results of the scenario work in Scenario Sprints. The process of a Scenario Sprint is described as applied in the project 'Multi-Agency Foresight with One Health Approach'. The Agencies are part of this scenario process and contributed with their expertise. The results are shortly narrated in raw scenarios with a title and a news headline from 2035. The scenarios were used for the sense-making workshop in November 2025 in Brussels.

The five scenarios are very different and describe future directions that range from a world, in which it needs a wake-up call for getting into action to a scenario with a more preventive society (preventing diseases, unwarranted social behaviour) in the EU or others with less technology development. Some scenarios describe the European Union and its agencies as very active, in others they are not and in one, private companies take over. All developments have their own directions and consequences and will be used for further analysis and strategic thinking. The factors with the highest influence and uncertainty how they might develop are the dynamics in technology and innovation on the one hand, and EU governance and cross-border coordination on the other.

The five different scenarios are described in more detail in this report. From the scenarios and the scanning, strategic areas are derived, and a first list is included.

The scenarios will be discussed further in a sense-making workshop with the aim of drawing conclusions for the agencies and their future work.

Keywords: Scenario Sprint, Ecosystem, European Union, Foresight, Horizon Scanning, One Health)

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Content

1 Introduction

This document is the third deliverable of the contract issued by EFSA under the Interinstitutional Framework Contract RTD/2023/OP/0011 – Lot 1 Foresight on Demand in Science, Technology, Research and Innovation Policy dealing with multi-agency Foresight with One Health approach, authorised by the European Commission, DG Research & Innovation, G1-Common R&I Strategy & Foresight Service.

The document contains the scenarios that were built during two workshops with different Agencies in a Scenario Sprint. The process started with factors of change from reports provided by the EU-ANSA Futures Cluster Agencies[1], ECHA and the JRC as described in Deliverable 2 and additional material. The scanned reports in Deliverable 2 include the publications and other sources that the agencies shared. From these, different types of factors, which influence future developments, were collected and described in the background document for the two scenario workshops (See Appendix A).

There are many different ways of building scenarios. In this project, we use a participative Scenario Sprint process. This work is complemented with an AI-assisted analysis later on in the Sense-making workshop in Lisbon. This Deliverable 3 describes the results from the Scenario Sprint preparing, running and reporting two online workshops and subsequent development of scenario narratives.

As the terminology in scenario work is not standardised, please note that **Factors for scenario work** are the neutral description of a field that is driving the issues under discussion. Factors are included if these drivers of change are under uncertainty. That means, they are mainly used to differentiate the scenarios by their potential different developments. Therefore, for each factor, different pathways into the future or "assumptions about the future" (projections) are formulated – and were jointly discussed during the first workshop. The assumptions were then combined in a Scenario Sprint to full scenarios. The next sections describe the steps of the approach and the scenarios 2035 in a brief way.

Some remarks: the factor titles were changed during the work compared to the scanning phase of the second deliverable. The titles of the scenarios may also change until the end of the project.

[1] ECDC, EEA, EFSA, EIGE, EMA, ETF, EU-OSHA, EUDA, EUROPOL and FRA.

2 The Approach of a Scenario Sprint

The Scenario Sprint is a morphological scenario approach (Zwicky 1969) that includes all findings from the previous work packages and is a systematic way of generating scenarios. These scenarios created by human beings are complemented by machine-created scenarios with a specific modular tool and discussed in a Workshop in November 2025 that takes place in Lisbon to work further with the scenarios. Both processes are intertwined by bringing different plausible scenarios into further discussions, but here, only the Scenario Sprint and its outcomes are described. The following steps have been followed in the Scenario Sprint:

2.1 Factors of Change selection

A first selection of driving factors was organised in the first phase of Task 2.2. of the project and is described in Deliverable 2. The most uncertain and influential factors were then taken over and explained in a background document for the preparation of the two scenario workshops (see Appendix A). In this document, only the neutral formulation of the factors was used, not the Wild Cards or trends from the scanning that already had a direction. The factors provided the starting point for the second step, the formulation of the assumptions.

During the first scenario workshop, the factors were introduced and discussed. A voting among the participants from the different agencies indicated the most uncertain and important factors. The first 12 key factors were used for the next steps. (Please note: the number of 8 to 10 factors is ideal for the following procedure). The selected factors are:

- Geopolitics
- EU governance and cross-border coordination
- Public health and disease prevention
- Climate change and health effects
- (Emerging) infectious diseases and health security
- Technology, digitalisation, innovation – particularly biosecurity and biotechnology
- Preparedness for crises
- Agricultural management approaches and food systems
- Education, training, quality of information
- Healthcare
- (In) Equalities
- Human-animal relationship

Energy supply and climate change should be considered in all assumptions. This list was refined and assessed in an influence matrix later in the process.

2.2 Assumptions about the future of 2035

For each of the driving factors, 3 to 5 assumptions (or projections) on how the future might unfold were developed on a board in the first online workshop. These assumptions were derived from the previous material and/or generated creatively during the online workshop. If assumptions are not very different, the Tetralemma method can be used to open up 4 or 5 very distinct assumptions. But in this workshop, we did not need this differentiation as the participants had enough (even too many) ideas for different assumptions how the future might unfold until 2035. In this step, the different views about the future and how it might unfold are brought in – and not discussed. The different views remain different as they are.

The number of assumptions in this case differed from five to eight. Here is the example of Human-animal relationship with eight assumptions:

1. **Alternative proteins**, e.g. meat from the lab, changed human-animal relations gradually, **animals are not kept for exploitation** of meat, milk, fur etc.

2. **Phasing out animal testing in research and development** - keeping the balance between safety for human and respect for animals

3. **Internet of animals** relies on putting **sensors** into individual wild and domestic animals and swarms, for monitoring their behaviour. This serves as a warning system not only for animal health but about changes in nature (quality of air, soil, water, occurring fires, floods, earthquakes, etc.)

4. **Animals are granted legal entities,** and their rights are implemented and protected by legal institutions

5. **Decrease of protected areas and wildlife reserves**, increase of probability of spilling over to humans and domestic animals of wildlife diseases. Deforestation, decrease of biodiversity, spread of diseases due to climate change.

6. The **increasing exploitation of animals**, breeding and keeping them in masses (will/ is clear to) **fosters the spread of diseases and zoonoses.**

7. Advancing **understanding on chemical effects on insect pollinators**, development of approaches and tools for monitoring, better protect insect pollinators and avoidance of their decline.

8. **Growing veganism and vegetarianism**

2.3 Influence Matrix

In an influence matrix, the most influential key factor (not assumption) was determined by giving weights for influence (from no influence 0 to high influence +2) on the other factors. This matrix was filled by the participants during the first scenario workshop. The sum of the matrix lines was calculated. The highest sum shows the key factor with the highest influence on other factors. This was the starting point for the Scenario Sprint on the board. In this case, the factor with the highest influence was: Technology, digitalisation, innovation – particularly biosecurity and biotechnology.

2.4 Scenario building in a Sprint – combining different assumptions

The task is to combine and 'package' the potential alternative assumptions (projections) into future scenarios of 2035, using a fast and efficient methodology[2]. The most influential two factors as defined in the influence matrix are placed at the beginning of the Sprint row (see Figure 1). The first assumption of the first factor is combined with a fitting one from the second factor, another one from the third factor, and so on. This combination is visualised by drawing lines of a particular colour that trace a path connecting the assumptions. The following figure is for visualisation only. The full scenarios are described in the following section of this report.

[2] Similar scenario sprint approaches were used in earlier projects: Cuhls, K.; Voglhuber-Slavinsky, A.; Banchs-Piqué, M. (2024): FOSTER project D 1.5 Report Context Scenarios for Food Systems. https://doi.org/10.24406/publica-2992 or https://fosterfoodsystem.eu/future-food-systems-knowledge/food-scenarios/; Cuhls, K.; Rosa, A.; Weber, M.; Giesecke, S.; Wasserbacher, D.; Könnölä, T. (2022): After the new normal: Scenarios for Europe in the post Covid-19 world, Foresight on Demand for the European Commission. Brussels. doi: 10.2777/21884. and Kimpeler, S.; Cuhls, K.; Freudenberg, Ch.; Giuffrè, G.; Galvini, G.; Ricci, A.; Marmora, L.; Giesecke, S.; Wasserbacher, D.; Heinonen, S.; Knudsen, M.; Könnölä, T. (2022): Impact of the COVID-19 pandemic on European Consumer Behaviour – Foresight Study. Foresight on Demand for the European Commission. Brussels.)

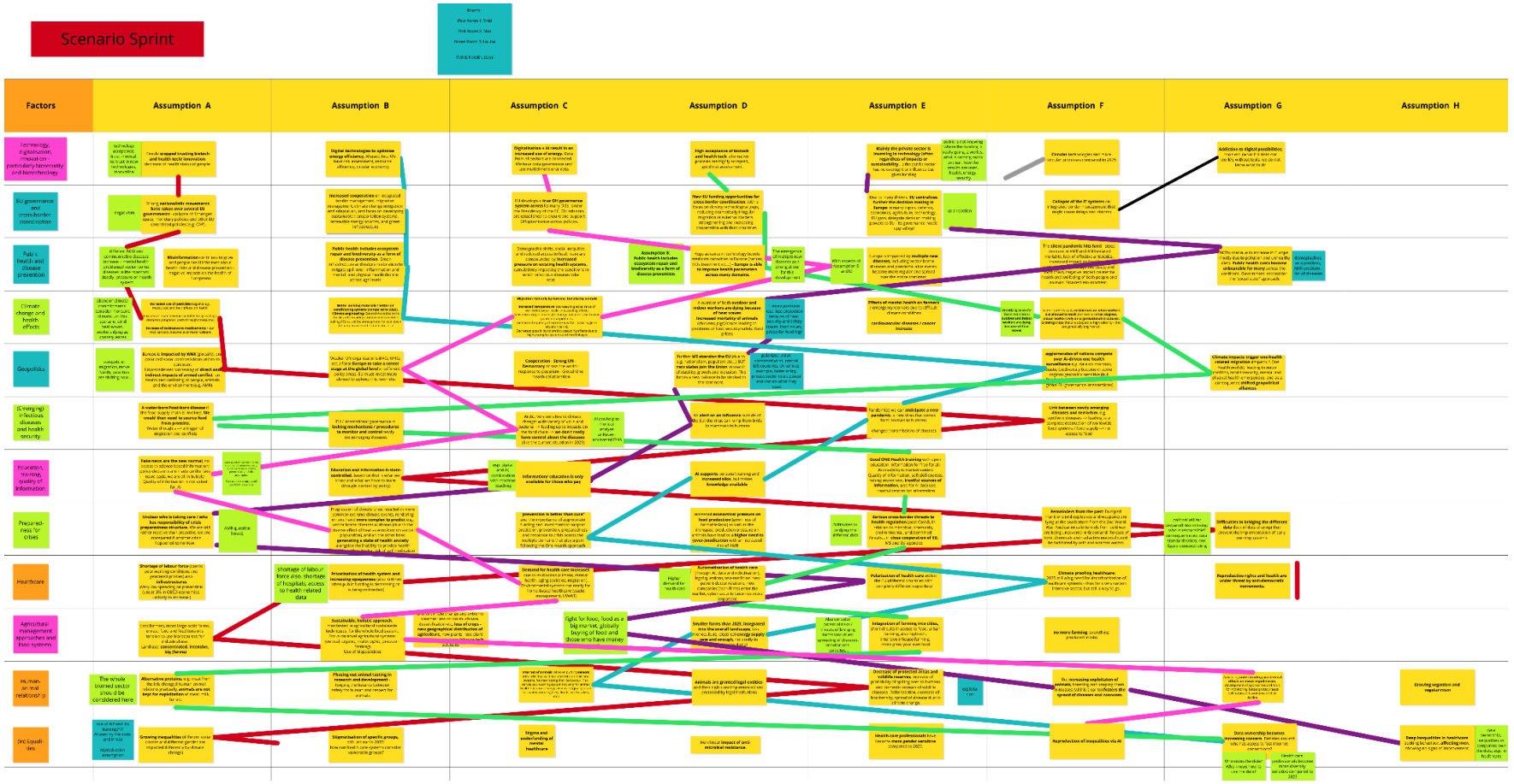

Figure 1: Demonstration of the work on the board with alternative pathways and connected assumptions – the pathways are summarised to the scenarios in the next section

All participants of the workshop discussed what fits (can co-exist in one world) and what does not for the first scenario combination. As we had 12 factors and many assumptions, this took relatively long time. Therefore, the next scenario lines (red, blue, pink, green, violet) were drawn in smaller groups, starting from the second assumption of the first factor in one group, starting from the third in another group and so on following the same procedure with a different colour for each group and each scenario. We did not follow the grey and black lines during the workshop, anymore.

One of the rules is that each assumption shall only be used once to make real differences. Scenarios can be built until all alternatives are used. In this case, five scenarios were built.

Each colour line puts together the assumptions forming one raw scenario, which later in the workshop were rephrased and elaborated upon into one full scenario 2035 narrative, including a headline and a title. As the time was scarce in this second workshop, some headlines and titles were added later by the consortium.

2.5 Scenario narrations, titles and illustrations

In the final step, the consortium and volunteers from the agencies further elaborated each scenario. This contains a consistency check, the enhancement of the narrative, the formulation of the scenario title and the image for the scenario by drawing it, selecting an image from a database or creating it with the assistance of AI. Here, we used AI. The "story" of the scenario was completed by the FOD team and sent to the participants for final additions and cross-checking.

Up to this step, the project team carefully edited and refined the text of each scenario to ensure clarity, consistency and accessibility. The language was streamlined for summarising the scenarios effectively, avoiding unnecessary complexity and technical jargon. But as there are multiple perspectives on the scenarios and as there were intentionally different views on the futures within the workshops, not all expressions or directions the scenarios are taking will meet the reader’s taste. Scenarios are there to provoke thought, to open up rooms for thinking and to work with scenarios as different, coherent images of the future.

The goal is to make the scenarios engaging and understandable to the agencies and a broad audience, including policymakers, stakeholders and the general public to be able to go on working with them during a sense-making workshop in November 2025 in Brussels.

To enhance the impact and appeal of the scenarios, we created an image for each scenario. These visuals try to capture the core themes and implications of each scenario, providing a compelling visual representation of its narrative. Readers’ associations with images may differ.

3 The Scenarios

The following scenarios have been built. They contain one or more news headlines illustrating the developments up to 2035. To keep an overview on the five scenarios, figure 2 summarises the scenario in a factor matrix according to two factors "EU governance and cross-border coordination" and "Technology and innovation dynamic", which were rated as the most influential factors from the uncertain and important key factors that were discussed during workshop 1. We clearly see that the factor technology and innovation dynamic dominated the scenario discussions expecting relatively high dynamics, here, whereas EU governance distributes along the full spectrum from high governance and cross-border coordination to low.

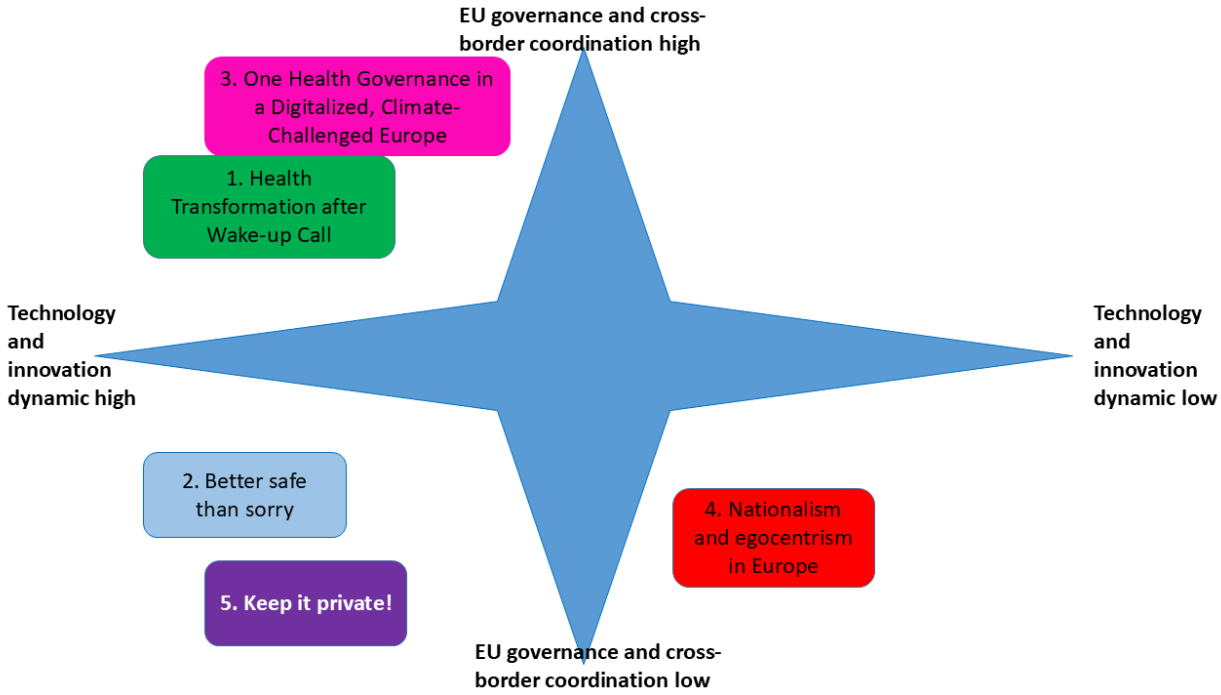

Figure 2: Matrix of the two most influential factors for visualisation (factors with highest rank in the Influence Matrix, starters of the Scenario Sprint; the axes are based on the factors with "high" on the left-hand side and above and "low" on the right-hand side and below)

Some of the differences in the scenarios are highlighted in Table 1, here according to the differences found.

Table 1: Differences in the scenarios according to categories mentioned in all scenarios (not according to factors)

Scenarios	Role of EU/ European Commission	Policies	Technology and innovation	Food security	Health
Scenario 1: Health Transformation after Wake-up Call	Public policy guide and funding – after disasters	Ecosystem repair and biodiversity protection; migration	New funding mechanisms, also for technology, new technologies like quantum technologies, new biotechnologies etc.	Restored	Rising demand for healthcare – trying to meet it
Scenario 2: Better safe than sorry	Does not intervene much in the market	Companies invest; policies minor role, laissez-faire	Ubiquitous, digital twins for everything	Food production more local and circular, but still underway, not secure	Data-driven, prevention in the forefront
Scenario 3: One Health Governance in a Digitalized, Climate-Challenged Europe	EU drives towards AI and data integration	Data and green infrastructure and nature restoration projects prioritized	Data integration – but challenged	Food security is a problem	New One Health governance; many health challenges from new and old pathogens
Scenario 4: Nationalism and	EU with many nationalistic tendencies,	Top-down rigid policies in EU and Member States	Science loser; back to old technology, but: AI and tracking	Food insecurity	Massive health problems; no antibiotics

egocentrism in Europe	members left, others came				
Scenario 5: **Keep it private!**	EU lost overview, companies follow their pathways	Centralised and dominated by economic considerations	Agglomerates of nations compete over AI-driven surveillance systems; research when profit expected	Food secure but not nutritious, old problems back; good food for high income people	Health costs high; not every-body able to pay for healthcare and health divide

3.1 Scenario 1: Health Transformation after Wake-up Call

News Headlines 2035:

"Europe embraces One Health: Linking Nature, Technology and Human Wellbeing"

"Heat Protection by Law: EU bans Outdoor Work During Extreme Heat"

"Climate Pressure reshapes Work Culture: 9-to-5 Model in Decline"

"Water turns Geopolitical: Europe invests in Global Water Security"

"EU pushes for Digital Health Sovereignty amid Data Privacy Concerns"

"From Reaction to Prevention: Europe plans for Future Pandemics"

"Data Silos hamper Crisis Response: Interoperability still a Weak Spot"

By 2035, Europe has undergone a profound transformation in its **public health landscape**. Triggered by the **emergence of multiple new infectious diseases, surge in mental health conditions** and compounded by escalating climate stressors, public health strategies are aligned with a "new One Health" approach. This holistic "One Health" approach now recognizes the interdependence of human, animal and environmental health. All European Union activities have become deeply integrated with ecosystem repair and biodiversity protection. Investments in biotechnologies and health technologies have surged in response to the threats, enabling the EU to make huge strides in combating cancer, emerging infectious diseases, new mental health challenges and other previously intractable conditions.

A steadily **rising demand for healthcare** driven by aging populations, climate-induced health crises (heat is a stress factor in an elderly society and communicable diseases are on the rise) and the surge of novel diseases – has pushed Europe to embrace deep technological innovation in the health sector. To meet the growing need for accessible and efficient care, AI-powered diagnostics, telemedicine and robot-assisted treatment have become widespread – also to replace the lacking personnel. These tools have reshaped the traditional patient-doctor relationship and opened the door for technology companies to play a central role in healthcare delivery. Alongside these advancements, new legal and ethical questions have emerged, particularly around liability, privacy and cyber-security. As trust in digital tools has become vital, Europe has invested in trustworthy information centres and regulatory safeguards. Medical professionals are now systematically trained in digital literacy, soft skills and cultural competencies, ensuring they can navigate both the technical landscape and the diverse, evolving needs of the populations they serve.

As Europe becomes increasingly data-driven, debates over digital equity, inclusive technological innovation and data ownership have intensified. Questions such as "Who has access to fast internet?", "Is no one left behind?" and "Who controls and understands health data?" have become central to democratic discourse. These issues intersect with broader concerns around algorithmic bias, the centralization of AI systems and equitable distribution of health benefits. A diversity-sensitive approach to healthcare, far more advanced than in 2025, is now a foundational principle – backed by regulation, education, inclusive technology design and governance of healthcare.

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Intensifying climate impacts have become the key driver of structural transformation across Europe. The increasing frequency and severity of heatwaves have led governments to introduce legally binding restrictions on outdoor work and to reorganize indoor labour through enhanced institutional and technological support systems. Escalating droughts, salinized soils and diminishing freshwater reserves have accelerated the shift toward climate-resilient agriculture, including genetically modified and salt-tolerant crops. These environmental pressures have also triggered large-scale waves of migration. The displacements are caused by cascading effects on water security, food systems and physical and mental health.

Political priorities had to shift as, again, the threats of mass migration were discussed leading to further attention to neighbouring countries and a re-evaluation of international partnerships. The fragility of many value chains became – again – obvious in these situations. In response, the EU has intensified its co-ordination with third countries, focusing on sustainable water management, resilient health infrastructures and co-operative migration strategies that reflect the new geopolitical realities of a climate-altered world. New geopolitical realities also mean many new players in the new world order – it is not the former industrialised countries of the world that "lead". Those countries already used to droughts, like the Arabian countries, China or Latin American regions, have adapted earlier and use their public profits from former fossil industry taxes to invest heavily in climate change management, infrastructures and living.

In the face of food and water insecurity, food systems across Europe have become more decentralized, often small-scale and technologically integrated. Urban and indoor farming, powered by automation and biotech, have flourished – enabling cities to grow food locally and reduce reliance on long-distance supply chains. But this takes time, and the change is still underway in 2035. But with the high acceptance of biotechnologies, many innovations can be seen on the markets. Alternative proteins replace a large part of the meat production as

animals cannot stand the extreme temperatures in Europe, anymore, and consumers do not want animals to suffer. Some producers shifted to lab-grown meat that is independent from weather and can be produced in a controlled environment. They now start to dominate consumer markets, transforming human-animal relations and reducing the exploitation of animals for meat, milk, or fur. However, the urban integration of farming has introduced **new challenges**: potential disease outbreaks, contamination risks and the need for robust biosecurity within city environments. Regulatory frameworks have been adapted to ensure safety, though not without occasional setbacks.

But also in healthcare, there is much automation, robots for care and small helpers that are step by step integrated into society, which is very open for this kind of innovation, now. However, for certain groups (older people, migrants, Roma communities), it is a real challenge to keep up with technological advances. Automation of healthcare also led to big job losses for women as they traditionally made up a large share of the healthcare workforce.

The EU, in recognizing the interconnected nature of health, environment and migration, has launched a **new generation of funding mechanisms** aimed at closing technological gaps and enhancing cross-border coordination. Special attention is paid to serious health threats – microbial, chemical, environmental or yet-unknown ones, especially for communities in disadvantaged situations – in close cooperation with EU agencies and Member States. Data interoperability remains a challenge, with differences in national systems and lack of data on 'hard to reach' communities slowing down response efforts. Still, joint exercises and scenario planning have improved, and open education and accessible public health information have become mainstreamed as part of a broader resilience strategy.

3.2 Scenario 2: Better safe than sorry: Nature-Smart Europe in the Age of Prevention

News Headlines 2035:

"Wildlife Wi-Fi Stops 'Disease X' in Its Tracks: Europe's Internet-of-Animals Triggers First-Ever Pre-Outbreak Lockdown."

"Digital Twins Slash EU Waste by 40 %—Circular Revenues Flow to Small Mixed Farms and Green Infrastructure."

"EU launches Resilience Fund to tackle Cross-Border Health Threats"

By 2035, technology **business thrive** and **people are empowered to apply their solutions** supported by companies and influencers. Public procurement has further boosted the technology uptake. Special programmes have been funded to technologically empower and digitally upskill economically disadvantaged communities, which are at highest health risks. **Europe is powered by quiet intelligence and green energy.** Quiet intelligence is using digital tools to generate information for any kind of control or tracking, trying to prevent social unrest, dissent in societies' opinions and avoiding the emergence of undesired actor groups. It remains invisible and nobody is talking about it. Every lamppost, tractor and kettle is connected to a **digital twin** and these twins work together to reduce waste in the grid. AI grades the costs, benefits and risks of each action, like shifting heat from a bakery to a school or putting scrap steel back into a 3-D printer. This keeps energy bills low and materials in

constant circulation. Every gram saved today means less crisis tomorrow, so "**prevention is better than cure**" isn't just a slogan.

Preventive thinking has completely changed the health playbook, too. Sensors are integrated in bed, in kitchen, in toilet, even in the car. Wearables are integrated in clothes and jewellery for constant monitoring. Doctors give personalised pills, but first they recommend capturing health benefits from spending some time in the shade of the city's new oak trees or enjoying a slow walk through the reedbeds and other nice plants that help to filter storm water and provide a home for herons. Biodiversity is perceived more than just a pretty picture: when you restore wetlands and tree lines, it can help to reduce inflammation and anxiety, and it can clean the air and water. Green corridors cool overheated streets and guide e-buses, turning nature restoration into essential public infrastructure.

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Technology is evermore ubiquitous and empowering people. Personal AIs are used to tutor languages or yoga. They lifted the immense burden of informal care from carers, women in particular, allowing more time for self-care and health enhancing activities. They are closing skill gaps but opening social silos, which are alleviated a bit with “cross-skill nights” hosted by café owners so that a coder can swap tips with a carpenter, for instance. Even tiny farms, scruffier than the monocultures of 2025, run fleets of soft robots that weed mixed crops nurturing biodiversity under solar trellises. Cheap local wind electricity generators and shared batteries power the many sensors. Agroecology has become good and common business, maybe in a different way people still assumed in 2025.

Signals from nature now travel at fibre speed. Sensors on foxes, storks and bee swarms send pulse, position and cough data to the **Early Warning Mesh**. When a bunch of wild boars in Andalusia got a fever last spring, vets gave the farmhands their jabs weeks before "Virus Nova" could jump species. The same mesh flags methane leaks, flash floods and brush fires, showing that wildlife is now Europe's most trusted perimeter sensor.

The data we all gain are gold, and gold invites quarrels. Groups of countries see One-Health dashboards – which have lots of information on zoonosis genomes, waste flows and butterfly counts – as important tools, now. The finally ratified WHO Pandemic Accord now dictates that in emergencies, data has to be released within six hours, but some capitals make it harder to see what's going on or ask for "model fees". Townhalls want household meter readings to help with planning, tech giants want to make a profit, and citizens now expect a cut. There's a lot of debate about who owns the data.

Debates on many issues, not only who owns the data, prevail, but it is still unsolved how to share and use data in governance. Brussels and Member States until now (2035) failed to agree on their responsibilities and debates return to the very first concept of One Health, especially around the question how to address animal rights. Lack of agreement hampers horizontal and cross-border coordination. With the hotter climate, ticks are doing really well now in Sweden, and there are concerns of a growing risk of dengue fever outbreak in Greece and France. However, border responses fail to swap climate, health and migration data to be fully prepared.

Finance has caught up with reality: **every Euro spent on prevention saves ten on response**. Ministers put money into a One-Health Prevention Fund that pays for risk scans, disease predictors, sensor upgrades and citizen science. Pre-medication is supported but not with high funds, the expectations are rather that people change their lifestyles in cases something is detected. People who have voted are less happy with the results of their political influence, facing shortcomings in stable political power and shorter hospital waiting times. "Circular economy", meaning more circular businesses making use of waste as a resource and trying to close some of the loops in recycling, re-use and full use of what was former "waste" thrives business but, not always. In many cases, bureaucratic rules, regulations or procedures still hamper the practical business.

Data royalties are still causing arguments in Brussels, and there might be another animal-borne virus on the way. But there is one thing that continues to challenge policy from farm gate to server rack, and that's the fact that **smart code and living systems work better together**. Companies' and public authorities' interests converge towards more order and control. Industry's selling point is that it's better to stop trouble before it happens than to deal with it afterwards. This simple insight is what keeps the continent buzzing and blooming.

3.3 Scenario 3: One Health Governance in a Digitalized, Climate-Challenged Europe

News Headlines 2035:

"Europe Leads Global Health Amidst Rising Uncertainty"

"Cyberhack in Talinn – millions of health data stolen"

"New cancer therapy developed in Europe – based on European patient data"

In 2035, Europe finds itself deeply transformed by digitalisation and Artificial Intelligence (AI). Now, data from all sectors on their impact on human and animal health and environment are seamlessly linked and managed under multidimensional, **robust data governance frameworks**. This data integration and the analytical systems enable both advanced monitoring and targeted interventions but also **create new vulnerabilities** and are the

cause of a new rise in energy consumption. The continent struggles with the severe acceleration of climate crisis matching the worst scenarios we ever imagined before.

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Technological breakthroughs, especially in medicine – ranging from cancer therapies, treatments for emerging infectious diseases (EIDs) or mental health conditions – have significantly boosted Europe's capacity to improve health outcomes. Public health, as defined in 2035, now explicitly includes ecosystem repair and biodiversity conservation. **Green infrastructure and nature restoration projects are prioritized** to mitigate disease spillover, inflammation and both mental and physical health declines among women and men across all age groups. AI is used in all applications but not yet fully adapted to the needs of the people in all their diversity. It still contains many biases from earlier times.

The European Union (EU) has developed a **comprehensive One Health (OH) governance system**. This system unites the efforts of numerous Directorates-General (DGs) with specialized OH advisors ensuring that OH principles are systematically embedded across all relevant policies. Governance is vital here, as Europe now faces frequent and unpredictable outbreaks of new diseases and deteriorating mental health conditions. Vector-borne illnesses and pandemic-like events have become regular, spreading rapidly across borders due to climate change, migration, armed conflicts and natural, business or innovation ecosystems.

The effects of anthropogenic climate change have accelerated across the planet. The effects on the Arctic is one example of how these have become new **severe health challenges**. As permafrost thaws, a wide variety of ancient viruses and bacteria are released, disrupting food chains and introducing diseases beyond our current control. The interconnectedness and complexity of these systems reduced the possibility of accurately forecasting cascading effects. We use a lot of technology, but the prediction capabilities of our AI fails.

As another second order consequence of climate change and the evolving crisis, **migration has escalated**, involving not just humans but also animals, as shifting climate zones force species to relocate. Melting glaciers and rising sea levels trigger cascading effects: new microorganisms are released, some of which spark new epidemics and pandemics. Extreme weather events are more frequent, threatening basic hygiene and sanitation and making outbreaks not only harder to predict but also to fight.

The ongoing **climate change and cascading crises** complicate any forecasts about vector-borne disease outbreaks, as the effects of heat, wind and rain on vector populations are highly variable. This unpredictability, combined with frequent extreme weather, leads to widespread **health anxiety** and an **overburdened health system**, pushing some to self-medicate. The demand for healthcare continues to climb, driven by multi-layered crises – climate, mental health, aging populations, security and migration – while environmental systems are not (fully) prepared for the rise in home-based healthcare needs (e.g., waste management, urban wastewater treatment).

The **weakening of global organizations** such as the FAO and WHO has compelled the **EU to assume a leadership role on the world stage**, investing more in global health and environmental initiatives. Sustainability and holistic approaches are at the core of EU strategies. Agricultural systems have shifted towards vertical, organic, multitrophic and precision farming. The use of biopesticides and new monitoring tools aims to protect insect pollinators and avoid their decline, while advanced understanding of chemical effects on these insects informs policy and practice.

While AI has enabled elaborated monitoring and analysis under a multidimensional, robust data governance frameworks, the validity of data is increasingly put under public scrutiny. **Misinformation and fake news intermingle with science-based information**. Policy decisions are sometimes based on unreliable sources, creating social bubbles where the line between true and false is blurred. The quality of information is rarely questioned. AI systems themselves are sometimes co-opted to generate or spread misinformation, further complicating governance. In addition, AI reinforces existing social inequalities, both in access to healthcare and to information. This environment creates open questions about the relationship between strong, evidence-based, AI-driven governance and a society where trust in facts is eroded.

3.4 Scenario 4: Nationalism and egocentrism in Europe

News Headlines 2035:

"New tracker software developed – Europalantir is used in all EU states now"

"Demonstrations in all capitals for more rights of citizens"

Nationalistic movements have gained influence in several EU governments with many seats in the parliaments and in EU institutions. The Schengen agreement is something from the past. We rather observe centralized EU policies including a comeback of the Common Agricultural Policy (CAP). Leadership is important and people are following. We all have a place in the new hierarchies.

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In such an environment, the spread of misinformation is increasing. It gets more and more difficult to understand who is trustful and who is not. **Science was the first loser** in the second half of the 2020s. Now, in 2035, it is nearly impossible to build up new trust in biotechnology and health technologies. This started 10 years earlier. Now, researchers do not dare to invest their careers in such a scientific endeavour – that does not pay off. It also means that research is not progressing and basic science is perceiving a backlash in freedom. New health technologies are not fostered and biotechnology is only used in rare cases. Old school treatments remain and many medications are not available at all, leading to a decline in the population's health status, especially when it comes to new or micro-biotic diseases.

We mistrust politics and we mistrust our neighbours, but we know that we need them. Trust in education is also fading away. Education and information are so much state-controlled that we talk about it as if it was a form of thought control. Greetings from Orwell 1984. The

role of artificial intelligence (AI) and its training raises concerns, particularly regarding its use by the state and in warfare, but at least the state we live in has European AI. Better not ask… because we see conflicts everywhere. Europe is facing global conflicts and even conflicts in Europe that result in polarization within the continent, with dramatic negative consequences for the health and well-being of people, animals and the environment (e.g., antimicrobial resistance).

It becomes clear that the different states have different interests in what to learn and how to profit. **Health is not a priority.** This led to inadequate awareness of health risks and disease prevention, with even more negative impacts on the health of Europeans. Health inequalities are on rise. We see a big rise in non-communicable diseases (NCDs) – especially those raised by stressors like cardiovascular diseases – and communicable diseases, alongside increasing mental health issues. Women's access to reproductive health and rights is severely restricted. Groups in socially and economically disadvantaged situations (e.g. people with disabilities, older, but also young people, migrants) are most at risk. Vector-borne diseases are at the forefront, the more they are putting pressure on the healthcare system the more the trust in new technologies and innovations is waning.

Our **early warning systems exist** but they are not very effective. Challenges in data management and a lack of accountability hinder the implementation but that is not so important. The privatisation of the healthcare system has led to increasing opacity, while there is a shortage of labour, skills of care personnel and of hospitals. All that is not new, most hospitals were closed at the end of the 2020s because they were too costly.

Commitments for fighting climate change have been abandoned; there are other problems. If others are not fulfilling their duties, why should we Europeans? So climate change is going on in changing pace, and the European climate is becoming increasingly suitable for the spread of diseases caused by pathogens and pests. Additionally, resistance to medications is rising, further complicating treatment options. Weather phenomena such as monsoons and cold or heatwaves lead to worker fatalities and a shift in priorities as migration toward northern regions is on the rise. Weaker UN organizations (FAO, WHO, etc.) force Europe to take centre stage in various policy areas, necessitating increased investments abroad. We Europeans still feel strong enough to take over the role.

In such an environment, solutions of the past, fast quick fixes and **strong, fast decisions** are back. For example, fostering our agriculture, here and now, is one of the solutions. One of the strong decisions is the **massive use of fertilizers and pesticides in agriculture** to boost productivity. The intensified use of pesticides and insecticides – the successful ones from the 1990s – particularly against the uprising of European mosquitoes, has health implications. But why bothering, we have to get rid of them. We Europeans have to eat and the question is more and more what is there to eat. Societies organise themselves and people try to survive – **food is available but good nutrition is scarce** and expensive. Only the rich can afford really healthy diets. We rely on self-organisation and do-it-yourself as much as possible.

Inequalities are growing under these circumstances, with different social classes, age groups, genders or ethnic groups being affected differently by climate change. The stigmatisation of specific groups remains or is even growing. We have to take care of ourselves, so why look at these unadapting citizens or minority groups? Our healthcare

systems can only address the needs of the majority and offer standard healthcare, not the specific needs of vulnerable populations.

Fewer farmers and big farms are there, but they are **incapable of producing as much as is needed**, so we import a large share of our food and of course, feed, too. Our large-scale enterprises have a problem of importing enough bioresources. There are permanent tensions with farmers about the question of bioresource use and land use, which is becoming more and more concentrated and intensive. Of course, there was a decrease in protected areas as we needed the space. So whatever land is arable, we try to use it, indoor farming turned out to be too resource-intensive.

But we set many new pathogens free, we provoked new risks, and even a link between newly emerging diseases, armed conflicts and terrorism has become evident. We are fearing a complete destruction of the exchange in the global food systems and supply chains when the permanent terroristic disruptions and armed conflicts are going on. With the strange weather and long droughts of the years 2026 to 2029, the likelihood of wildlife diseases spilling over to humans and domestic animals has drastically increased as well as the many wildfires we have seen last year when Athens burned down.

Europe is facing numerous challenges.

3.5 Scenario 5: Keep it private!

News Headlines 2035:

"Public Sector loses oversight on technology developments!"

"EU GDP rise to new records"

In 2035, **Europe is dominated by economic considerations**. While the private sector heavily invests in (new) technologies with high expectations on innovation, profit and higher margins, often disregarding sustainability or social impacts, the public sector remains largely unaware of what is funded and how the allocated funding from public sources like Framework Programme 12 is truly utilised. As a consequence, the **EU has further centralised her decision-making processes** in many topics, for example defence, economics, agriculture, technology. National governments increasingly delegate responsibilities to the EU, but its governance is not optimally equipped to tackle the many different upcoming new challenges.

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As companies are mainly running the health system, health costs are skyrocketing. Social exclusion is gaining strong ground. Noncommunicable diseases continue to increase in Europe mostly due to pollution and unhealthy diets. **Public health costs become unbearable for many** across the continent. Governments of the Member States reconsider the "social state" approach. **The high costs evoke deep inequalities in healthcare** and in healthcare seeking behaviour. As rather women use more healthcare services and follow preventive health recommendations, men delay or avoid seeking care, thus amplifying gender inequalities in health outcomes and showing no signs of improvement. Men die earlier, that is clear statistics. **The polarisation of health care** is also visible within the EU where we have different countries with completely different capacities in healthcare. Some use AI and data bases for diagnosing but the question of data ownership is not solved. In most cases, companies own the data and profit from them, aggravating the inequalities even more.

At the same time, both outdoor and indoor workers are increasingly affected by heatwaves, leading to alarming death tolls. The mortality of livestock and crop failures exacerbate food security issues and drive food prices up.

While some Member States abandon the EU due to nationalism, populism or other reasons, new states seek stability and growth by joining the European Union. This creates a **new power balance in Europe,** a polarized Union with more conservative versus countries that in the old times would have been called "central left" countries. Politicians unite in issues, popular slogans and big claims, this "left" and "right" thinking is gone – only the chairs in parliaments remain. With the experience of the Brexit years ago, it is easier now to leave or become member of the EU – Ukraine was the first example of a "fast entry" state. Companies play a role in politics, they are powerful players and often neglect what the public institutions regulate. They do what they want.

Agglomerates of nations **compete over AI-driven surveillance** systems, tracking people, animals and plants, so that e.g. data on zoonosis, waste or biodiversity become geopolitically

sensitive in some regions. We see some attempts for improvement, e.g. the Pandemic Agreement or Pandemic Accord (for WHO) for interventions and global EU governance interventions, but they do not solve the problems coming up with increasing surveillance. One reason for the surveillance and for missing preparation for futures may be missing information, training or education because **information and education is only available for those who pay.** And for those who have the money, information and education is not in the forefront. For those who pay, we have good education in nice surroundings with teachers and digital tools or even AI solutions. The combinations with machine teaching are manifold.

This brings us back to the people. Europe's demographic problem remains severe with even faster aging societies and especially aging-related and chronic diseases increase further**. Anti-microbial resistance remains a problem** as the last antibiotics ran out of efficiency and for companies, it is still not profitable to develop new products in this field. They rather concentrate on products with high margins or big markets.

In this political situation, the EU goes back to what was possible in former times, for example in agriculture, food security is a premise and allows for **more pesticide use**. Protection in times of heat, security and safety issues are not in the forefront – or better: often ignored. A number of both **outdoor and indoor workers are dying because of heat waves,** and especially in agriculture. There are thus many food issues. The prices for food are very high and nutrients in food are scarce. We also see an **increased mortality of animals** (chickens, pigs). The **increased exploitation of animals**, breeding and keeping them in masses is clearly **fostering the potential spread of diseases and zoonoses.** Crops suffer, too, harvests are low leading to sharpen the problems of food security and safety and driving food prices further. We fight for food – and the food market is a big and powerful, profitable market for some monopolies and for those who are able to buy food on the global market. Those who have money profit. People in countries at the bottom of the buyout-chain are suffering most.

In these times, we have an **alert on an influenza** outside of the EU: the virus can jump from birds to mammals to humans!

It is very unclear who is taking care of the crisis management in this or other cases, or who has responsibility for **crisis preparedness.** In most countries there is no structure to deal with crises like pandemics or natural disasters. Europeans are still rather reactive than proactive; we are rather unprepared if another crisis happened tomorrow. This keeps us anxious and most of us are not so optimistic about the future. Let's survive the next year and see then…

4 Next Steps of scenario work in the joint project

The scenario work continued in the two-day workshop in Lisbon on November 12 and 13. The first day was used for scenario work that provides long-term perspectives to support the second day, when the agencies explored strategic areas for where they would like to jointly work.

During the first workshop day, there was a session on AI-based scenarios. An AI-supported morphological scenario process was implemented by VTT to add scenarios to the discussion and to demonstrate the capabilities of AI-based work. This approach mirrors the classical morphological process employed by Fraunhofer ISI but replaced manual steps with AI-driven automation, potentially enhancing efficiency, consistency and analytical depth. In this **machine-based procedure**, a consistency matrix was filled matching assumptions and automatically generating a measure of how consistent the assumptions are. This AI-driven consistency analysis of the table of the morphological future used pattern recognition and probabilistic modelling to assess logical coherence across factor-outcome combinations.

Within this process, human intervention can be made to ensure that the foundations for the consistency matrix are intact, thus assuming higher validity for the automated process. A key differentiator of the AI-driven approach is its algorithm-based assumptions and thus, scenario selection. Unlike manual approaches that rely on "expert intuition", AI maximizes scenario plausibility and uniqueness by applying optimization techniques, ensuring robust and non-redundant scenario sets. In this way, additional scenarios were generated.

The last part of the scenario work in the workshop was mental time-travelling into one of the scenarios and deriving recommendations. This gave room and opened up new ideas for the discussion on future joint work of the Agencies.

5 Thematic areas for strategic multi-agency collaboration

The 12 strategic areas emerged from a structured foresight process combining analytical and participatory approaches. They were defined through the work carried out in DL1 and refined during the Scenario Sprint, in which we identified the most influential and uncertain factors of change shaping the future of European health, environment and food systems governance. These factors – such as technology and digitalisation, public health and disease prevention, climate change, EU governance and inequalities – served as the building blocks for the scenario construction process (see above).

Each of the 12 strategic areas stands for itself and comprises a rather complex matter that will be crucial for the future of well-being for the people living in the EU. At the same time, they can also be subsumed under the One Health approach and can be considered as relevant areas for the future re-orientation of health governance and related areas. The areas were thus deliberately designed to be generic yet actionable, providing a shared strategic language for a broad range of European agencies with different mandates.

In essence, each area represents a nexus of key drivers – technological, ecological, socio-economic or governance-related – identified in the influence matrix. For instance:

- **Digitalisation & Foresight Tools (A)** directly reflects the high influence of the "Technology, digitalisation, innovation" factor, which ranked highest in the influence matrix.
- **One Health & Health Systems (B)** embodies cross-sectoral integration across human, animal and ecosystem health. This area consolidates multiple factors such as zoonoses, AMR and demographic change, translating them into a governance challenge rather than a disciplinary one.
- **Food, Bioeconomy & Innovation (C)** aligns with the EU's Farm-to-Fork and Bioeconomy strategies and directly builds on the factors "agricultural management" "technology and innovation" and "(in)equalities."
- **Climate, Crisis & Public Engagement (D)** synthesises interlinked factors such as "climate change and health effects", "preparedness for crises" and "public health and disease prevention." It recognises that climate adaptation and risk communication are not sectoral issues but require joint data, governance and societal trust mechanisms.
- **Governance Innovation & Capacity Building** was added as an enabling area, cutting across all others. It corresponds to the Foresight finding that structural silos and uneven capacities across agencies are among the most constraining factors for coordinated European action

Thus, the 12 areas combine:

1. **Empirical grounding** – derived from key influencing factors identified in the scenario sprint and influence matrix; these factors were then influenced also by the research work done in DL 1;
2. **Strategic relevance** – aligned with current EU priorities as it is indicated in DL 1;
3. **Systemic logic** – each area represents a cross-cutting interface (digital–health–food–climate–society) where collaboration can yield future public value.

In conclusion, these 12 areas are not thematic silos but interlinked collaboration domains designed to guide European agencies in jointly navigating uncertainty, building Foresight capacity and developing integrated responses to the grand challenges of 2035 and beyond.

12 Strategic Areas for Foresight Workshop

A. Digitalisation & Foresight Tools

1. **Data, AI, and Digital Governance**

- Secure, interoperable data systems across health, food and environment.
- Standards for AI in surveillance, risk assessment and decision-making.
- Addressing algorithmic bias, privacy and equity.

2. **Future Risk Modelling & Digital Twins**

- Use of simulation, AI and digital twins for cross-sector Foresight.
- Scenario-based early warning (pandemics, food insecurity, climate crises).
- Building Foresight capacity into agencies.

B. One Health & Health Systems

1. **One Health Integration & Governance**

- Operationalising One Health across human, animal, plant and ecosystem health.
- Address zoonoses, AMR, biosecurity and ecosystem repair.
- Cross-agency frameworks for resilience and prevention.

2. **Health Systems, Equity, and Demographics**

- Ensuring equitable access to healthcare and safe food.
- Anticipating chronic, mental and climate-related health burdens.
- Responding to demographic change and ageing populations.

C. Food, Bioeconomy & Innovation

1. Food Security, Safety, and Sustainability

- Resilient and safe food systems under climate and supply-chain stress and emerging biological, chemical and physical hazards.
- Anticipating risks from intensive agriculture and pesticides.
- Addressing nutritional inequalities and affordability.

2. Biotechnology & Sustainable Food Innovation

- Scaling alternative proteins (cellular agriculture, fermentation, biotech crops).
- Evaluating risks, safety, and sustainability of new food technologies.

3. Circular Bioeconomy & Resource Use

- Transition to sustainable, circular resource management.
- Waste reduction, pollution prevention, and planetary boundaries.
- Bio-based systems that link food, energy, and environment.

D. Climate, Crisis & Public Engagement

1. Climate Change Adaptation & Crisis Preparedness

- Building climate-resilient agriculture, food, and health systems.
- Early warning and crisis management for extreme weather and disasters.
- Identification of emerging risks for food and feed safety driven by climate changes
- Addressing migration-related health and security challenges as well as conflicts.

2. Biodiversity & Ecosystem Services

- Monitoring and protecting biodiversity, e.g. under climate stress.
- Restoring ecosystems for resilience and prevention.
- Embedding ecosystem services into risk and policy frameworks.

3. Trust, Risk Communication & Public Engagement

- Trust in information and in science.
- Ensuring transparent communication during crises.
- Strengthening citizen science, literacy, and participatory monitoring.

4. Governance Innovation & Collaboration

- New cross-border and cross-agency governance models.

- Frameworks for accountability, monitoring, and decision-making.
- Bridging silos between health, food, climate, and digital policies.

5. Capacity Building & Skills for Transformation

- Training for One Health, digital skills, foresight, and crisis response.
- Cross-sectoral capacity in agencies and institutions.
- Supporting lifelong learning and adaptive governance.

References

Cuhls, K.; Voglhuber-Slavinsky, A.; Banchs-Piqué, M. (2024): FOSTER project D 1.5 Report Context Scenarios for Food Systems. https://doi.org/10.24406/publica-2992 or https://fosterfoodsystem.eu/future-food-systems-knowledge/food-scenarios/

Cuhls, K.; Rosa, A.; Weber, M.; Giesecke, S.; Wasserbacher, D.; Könnölä, T. (2022): After the new normal: Scenarios for Europe in the post Covid-19 world, Foresight on Demand for the European Commission. Brussels. doi: 10.2777/21884. and

Kimpeler, S.; Cuhls, K.; Freudenberg, Ch.; Giuffrè, G.; Galvini, G.; Ricci, A.; Marmora, L.; Giesecke, S.; Wasserbacher, D.; Heinonen, S.; Knudsen, M.; Könnölä, T. (2022): Impact of the COVID-19 pandemic on European Consumer Behaviour – Foresight Study. Foresight on Demand for the European Commission. Brussels.)

Zwicky, F. (1969): Discovery, Invention, Research - Through the Morphological Approach. Toronto: The Macmilian Company.

Appendix A Factor Document used for the preparation of the workshops

Preparatory Document

“CONTEXT OF ONE HEALTH”

Factors of Change for our futures in common

Authors: Miquel Banchs-Piqué and Kerstin Cuhls, Fraunhofer Institute for Systems and Innovation Research ISI

Date 17-7-2025

CONTENT

INTRODUCTION AND METHODOLOGY

This is the preparation document for the scenario workshop 1. The aim of the two workshops is to develop common scenarios of our future (context scenarios for “One Health” but very broad, common European futures). On the basis of a scoping and framing exercise, the Foresight on Demand (FOD) Team scanned literature and searched for issues under uncertainty in their future development. These issues are called “factors of change”, they are “drivers” but formulated in a neutral way (like “policies for health” or “economic development”). For these factors under uncertainty, we will develop assumptions (projections). The assumptions state the future directions or developments briefly and in present tense. This will be done during the first scenario workshop on July 22, 2025.

You do not need to read this document in detail but please try to get an overview on the factors. We will discuss them during the workshop, and we will ask you for missing factors, for re-framing etc.

Aim of the Scenario-Workshops

The aim of the scenario workshops is to build context scenarios that are relevant for the future of the participating agencies. The scenarios are possible scenarios, and they need to be plausible. The scenarios centre around the future of health, security and global developments. They are not describing “One Health” but its environment or context.

Scenario work

Factors of change highlight key aspects of the context, here the context of One Health but the future characteristics are still subject to uncertainty. The time horizon of the scenarios is 2035.

At the beginning of the first workshop on July 22, 2025, the 8 to 10 most important factors for the agencies that may have a large impact and are particularly uncertain are prioritized and/ or reframed. These are the key factors used to create the skeleton of the scenarios, whereas those factors and developments that are relatively obvious in their development are taken up in the later scenario work where they fit. Since it is still uncertain how the key factors may unfold until 2035 and how the developments within the factor are coined, different (3 to 5) assumptions are developed for each factor in the first workshop. At the end of the workshop, we will assess the assumptions in an influence matrix.

During the second workshop on July 23, 2025, the assumptions are combined to form raw scenarios in a Scenario Sprint. The full combinations of assumptions are then used to formulate the final scenarios.

Final scenarios consist of a title, a descriptive text and an image. They will be enhanced by the findings from the horizon scanning and by other findings later on.

WORKSHOP AGENDA

Workshop 1

22-7-2025, 9:00-13:00

Workshop 2

23-7-2025, 13:00-17:00

Workshop 1, July 22

9:00	Welcome, Introduction into project and workshop Tour de Table
9:30	Formulating and prioritising factors
10:30	*Short Break*
10:45	Group work: Assumptions about the future Feedback to the Group
12:30	Influence Matrix to define the most influential factors
13:00	*End of Workshop 1*

Workshop 2, July 23

13:00	Welcome
13:15	Scenario Sprint
15:00	*Short Break*
15:15	Group work: scenario and title
16:15	Short presentation of the scenarios
16:50	Next steps
17:00	*End of workshop*

FACTORS OF CHANGE
POLITICAL

Factor 1: Public health and disease prevention

- How well functioning are public health systems? Is it more a public or a private health system?
- Amount of public spending needed for the health system: will health risks increase (e.g. worsening of mental health, effects of micro-plastics) or will they decrease?
- Amount of public spending actually dedicated to health (e.g. will it be redirected somewhere else due to conflict?)
- What kind of (human and animal) disease prevention will we see and how much is invested in public health?
- How will the health system look like? Tensions between spending needed and actual spending.

Factor 2: (In)Equalities and governance

- Within the European Union, we observe differences in inclusion, equality, fairness and justice. How does this unfold? The global pandemic has brought many different forms of individual inequality into the spotlight – underpaid essential workers, access to services (education, healthcare, financial assistance), domestic abuse, and others. Do inequalities in gender, healthcare, financial support or education persist?
- Do inequalities increase, stay similar, decrease?
- Society's (in)tolerance for inequalities (e.g. are the marginalised getting violent?) and its effects on securitisation and governance (e.g. do governments become more authoritarian as a result of social unrest?).
- Impacts of socioeconomic inequalities on health. Health economics and inequality.
- Impacts of socio-economic inequalities on governance and environmental priorities.

Assumptions 2035/ Examples (from a previous scenario project):

A1: Existing inequalities drastically increased. Economic recession and unemployment hit vulnerable populations the hardest during the last 10 years, especially in countries without a functioning welfare state or fiscal policy flexibility. Women, minorities, non-citizens, and other traditionally weaker groups are even more marginalized. The inequalities not only between individuals, but also between Member States within the EU increased with different levels of inequalities within some MS.

A2: A more equitable society emerges. Gender-role attitudes adapted to the lived realities, ‘essential workers’ wages smoothly went up while wealth taxes increased. Funding focuses on improving lagging infrastructure to relatively impoverished areas.

A3: New policy addresses the most vulnerable populations with guaranteed income, housing, access to information technologies, education and training, domestic care, health care, and other forms of critical assistance. These policies persist abated given the net returns are clearly positive.

A4: Temporary measures to alleviate social inequities receded years ago, when the last pandemic faded and the effects were forgotten. Issues of equality remain unaddressed in a meaningful way and set up greater social disruptions and civic unrest in response to the next crisis. Vulnerable populations, pushed too far already in the Covid-19 phase, by the energy crisis and other crises on top respond unpredictably and sometimes violently in 2035. The inequalities are a permanent source of conflict, e.g. work conditions. Since 2025, inequality among generations even increased. The young seem to have to pay the bill for former mistakes and demand a balance between the younger and older generations.

Factor 3: Geopolitics

- We are living in a world of intense international exchange where people, companies and countries are interconnected and hyperconnected on different levels. But we thought that globalization is set as it can also be seen as a function of cooperation. As we now see, some countries are shutting up from others, we observe the building of blocks and less interaction. Globalisation is in doubt and geopolitics around resources are a powergame. Even Europe’s friends are putting protectionist measures on their friends, changing delivery chains, trust and businesses.
- War, trade, energy, food, data, technology, terrorism.
- Direct and indirect impacts of armed conflicts and other conflicts in emissions and the environment in general.
- Competition vs partnership.
- Political stability and crisis response.
- Role of (mis-) information in geopolitics boosted by digital technologies.

Factor 4: Open Strategic Autonomy

- Open Strategic Autonomy is the EU's approach to making independent decisions in global affairs while being open to international trade and cooperation, with emphasis on resilience, competitiveness, sustainability, and fairness.
- One example of open strategic autonomy in the food system is the EU's Protein Plan. This initiative aims to reduce the EU's dependency on imported protein crops, such as soybeans, by promoting the cultivation of protein-rich plants within Europe to enhance the EU's food security and sustainability by ensuring a stable and local supply of essential nutrients.
- But how will the open strategic autonomy develop until 2035? How open is Europe in ten years from now?

- How autonomous are we in technologies, e.g. the digital ones, in food or feed supply?
- What can be produced in Europe and what has to be imported? What about pharmaceuticals? Are we still dependent on Indian or Chinese imports, especially as it is not economically viable to produce drugs in Europe? This is very uncertain and can develop into different directions.
- Will the EU be able to reduce dependencies on external resources?
- Will the EU be able to enhance its strategic capabilities?
- Will the EU be able to balance local production and imports?

Factor 5: EU governance and cross-border coordination

- Europe's response to global disruptions.
- Is there international coordination and governance? Or on EU level? On national levels with the revival of nationalism? Are regions strong in governing health issues?
- EU identity in a changing international context (vision, values, political structures, alliances…).
- Global war of subsidies in the green transition.
- Size of EU: enlargement (new member states), shrinkage (Brexit-like), both?
- Coordination of member states.
- Degree of autonomy of the EU in various aspects (energy, food…).
- Coherence of EU policy and regulation – also in the regional and national levels.
- EU regulation as driver for member states and/or the world.
- Digitally supported authoritarian governance of individual emissions and energy consumptions ("green" passes).
- Biodiversity regulation, regulation regarding pollution, etc.

Factor 6: Environmental and health regulation

- Regulation related to environment and pollution, and economical priorities (isolation of EU strategies vs. the rest of the world).
- How much regulation is in place?

Factor 7: Preparedness for crises

- How is preparedness organised? Is this a legal issue or an issue of awareness?
- Is there regulation or education for preparedness?
- Is there training for reactions when a disaster occurs (fire, earthquake, storm...)?
- Is there training or education for disease prevention or actions in case of epidemics/ pandemics?

ECONOMIC

Factor 8: Infrastructures

- Who owns, invests on, maintains… infrastructures? What is the general state of infrastructures?
- What kind of infrastructures are important in 2035: R&I infrastructures, labs, databases, AI, energy infrastructures (new grids)?
- One signal is: (from POLITICO 2025): “The European Commission wants to funnel billions more into energy infrastructure as part of the EU’s next long-term budget. Energy ventures would see a significant increase in funds under the proposal. The Commission suggests €30 billion of its Connecting Europe Facility for energy infrastructure — up from €6 billion. That would mean more money for things like grid upgrades, battery storage and hydrogen infrastructure.”
- Are there differences between urban and rural areas? And between countries or regions?
- Infrastructures as drivers for progress vs locked-in uses or stranded assets due to bad planning.
- Condition and availability of power infrastructures for electrification and renewable energies (incl. oceans).
- Military infrastructures and dual uses (bridges, roads etc).
- Marine transportation infrastructures.

Factor 9: Economic development

- What is our economic model? How does the economy develop and how is the economy measured?
- Economic system(s) (growth, post growth, sufficiency, degrowth...).
- Environmental and climate economics.
- Regulatory economics and compliance costs.

- What are the underlying values behind the economy?
- Are countries able to deliver on those values?
- Do these values and economic systems differ between the EU and the rest of the world?

Factor 10: Agricultural management approaches and food systems

- Approaches to farming, forestry and fisheries, and their role in deforestation, pollution, animal welfare and sustainability in general (e.g, resource use, fertiliser runoff, waste water…).
- Adoption of digital tools and advanced techs (data-driven platforms, IoT, indoor production, urban farming…) in food management systems.
- Economic sustainability and role of big vs. small producers.
- How circular is the system? Do harmful substances concentrate in these systems?

Factor 11: Nutrition and food security

- Food security for all, resilience, safety and their relation to health (related to pollution).
- “Feed the world” vs preservation of socio/cultural aspects.
- Overnutrition, malnutrition, nutrition-related illnesses, etc.
- Healthy diets for all or for the rich only?
- Who knows what is “healthy”?
- Over-use of antibiotics in food production?
- Reduction of feed stock and impacts on sustainability and animal welfare.

Factor 12: Supply chains

- Role of supply chains in pathogen movement.
- Complexity of supply chains (same, increase, decrease, different compared to 2025?).
- Link to geopolitics: new/different pathways, emerging role of some countries.
- Are supply chains resilient, reliable and fast enough even in case of disruptions (war, climate, power cut etc.)?
- Are supply chains prepared to provide real-time data for outbreak detection and monitor important issues like antimicrobial resistance?

- Threat and control of alien species (ballast water management)

Factor 13: Degree of collaboration and international trade (and international travel)

- (Trade-) blocks, alliances, trade and customs policies.
- Global, or regional focus.
- Who cooperates with whom?
- Trade policies (national vs EU vs regional non-EU vs international).
- Trade (and travel) and the spread of diseases.
- Globalisation and connectivity.
- Consequences of changing population distributions across regions (e.g. BRICS: half of the world population vs. EU aging societies).
- Trade of endangered species.

Factor 14: Energy Supply and Demand

- EU's energy needs and how it will secure them (infrastructure, raw materials).
- Increase of energy demand or decrease? Does supply meet the demand?
- Dependency on other countries (raw materials such as rare earths, fuels…).
- Effects of the variability associated with renewable energies.
- Energy storage.
- What are the (health) consequences if there is not enough energy (energy shortages and power outages)?
- Impacts of electrification, improved indoor and outdoor air, new battery related risks or mining and use, electromagnetic fields.

Factor 15: Energy Costs and Industrial Base

- Do Energy costs increase or decrease?
- How much do energy costs effect the European industrial base?
- Does production leave Europe?
- How much production and employment do we still have? Do we have unemployment because of energy costs?

Factor 16: Healthcare

- How close or distant is healthcare to the people? Can people reach hospitals in reasonable time?
- Is there enough capacity (e.g. beds in hospitals)?
- For example, the number of hospital beds available in the EU has decreased by 7 percent in the past 10 years, according to figures released by Eurostat in 2025. There were 511 hospital beds per 100,000 people in 2023, a small decline from the 516 in 2022 and an even larger decrease from the 557 in 2013 and most EU countries reported fewer hospital beds in 2023 than 2013, with the largest decline seen in Finland, where overall bed numbers fell by 45 percent in that 10-year span. In only six EU countries the number of beds increased between 2013 and 2023: Portugal, Spain, Romania, Malta, Bulgaria and Ireland.
- Despite the decline, Eurostat notes that a mitigating factor might be that “scientific and technological developments have shortened the average length of stay for many in-patient procedures or replaced them with out-patient or day care alternatives.” But how is this integrated into the different national healthcare systems?

SOCIAL

Factor 17: Demographic dynamics

- Most European populations are aging. Some are even shrinking.
- Lack of educated personnel in healthcare and healthcare personnel is aging, too.
- What consequences does this have? (e.g. care personal missing) (related to health, war and environment).
- How are fertility, birth, mortality rates in Europe and European regions? And everywhere else?
- Do societies (try to) manage demographics? If yes, how?
- How do these factors affect the mobility of people? And the concentration in urban areas?
- Is population increasing (because of migration), decreasing, staying the same in the EU? And elsewhere? And its consequences (e.g. for urban concentration).
- Changes in pension systems and taxation to cope with aging, from income to capital etc.

Factor 18: Education, training, quality of information

- What is the purpose/drive of education? (knowledge, pragmatism, employment…)
- Education and knowledge about health issues. Is there One health awareness and environmental communication?
- Digital overload and information fatigue.
- Are most people able to distinguish between facts and opinions, fake and real? Can they fact-check? If they can, are they doing it?
- Role of education in one's own health and in that of others (including animals)
- Role of education in one's environmental footprint.
- Public vs private education. Good education for all vs for whoever can pay for it.

Factor 19: Culture, community, polarisation, diversity

- Local vs global culture/focus.
- Consumption patterns and health.
- Fragmentation of societies or not (only listening in within bubbles or not).

- What are the values and lifestyles of the population?
- Individualistic society vs communitarian society.
- Social cohesion and social diversity (overlap with equality).
- Trust in institutions? [3 levels: international (UNO, science), regional/country (governments), local/community (each other, associations, town halls)]
- Prejudices vs openness vs tolerance.

Factor 20: Religion

- What is the role of religion in and for health?
- Impacts of religions on human and animal health (e.g. Jehovah's Witness do not accept blood transfers, halal meat).
- Religion and treatments.
- Religion and animal consumption and animal welfare.
- Various types of religious rules vs innovative food production (e.g. cell-cultured meat).
- Religion and AI (worship of AI, virtual “gods”)

Factor 21: Human-animal relationship

- Animal welfare and public sentiment towards it (vegetarianism, veganism, flexiterianism…)
- Cognitive dissonances (e.g. loving pets vs. eating meat and favouring animal testing)
- Regulations regarding animal welfare considerations.
- Close contact between humans and (wild) animals as disease vector?
- Are animals used in research?

Factor 22: Acceptance of vaccination or specific treatments

- There are more and more vaccinations of any kind available, and evermore faster. Same for new treatments and medical equipment.
- Do people make use of the offer?
- Do they oppose it – what are learnings from the last pandemic?

- How do states and EU (re-)act – is there a must for some vaccinations to get rid of certain diseases?
- Do people rather believe in “experience medicine”, esoteric healing or shamans than in classic school medical treatments?
- How much does “Western medicine” take up practices from other paradigms? (Like in the past acupuncture, chiropractics, homeopathy etc.) even though they are not fully evidence-based.

Factor 23: Consumption and consumer ethics

- Willingness and capacity of consumers to pay more for better (animal, plant…) products.
- Willingness and capacity of consumers to distinguish and avoid harmful products.
- Do consumers support ethical production practices? (sustainable, with fair, diverse and equitable labour, animal welfare, etc).
- Willingness and capacity of consumers to distinguish and freely chose to consume or not new foods (supplements, NGTs, GMOs, precision fermentations, insects, algae…).
- Do consumers have a will or are they just addicted to certain foods?
- Public acceptance and use of cultured meat and meat alternatives.
- Related to agriculture management approaches and the food system.

TECHNOLOGICAL

Factor 24: Technology, digitalisation, innovation – particularly biosecurity and biotechnology

- Do people trust in technology? Do we have innovation or do people refuse technological solutions? What is the attitude towards new technologies like for example:
- Techno-biological engineering, synthetic biology, CRISPR/Cas9, genetic engineering, new breeding technologies, etc. Are people making use of them?
- How do technologies influence plant and animal breeding, conservation, ecosystem restoration and sustainability in general (e.g. engineer vegetation to help it adapt to climate change).
- Side effects, unexpected outcomes: e.g. our circadian rhythms are disturbed by use of screens at unusual times – what are the consequences? Unintended consequences to human, animal and ecosystem health.
- General innovation, investment and digital transformation.
- Private-led innovation vs public-led innovation.
- Opportunities and challenges for the EU food production and digitalisation system.

- Rate of development and availability of cultured meat and meat alternatives.
- Impact of AI in various aspects: brain activity, environment and sustainability…

Factor 25: Human and Animal Improvement

- Do people improve themselves? Does the beauty role model persist? Do humans improve mainly for health or more for longevity or beauty? Do people improve themselves for work or leisure or sports? Is it a must to be beautiful and perfect? Who sets these values?
- Humans improved animals and plants by breeding for a long time. How do we modify animals and plants in the future? What about their well-being?
- What is the role of influencers?
- Do they improve themselves for prolonging lives of humans, animals, plants?
- Who is investing in that and promoting it?
- Consequences for the health of the individual? And for society (haves and have-nots, see equality).

ENVIRONMENTAL

Factor 26: (Emerging) infectious diseases and health security

- Zoonotic and (re-)emerging infectious diseases (including bacteria, viruses and fungi).
- Cross-border health threats.
- Wildlife trafficking, introduced species, wet markets, tourism, commerce/transportation.
- Melting of arctic, Siberia, other regions / increase of oceans' temperatures.
- (Dis-) control of invasive species, e.g. via ballast waters.
- Number and activity of biological warfare facilities (related to geopolitics).

Factor 27: Climate change and their health effects

- Climate change as driver for migration and conflict – and thus for health.
- Climate change has direct and indirect effects on the health of people, plants and animals. How does that unfold?
- Who is able to cope – who is not?

- Are we humans or animals or plants developing mechanisms to cope?

Factor 28: Environment and pollution

- How do air pollution, water pollution, soil pollution, chemical pollution, environmental noise pollution, microplastics, waste, etc. effect human, animal and plant health?
- How much do environmental & socio-economic stressors affect well-being, aging (see e.g. https://www.nature.com/articles/d41586-025-02181-x?utm_source=Live+Audience&utm_campaign=2ea4dfb669-nature-briefing-daily-20250715&utm_medium=email&utm_term=0_-33f35e09ea-50422020) or mental health?
- Biodiversity and ecosystem services: what role do they play?
- Planetary boundaries and carrying capacity.

Factor 29: Resistances

- Effects on antimicrobial and antifungal resistance. Do they increase or decrease?
- Are there other effects to be expected?
- Are there new antimicrobial treatments or antifungal strategies?

Factor 30: Living Spaces

- Where do we live? In classic settlements, urban areas mainly, more in rural areas and which distribution have populations?
- How do we live? How close do we live together?
- How much space does a human being need to be healthy? “Artgerechte Haltung” (species-appropriate keeping) of human beings.
- Construction techniques and methods.
- Density of settlements. Vertical expansion, especially underground and underwater and impacts to human health
- City planning.
- Materials used in construction.
- Urban environment.
- Rural environment.
- Urban agriculture.

Factor 31: Water

- Is water scarce? How is our water management? Do we have enough clean drinking water in all places of the EU? We thought, we are safe…
- Are there illegal water markets?
- Desalination (effects of mass use?)
- State of glaciers and aquifers (and consequences).
- Connection to society: water for corporations (extraction, use,...) vs for locals.
- Droughts? Floods? (related to environment / climate change).
- (Lack of) water as driver for migration and conflict.
- Water reserves as critical infrastructure.
- Water as target for terrorism

Factor 32: Resource extraction and exploitation of new frontiers

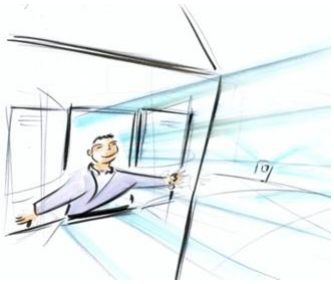
- Availability of necessary resources. Who has access to them? Externalities of their extraction.
- Exploitation of untouched resources (e.g. sea mining, space, asteroids, poles) and its impacts, particularly in the spread of diseases or destruction of ecosystems.
- Conservation vs recycling vs exploitation
- (Ecological) impacts of the new space economy.
- Effects of collisions of objects in space (e.g. possibility of global communication disruption, space economy potentially on a halt for decades...).
- Proliferation of drones and how they impact the access to the European airspace and critical services.
- Impacts of the exploitation of the arctic routes.

ANNEX: SCENARIO-PROCESS: APPROACH AND METHOD

The scenario technique is an established method of Foresight and has numerous variants. The Fraunhofer ISI scenario approach chosen here is based on four basic ideas for dealing with possible futures and uncertainty - which can never be completely overcome despite an intensive analysis of the current situation and the use of de-biasing and Foresight. The basic ideas are as follows:

- **1. Expand the range of perception**

In order to address bias and misjudgements, different expertise is combined in the process from the outset. This is achieved, for example, through a 360° perspective on signals for change from the environment, desk research of studies and analyses and, in particular, through the involvement of stakeholders, knowledge partners or individual experts in the evaluation of key factors and projections.



- **2. Systematically consider interactions**

Particularly relevant signals are selected from a number of perceived signals for social, technological, economic, environmental or political issues in the area under consideration and underlying drivers and influencing factors are identified. It is very important to Fraunhofer ISI that the interactions between developments are also taken into account in the further analysis and evaluation in order to do justice to the systemic complexity of socio-technical change. Approximately 10-15 key factors are selected that can bring about particularly significant changes with regard to the research question.

- **3. Making different expectations explicit**

Despite in-depth analysis of scientifically sound findings and assessments by experts, there is often uncertainty as to how the individual key factors will develop. Although in most cases 3-4 alternative assumptions can be narrowed down that are plausible and conceivable for those involved, these must remain on an equal footing, as weighing them up according to probabilities, for example, would not be serious due to the complex interactions between the factors. Developments in which those involved have different expectations of the future are particularly relevant for a scenario process to develop different futures. At ISI, we use the tetralemma method to support the development of more radical assumptions.

- **4. Development of alternative development paths**

In order to be able to define a sufficiently broad range of possibilities, the assumptions for each key factor are precisely formulated in comparison to the current situation and then evaluated, for example, as part of a consistency analysis or, depending on the process type, an interaction analysis of the relationships between them.

This information forms the basis for the development of concrete scenarios, e.g. with the help of a software-based scenario tool or as part of a scenario sprint. It makes sense to select from the fundamentally

possible scenarios for further elaboration and analysis those that illuminate the range of possibilities and illustrate the possible development paths particularly well in terms of differences and potential for change. This approach is therefore by no means about desirable versus undesirable (worst and best-case scenarios), but rather about strengthening the strategic handling of uncertainty and a broad range of possibilities.

The scenarios are not the end product of the strategy process, but rather the scenario development is a “tool for organizational learning”. Scenarios show the possible scope of environmental developments, allow opportunities and risks per scenario to be identified and the need for action to be derived.

These basic ideas give rise to **seven functions** of the scenario approach:

1) Developing a shared vision of possible development paths

2) Integration of different expertise and use of collective intelligence

3) Estimation of the range of possibilities through several alternative, consistent visions of the future (systematic bundling)

4) Mitigating typical cognitive distortions in connection with uncertainty and future options

5) Breaking up established, hardened positions

6) Basis for the discussion of possible effects and options for action between different age groups

7) Inspiration for the development of design ideas and transformation paths

FORESIGHT ON DEMAND IN SCIENCE, TECHNOLOGY, RESEARCH AND INNOVATION POLICY (ARGE FOD)

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