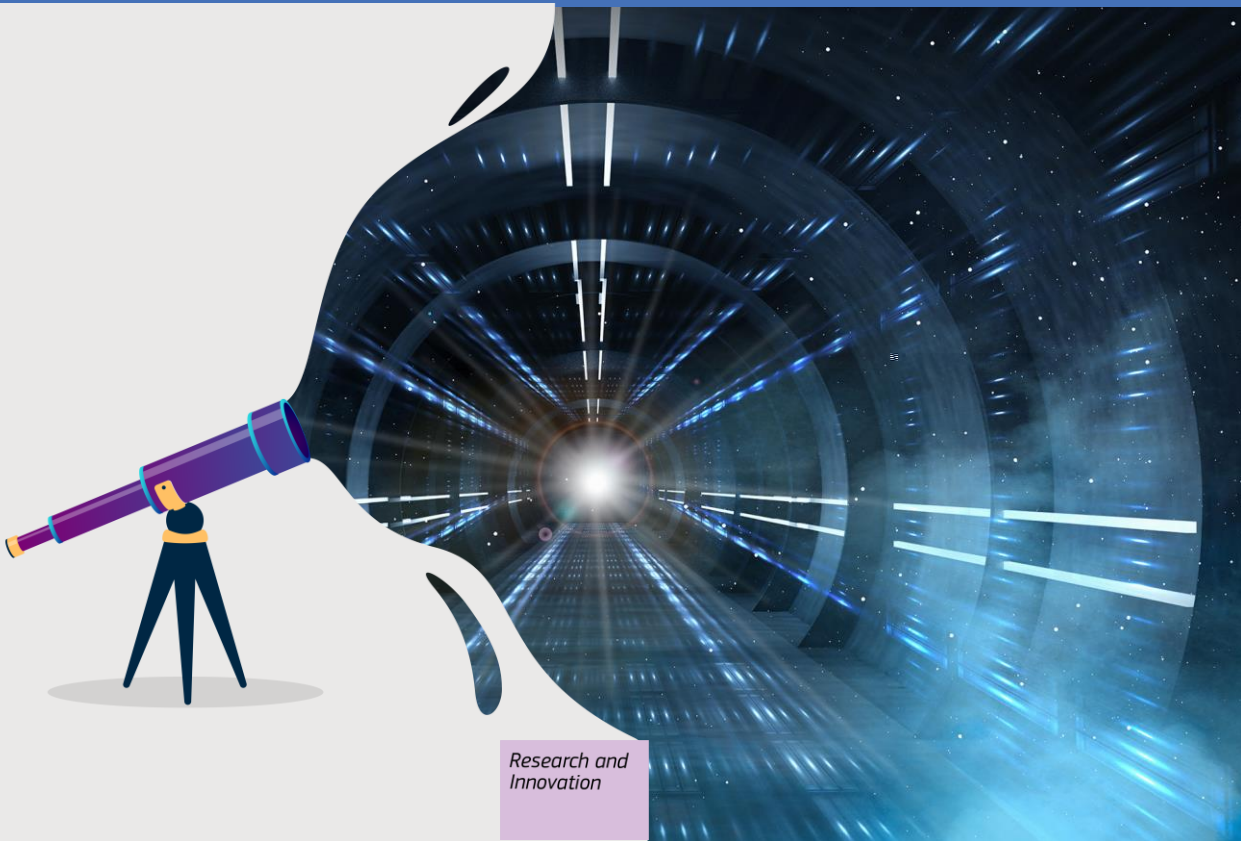




FORESIGHT

**After the new normal:
Scenarios for Europe in the
post Covid-19 world**



*Research and
Innovation*

After the new normal: Scenarios for Europe in the post Covid-19 world

A Foresight on Demand Project

European Commission
Directorate-General for Research and Innovation
Directorate G — Common Policy Centre
Unit G.1 — Common Strategy and Foresight Centre

Contact César Dro
Email cesar.dro@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

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After the new normal: Scenarios for Europe in the post Covid-19 world

Foresight on Demand (FoD)

Kerstin Cuhls (coordination, Fraunhofer ISI)

Aaron Rosa (Fraunhofer ISI)

Matthias Weber (AIT)

Susanne Giesecke (AIT)

Dana Wasserbacher (AIT)

Totti Könnölä (IFI)

Table of Contents

EXECUTIVE SUMMARY	3
After the new normal: Scenarios for Europe in the post Covid-19 world	6
1. Introduction.....	6
2. The scenarios.....	9
2.1 The Long Recession Scenario	12
2.2 The Back to 'normal' Scenario	20
2.3 Big tech shapes Europe Scenario	26
2.4 Circular trials and real-life errors scenario	37
2.5 Green Utopia - New Hope Scenario	46
3 Common Findings and Recommendations: New R&I Policies Ahead?	61
3.1 'Control' over technological development	62
3.2 Resilience, adaptability and crisis preparedness for times of crises	64
3.3 The key role of education	67
3.4 EU level financing for R&I	70
3.5 Regional disparities in R&I performance	71
3.6 Defining future priorities in R&I policy	73
3.7 Final Remarks	76
4 References	78
5 Annex	83
5.1 The Methods applied in different steps	83
5.2 Table A1: Scenario and Delphi statement connection	91
5.3 Questionnaire - Research Design	92
5.4 Demographic data Delphi survey	95
5.5 The Delphi Results in detail: Single Statements	98
5.6 Sources from the Horizon Scanning	108

Executive Summary

The Covid-19 pandemic has shattered our sense of 'normal', and amplified uncertainties and issues at the core of what the future may hold. The project 'After the new normal: Scenarios for Europe in the post Covid-19 world' examined possible futures of 2040 for the EU emerging from the crisis of the pandemic, as possible contexts for EU R&I. The five scenarios described in this report chart different possible post-Covid-19 evolution paths, creating new perspectives on key EU R&I policy issues.

Control over technological development

Across all scenarios, the ability of the European Union to exert control over future technological development - through regulation, standardisation, and the enforcement of policy - entails wide ranging socio-economic implications for the broader society.

The EU share of global R&D is shrinking, and there is an unavoidable, growing EU dependence on technologies developed and produced elsewhere in the world, most notably in the US or China. There is also an ever-increasing influence of private firms on technological development, including large multinationals, which remain largely outside public control as regards potential societal consequences of the deployment of those technologies. The challenges these trends may pose to the ability of the EU to exercise control over technological development will depend on the speed of the recovery from the Covid-19 crisis and on the character of the relationships that will be built during the recovery effort.

Resilience, adaptability and preparedness for future crises

Resilience, adaptability and preparedness require an anticipatory R&I policy including ways of identifying, monitoring and addressing threats and developing new emergency response capacities that involve science in systemic roles: as a generator of advice, as a capacity for quick analysis, monitoring of the challenge and evaluating the efficacy of responses, as well as a generator of new responses and tools against the crisis. Preparedness should include:

1. 'Wind-tunnelling' new plans, policies, and institutions through worst-case scenarios for alternative crises.
2. Exploring regularly new modes of assessing threats and trialing emergency responses, which offer the possibility to explore hidden opportunities.
3. Engaging research with all branches of government to share findings about threats and opportunities, and to foster more integrated and coordinated responses.

The key role of education

The Covid-19 crisis precipitates the introduction of a new wave of educational technologies, opening up new possibilities and engendering new challenges and risks. This could be heralding new opportunities for improving the relations

between science and education, and therefore strengthening the contributions of science to society, as well as new challenges of fracturing value and belief systems, populism and fake news. The availability of public funds for education and the role that private companies will play in new educational developments will be critical. EU R&I policy can contribute to improving the links between science, technology and education by supporting local experimentation in education in a framework that could help diffuse good practices across the EU.

EU level financing for R&I

After nearly 50 years of Framework Programme, EU direct funding for R&I projects has become part of the institutional backbone of the EU. The scenarios remind us that this is not given and that the EU budget is subject to political negotiations despite its importance for the maintenance of R&I capacity in different Member States. There is a continuous need for ensuring that the EU gets value for money out of its investments in R&I including the recognition of the benefit that Member States and EU policies across the board gain from the EU Framework Programme.

Regional disparities in R&I performance

The persistence of regional disparities in R&I performance has been a problem for the EU for a long time, and one that the EU has yet to resolve. The scenarios remind us that such disparities can develop into deep divide across the economy and politics of the European Union. Furthermore, the scenarios demonstrate how some modes of recovery can be better suited for enabling the more equitable generation of economic and social value from R&I, particularly in those regions facing greater present day challenges. Emphasis in social innovation, social entrepreneurship and frugal innovation in the EU instruments may make important contributions to overcoming regional disparities.

Defining future priorities in R&I policy

R&I policy priority-setting processes and the extent to which R&I priorities are driven by concerns with the past, current and future challenges vary across Member States of the EU. This affects the definition of joint priorities as well as the diversity and vibrancy of the EU innovation ecosystem. Scenarios that explored conditions of challenging polarisation between different national interests and between public and private interests, highlight the importance of public engagement and especially of engagement with new actors, such as social-purpose companies, in the definition of future priorities of EU R&I policy as well as in the governance and implementation of the R&I effort.

Other emerging issues of relevance to EU R&I policy

Additional emerging issues that may deserve particular attention in the coming years include:

- Several scenarios suggest that there will be both a greater need and stronger willingness for Member States to collaborate closely on matters of R&I policy.
- The widening of the range of actors as well as of policies that matter for R&I, linked to the growing policy attention to system change will become an important challenge for coordination of efforts and policy coherence.
- With their strong emphasis on competitiveness and growth objectives, the established rationales underpinning EU R&I policy are increasingly out of synch with the needs of societal and world challenges.
- As the landscape of European knowledge systems continues to evolve, R&I policy must realise its influential role in shaping broader change and adopt socio-economic disparities and environmental concerns as guiding principles.

All scenarios suggest the need for stepping up collective capability and willingness to actively engage in open and collaborative R&I relationships, both within Europe and with the world beyond Europe. This is obvious in relation to some of the global challenges Europe is aiming to address, but also with regard to emerging technologies where international alliances are decisive for establishing common standards and regulation. In order to ensure a relevant global role of Europe in the world, it is essential to build upon a strong, stable and coherent home base in R&I.

After the new normal: Scenarios for Europe in the Post Covid-19 world

1. Introduction

In recent years, the European Union (EU) has given high priority to transformative change in several of its new policy initiatives, including the new Horizon Europe framework programme. The Covid-19 pandemic certainly changed the baseline of normal life on which transformative aspirations were founded, showing that we should be better prepared for unexpected, seemingly unrealistic future scenarios.

Many scenario-building projects started during and shortly after the pandemic hit, some looking at the short-term direct effects (Varnai and Simmonds 2021) and others taking a more long-term view and broader thematic reach. There were expert group papers and studies launched on the EU level (e.g. ESIR 2020, 2021a,b,c; the EU projects Transmango¹ or Trigger²), on national level (e.g. RSE Post-Covid-19 Futures Commission 2020ff., an overview e.g. by the Council of the European Union 2020; the German BMBF 2020 or BMZ 2020). Consultancies (e.g. McKinsey 2020, Bertelsmann 2020, Khanna 2021 and others) added to the selection of outlooks or scenario work for the time 'after' a pandemic. Such reports as well as conversations (e.g. Mair 2020) and blogs served as inputs into this project (for the full literature list of the Horizon Scanning see Annex 6.6) helping to formulate alternative paths into the future.

The Covid-19 crisis called for immediate responses, and the most recent initiatives like the national recovery plans and NextGenerationEU³ are meant to not only remedy the immediate consequences of the crises, but also to contribute to triggering the longer-term transitions that make up the core of the EU policy priorities. The Covid-19 pandemic may have an impact on reaching the Sustainable Development Goals (SDGs⁴) (see Fenner et al. 2021), on development issues, especially in Africa⁵ and on research and innovation (R&I) issues like Intellectual Property Rights (see e.g. Hepburn et al 2021, Srinivas 2020). Moreover, the Covid-19 crisis is not the only crisis - many other challenges remain on the agenda, from climate change to biodiversity loss (see for example

¹<http://www.transmango.eu>

²<https://trigger-project.eu>

³https://europa.eu/next-generation-eu/index_en

⁴<https://sdgs.un.org/goals>

⁵<https://www.foresightfordevelopment.org/bibliozone/post-covid-19>, see also BMZ 2020.

the Strategic Foresight Report of the European Commission 2020, the IPBES Report 2019, the IPCC reports⁶, ESPAS with their global trends⁷ etc).

The purpose of this study was to chart the scope of change that the Covid-19 pandemic may bring to the context of EU R&I policy, taking into account the pandemic's global repercussions. The Covid-19 pandemic has amplified many of the uncertainties regarding the prospects for the EU, and the world, and has led many to imagine that it is a turning point for our human societies in the 21st century. The 'New Normal' has arisen as a popular new way to paraphrase the world's collective reaction to the pandemic and its impacts on all manner of human systems.

While the Covid-19 lock-downs have incited numerous disruptions to our daily lives, what remains to be examined - and is the focus of this report - is the extent, to which the pandemic might raise new requirements for the EU's future policy frameworks, initiatives and programmes, for example in terms of impact, time horizon of projects or investments.

At the time of the writing this report, we are still in the crisis, a fact that underscores a few key points that run across this project. First, Foresight is not about prophesising the one post-Covid-19 future but rather to chart, imagine and utilise divergent possible futures, in order to better reflect on the current state of affairs, strategy and orientation. Second, the phrase 'the Post-Covid-19 World' should not be taken to imply that the virus SARSCov2 will disappear, but should include an acknowledgement that we live under the constant threat of viruses and other pathogens, and will likely continue to do so as long as our species persists (see e.g. Varnai and Simmonds 2021). Third, the Covid-19 pandemic demonstrated the frailty of many systems on which societies rely beyond health systems, such as global supply chains, commerce and retail, arts, tourism, education and countless economic sectors. While the disruption has strengthened the emphasis on resilience as a key component of EU Foresight⁸, the question remains: how prepared are we for the next major disruption? Not the next pandemic *per se*, but the next event or innovation that may fundamentally shift how our societal systems, and we as individuals, approach daily life. For example, the Covid-19 lockdowns have accelerated the spreading of the use of digital technologies, which – after now more than a year of experience – are becoming part of our standard daily practices, with important implications for mobility patterns, work practices, the organisation of value chains and several other areas of social and economic life. Our daily practices and routines may irreversibly change, and with them industrial and organisational structures.

The scenarios produced during this project examine some of the fundamental uncertainties that the EU and its Member States may have to grapple with in the

⁶with the latest to be found here: <https://www.ipcc.ch/report/ar6/wg1/>

⁷<https://ec.europa.eu/assets/epsc/pages/espas/index.html>

⁸https://ec.europa.eu/info/strategy/strategic-planning/strategic-foresight/2020-strategic-foresight-report_en

next 20 years, and they are written to provoke questions about what 'normal' means in the context of heterogeneous values and principles. Specifically, the directionality of R&I framework programmes is supposed to help focus efforts and coordinate diverse resources and capacities, but it also implies a carrying forward of the values of the present into future generations. To which these scenarios ask: Are we so sure of the validity and relevance of these values for future generations and of the 'new normal' these R&I efforts will implicitly promote? While the NextGenerationEU funding programme seeks to address these questions⁹, and opens corridors of opportunity for R&I activities, these scenarios offer views into possible worlds that could emerge despite, or because of, our best contemporary intentions.

On this background, the study has followed well-established methods and activities at every phase, from horizon scanning and background research, factor selection and analysis, the development and testing of multiple scenarios, and an expert-based Delphi survey. An overview of these stages and further details are available in the annexes. Throughout this process, the key goal was always to deepen the understanding of **what futures might be**, not what future will be, so that policy and decision-makers can better act towards those futures we Europeans would like to see, and against others that we would not like to see.

Scenario processes are often deployed to address multi-dimensional problems that are not quantifiable and do not lend themselves to causal modelling or simulation. The scenario development approach used in in this case was a **Scenario Sprint combined with Horizon Scanning** (Cuhls 2019), i.e. a combination of explorative workshops, an impact matrix analysis and scenario path development in workshops and creative writing. The **scenario development based on workshops** in which we applied a methodology with morphological analysis (Zwicky 1969), interdisciplinary discussions, and additional desk research. We have chosen this approach (see figure 1) from a wide variety of scenario concepts, ranging from pure intuitive to very systematic and software-based methods (Bishop, Hines, and Collins 2007; Börjeson et al. 2006; Bradfield et al. 2005; Godet 2000; Kosow and Gaßner 2008; van Notten et al. 2003). Given the increased uncertainty that Covid-19 has caused, the scenario sprint model was selected as most appropriate for this project.

⁹https://europa.eu/next-generation-eu/index_en

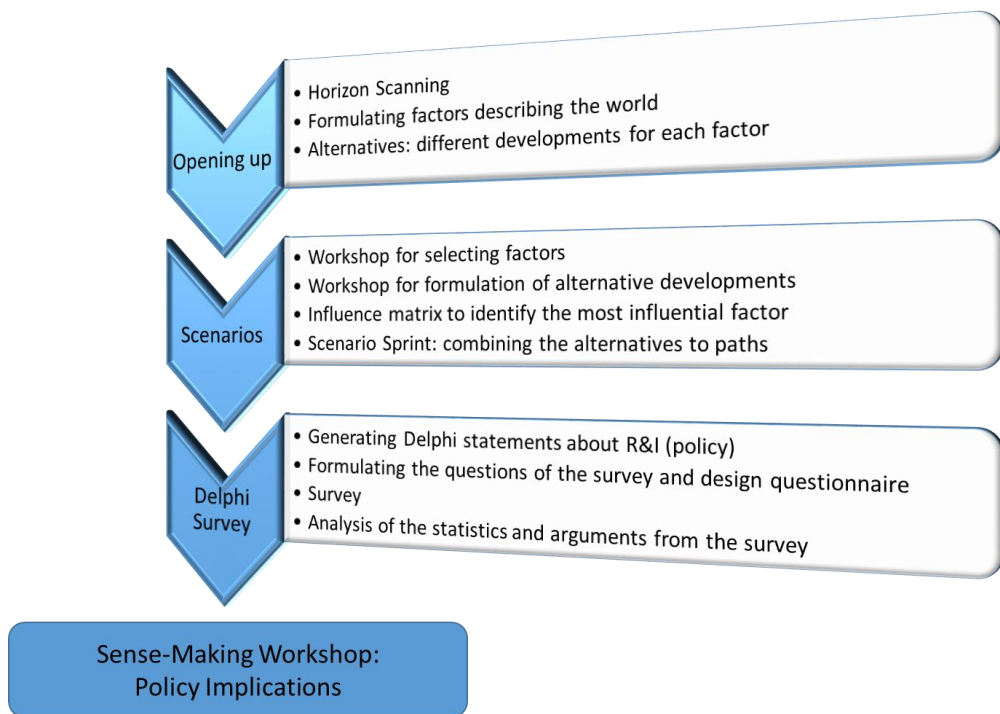


Figure 1 - Overall approach and methods

The 21 Delphi statements about research and innovation (R&I) issues were formulated based on the scenario descriptions. Their likelihood and importance were **assessed in a Real-time Delphi**. The Delphi results were summarised and served as an input into the scenarios and R&I policy discussions during the sense-making workshop. The results of all three phases - 1. opening up by scanning, 2. developing scenarios, 3. narrowing down on R&I policy and its implications for the future are integrated in the scenarios.

The report presents the five scenarios that were developed followed by an analysis of their contributions to key EU R&I policy issues.

2. The scenarios

Five scenarios were formulated. Four of the scenarios are based on the assumption of a certain economic recovery in the next 20 years, while in the fifth one, a long crisis is followed by a long period (10 years) of economic decline and recession. In this last scenario, there is no growth in terms of GDP and recurring economic shocks are expected. From a political point of view, in all scenarios, the EU remains a union, but in some scenarios, countries are leaving the EU and collaboration of nations in the EU is challenged.

All scenarios assume that the pandemic pressures of Covid-19 fade out - which does not mean the assumption of an eradication of SARSCov2, but rather of a kind of 'coping' with it, with vaccines and other preventive measures as well as better treatments helping to keep the mortality low enough for economic activity to proceed.

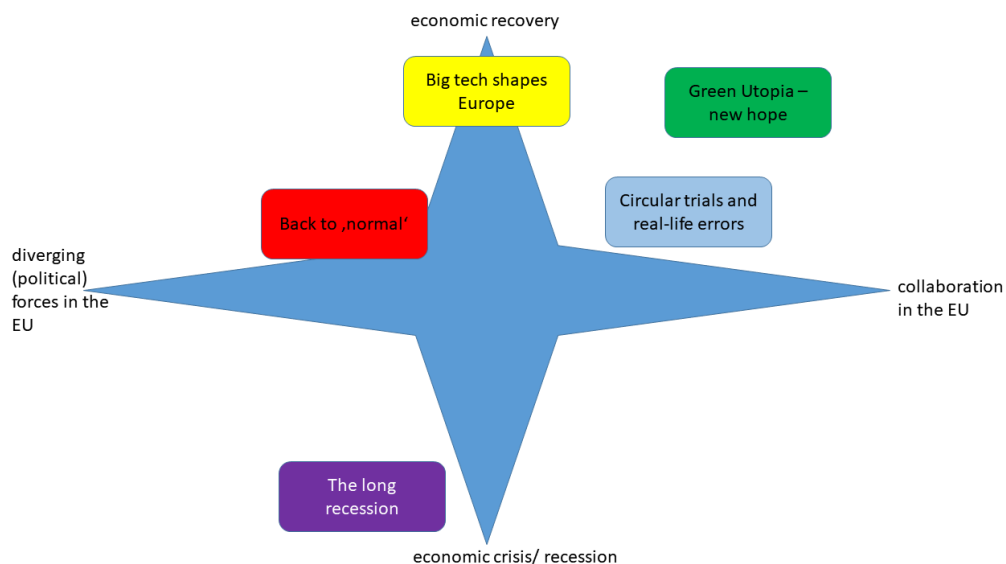


Figure 2 - Scenarios located in 2x2 (economic strength, EU cohesion)

The Delphi statements were derived from the different scenarios as depicted by the colours used in figure 2 and 3. In the Delphi survey, respondents were asked to assess the importance and likelihood of each statement on a scale from 1 to 5, with 5 being the highest. As we can see from the comprehensive data matrix matching the mean calculation for the different statements (Figure 3), **none of the statements were viewed as unimportant or completely unlikely**. The detailed data of the Delphi survey can be found in the Annex 6.4 and 6.5.

All statements are rated as high to very high in importance. Likelihood assessments are more diverse¹⁰. Statements derived from **The long recession** scenario were seen as less likely than most whereas the statements derived from the **Green Utopia - new hope** scenario were assessed as likely or very likely.

¹⁰ When reading figure 3 note the scales on the axes: importance is only shown from medium to very high importance, likelihood from low to very high

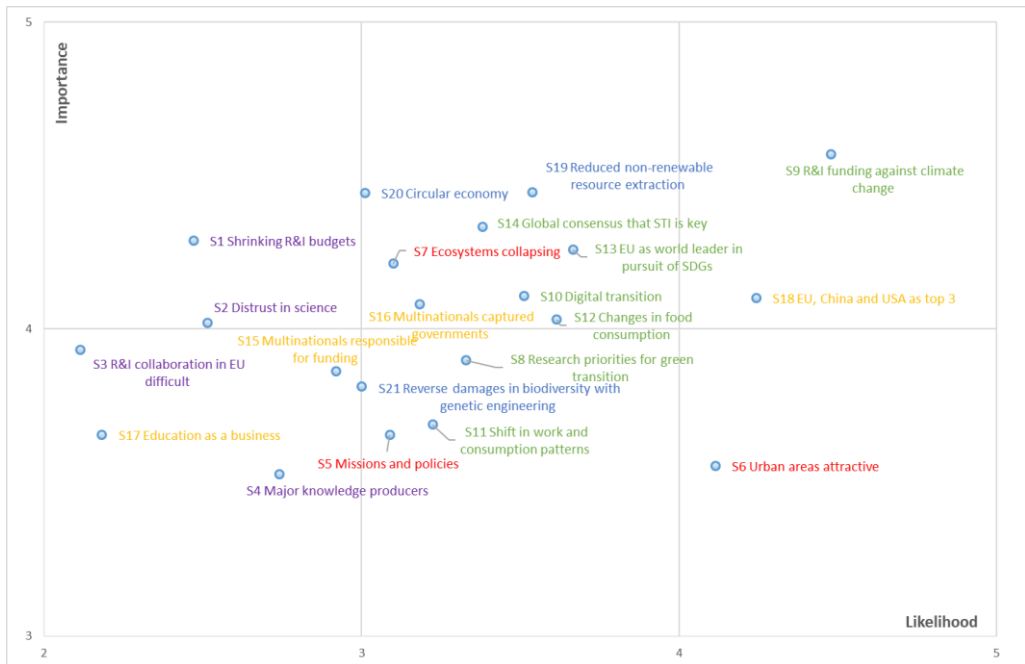


Figure 3 - Delphi Results - Mean Likelihood versus Importance.

More specifically, 10 of the statements were judged as being of high importance and either likely or very likely. While this could be indicative of some latent optimism bias (Schirrmester et al. 2020; Blind et al. 2001), we are still able to draw some important inferences from these statements regarding the perceived futures for R&I policy. Of these ten statements, three are directly tied to R&I, with the statement **S9 - relating R&I funding to climate change** - being viewed as both the most likely and the most important of all statements. The other two statements (**S18** and **S14**) relate to EU R&I efforts within the global context - prioritising that the EU maintains its position within the top global R&I actors, and highlighting that R&I is seen as critical to overcoming global scale challenges.

Of the remaining statements, three target more specific sectors or industries for increased R&I - **food chains and consumption (S12)**, **resource extraction (S19)**, and the **digital transition (S10)**. These statements might be seen as linked to areas, in which R&I is needed, and areas that can help EU R&I with respect to the above mentioned 'goals' - addressing climate change and maintaining EU R&I as among the world's top ranked.

The final four statements of these ten (**S1 - Shrinking R&I budgets**, **S2 - Distrust in science**, **S7 - Ecosystems collapsing** and **S16 - Multinationals captured**) could be seen as both aspirational and reactionary. The two aspirational statements position R&I as key to achieving more abstract goals - the creation of a more **Circular Economy (S20)**, and positioning the EU as the world leader with respect to achieving the Sustainable Development Goals, **SDGs (S13)**. The Delphi experts' support behind these statements could signal that

aspirational goals, such as these, are important motivators for R&I institutions and researchers.

The more 'reactive' statements involve issues that threaten to destabilise part of the environment surrounding R&I activities, but they work on different scales. One statement concerns the increased influence and political power of **private corporations (S16)**, which could influence R&I funding or directionality. The other statement regards **ecosystem collapse (S7)**, which carries many degrees of uncertainty (location and scale of collapse being unspecified) and still threatens disruption to societies and economies that R&I efforts rely on.

It is important to note that, while each of the statements was more directly linked to a single scenario, all of the Delphi statements were pertinent to one or more additional scenarios. The following scenarios are the combination of the results of the scenarios (**texts**) including the Delphi results (boxes).

1 The Long Recession Scenario

The long recession

- Severe and long-term economic decline
- Regime changes around the world
- "My country first - me first"
- EU Member States have left or had their membership revoked
- Social disparities emerged, unsettled and disenfranchised population
- Disinformation undermined trust in governing institutions
- There is a lost generation and a stagnant SME ecology
- Paralyzed policy to address climate change

Figure 4 - The long recession

A long recession started in the 2020s, after the global pandemic caused by SarsCov2 and its mutations. The flight of the financial markets into cryptocurrency led to a bubble that eventually crashed, causing turbulences in commodity stocks. This caused a crash of the food market, and the over investments in housing finally ended in a crash of the sub-prime market, a housing crisis and a cascade of other crashes.

Economic downturn

In this scenario, supply chains, travel industry and investment flows have not only been temporarily disrupted but at different times and for longer periods. They play a different economic role in 2040 compared to 2020. People, at least those with regular jobs, are saving and not spending their money, fearing even worse times. This behaviour is further fuelling a **severe and long-term depression** that defines the economy of 2040.

In the Delphi survey, we asked about the possibility of a long recession, fewer EU Member States and financial hardship, leading to a drastic reduction in R&I budgets.

Statement 1 (Delphi survey): **As the result of a long-lasting recession following the Covid-19 pandemic, private and public research and innovation have shrunk considerably (50% compared to 2020) in absolute terms.**

Shrinking R&I budgets

There was no consensus about the likelihood of this statement (on average, moderate likelihood but as many judging high or very high likelihood as low or very low likelihood). On the one hand, R&I activities are at the core of efforts to build competitive economies and exit the recession - R&I has illustrated its key role in managing the pandemic. On the other hand, a long lasting recession may reduce the fiscal space for public R&I efforts and reduce the size of Europe's scientific enterprise.

The political and economic leaderships' failure to take socio-economic counter measures early enough was followed by a number of regime changes, beginning with major political shifts in Iran and the USA. Across the globe, economic systems under stress have been lead to widespread economic collapse, and humanitarian catastrophes have become all too common. Research investments have not been exempt from the crisis, and some argue that the situation of the R&I budgets has been responsible for a marked slowdown in the pace of technological development, particularly within the EU.

And what about the European Union?

The **continuous economic and political decline** that began in the early 2020s has had direct and indirect effects on traditional European values (like inclusion, tolerance, justice, solidarity and non-discrimination as well as human dignity, freedom, democracy, equality, rule of law and human rights¹¹), which changed when being confronted with the realities of economic downturn, and a serious re-nationalisation movement. Unfriendly forces from the US and Russia affected the EU's collective polities, funnelling conspiracy theories to the general populace and with that even further **undermining trust in governing institutions**. Some

¹¹<https://ec.europa.eu/component-library/eu/about/eu-values>

populist leaders, seeking to gain power on a nationalist agenda, have seized momentum to lead their nation states to exit the EU. **Market-driven forces and libertarian views** on the importance of free markets, exports and competition **dominate the economic values of those nations who left the EU.** In the remaining EU countries, environmental concerns are not addressed, as the public budgets are empty.

A race to the bottom has ensued for environmental standards, as countries compete to attract business and investments from all over the world - a trend that has also influenced the economic and environmental policies of nations remaining in the EU. Most, but not all, **EU countries stay together** only because a complete break-up of the EU would even worsen the situation, and their minor, but notable, successes have bolstered the narrative that concerted efforts are more effective than singular nationalist strategies. Values of fundamental freedom are relative, but flexibility and acceptance of difference remain important to keeping the EU together.

In this recession and depression scenario, nationalism prevails and barriers to collaboration may emerge even in the EU.

Statement 3 (Delphi survey): **In 2040, it is more difficult than in 2020 to collaborate in R&I across EU countries.**

R&I collaboration in EU difficult

The result of the Delphi survey is: it is rather unlikely (the majority ticked very low or low likelihood) that collaboration in the EU will be more difficult in 2040 compared to 2020 - or better: European-wide R&I collaboration is rather likely, also in the future. It is regarded as an important or very important issue by more than three quarters of all Delphi participants. The pandemic has changed neither our economic model nor the economic priorities. Pursuing economies of scale will need cross-border cooperation and knowledge spillovers. There are several factors promoting the scientific collaboration across borders within the EU:

- experience of the Covid-19 situation and common achievements
- collaborative platforms, digitalisation
- networks are emerging that help clusters identify collaborative innovation opportunities.
- more multinational companies with multinational management and/or employees.

Nevertheless, in 2040, individual nation states and their specific interests are dominating the political agenda within the EU, undermining 'common policies'. Xenophobia, spurred by some blaming the health and economic crises on foreigners, has put pressure on fundamental values of the EU, which become less shared across the continent and more contested in difference countries. In some parts of the Union regulations curtailed individual rights, with little resistance from the people and preventative pandemic measures became permanent.

Outside the Union such tendencies went even further. In some departed nations, 'crisis management' was synonymous with the elimination of privacy and personal liberties, and placed disproportionate power in the hands of a small elite.

Autocratic forces are also emerging within the EU. People are searching for political guidance in a fractured political landscape, a development in the 2030s promoting nationalistic policies and isolated economies. **'My country first - me first!' 'Why should we care?'** - These are the slogans of 2040 that propagate individualistic mindsets and nationalist sentiment, as promoted (and lived) by leaders in society.

The **retreat of the state** from several formerly public duties caused by empty budgets in this scenario might invite criminal organisations to fill the gap and make corruption common. Of equal concern for policy is also the **risk of rising social inequality** and thus **more political radicalisation**. Corrupt political structures as well as family clans profited from the COVID-19 crisis, gaining control over critical supply structures and even political networks in- and outside the core EU.

Companies paralysed

Most companies have had tough times for a long time, and they are not over. In **the long recession** many companies got bankrupt. Some of the strong small and medium-sized companies still survive. Mostly those prospered when they had the capability of offering necessary crafts and services or products that are really needed. Most **companies** could only **muddle through the crisis**.

One of the effects of the pandemic were 'ghost companies', surviving only on the welfare payrole. This created an environment in some of the European countries where especially medium-sized but also large companies got more and more dependent on 'welfare', receiving one state-guaranteed loan after the other even though public budgets were under pressure. Smaller companies in the 'right' sector (offering healthcare or specific equipment at the right time) survived, others got bankrupt.

SMEs are still the biggest employer in the EU, but more and more SMEs became single-person companies as the economy shed jobs and former big employers reduced staff and slowed hiring. After the 2025 riots, they were not allowed to send people into unemployment, if they wanted state subsidies. As now many of their personnel retired, they are no longer large employers, but automated companies. People are a cost factor, not an asset anymore. Many SMEs specialise in small narrow but truly global markets – wherever economic activity is possible.

Uncertainties in the population - what is right or wrong?

In 2022, **people were confused by the different rules and regulations concerning daily life in response to Covid-19**, as there was no unified agreement on preventative measures across the EU's regions, federal states, or major cities. It was increasingly **difficult for the population to understand what is fact and what is not**. Many of the regulations were never given up - and people got lost in understanding the state of the art. They were also confused by the different way of presenting statistics, interpreting data or understanding what scientists tried to explain them - about health, the remainder of SarsCov2 and mutations, the economic situation or technical explanations about what

During the Covid-19 pandemic, science gained trust and became a close partner of government. This created risks for political debates undermining the trust in science.

Statement 2 (Delphi survey): **In the aftermath of Covid-19 (up to 2040), political divisions have led to a strong distrust in science.**

Distrust in science

More than 50% of the experts judged the likelihood of a strong distrust in science as very low to low but as an important or very important issue (78%). The contributions science has made to coping with the pandemic, especially on the medical and digital sectors have increased the commitment to evidence-based science. The pandemic has shown, though, that it is difficult for policy makers to balance between political opportunity and scientific evidence.

Arguments in the survey mention that a growing citizen science community with more skills to interpret statistics and more engagement in societal discussion processes with experts could contribute to better science communication and understanding of citizen needs – also for policy makers. New transparent science consultation practices and transparent policy decision-making need to be established, making clear in who's interests decisions are taken. The media and schools play a crucial role in this respect as well and reflect their narratives in the (re-) construction of reality.

Artificial Intelligence is able to do unnoticed. By 2040, the confusion between messages drawn from scientific research and the more popularly accessible 'facts' has only grown. The EU has initiated numerous programmes to develop more clarity around scientific decision-making, to explain policy guided by data, and to be responsive to the emotional appeal of misinformation. However, these programmes have seen limited success, with distrust calcifying in regions where economic hardships and limited services strengthen anti-government opinions.

Education means learning only what the economy needs

Education systems were disrupted in all European countries during and after the Covid-19 crisis, highlighting the differentiated capacity for nations to respond appropriately to emergencies. While some countries managed to keep schooling and universities going during the pandemics by creating new home-schooling infrastructures and didactics, **many nations and institutions were unable to provide digital education or find adequate solutions during lock-downs.** Schools and single teachers were often left alone with finding a way - and many of them just gave up.

The pandemic of 2020 was a **gift to many private sector education firms**, particularly those companies that offered online higher education and teaching tools. Homeschooling was legalised in some EU countries, adding to the diversity of educational offerings, at a time when public education systems are under severe budget constraints. Officially, the public sector is still responsible for

primary education in the EU nations, though vocational training is provided by the few companies that have remained stable during the recession.

In a time of empty public budgets and confused citizenry, self-organised knowledge communities may emerge to pursue research and learning, take control of schooling and become major knowledge producers in society.

Statement 4 (Delphi survey): **In 2040, as a reaction to the distrust in the 'elite science' represented by scientific institutions and big companies, self-organised citizen associations, communities, and SMEs have emerged as alternative major knowledge producers through communication networks such as social media.**

Major knowledge producers

The statement got very scattered likelihood estimations (from very low to very high likelihood), but was viewed as *important* or *very important* by the majority of experts. In opposition to an 'elite' institutional science, a scientific counter-culture manifested in self-organised citizen associations, communities, and SMEs could account for a better balance of knowledge production and science communication. Some of these initiatives might have a long-lasting effect if they manage some kind of institutionalisation. But the majority of these initiatives will be ephemeral. They will pop up at a certain point in time, possibly issue-related, and will be substituted by new issues and initiatives eventually.

The institutionalisation of the longer lasting initiatives will depend on the support of governments and big science institutions, big companies etc. They have the chance to establish themselves in some areas, possibly less resource-intensive disciplines. A prerequisite of this scientific counter culture and a skilled understanding of science per se, however, is proper basic education available to all. This includes also the existence of and access to libraries, civil society organisations and science museums etc.

The former 'educational canon' - a set of basic knowledge agreed upon implicitly and explicitly in education plans - no longer exists as people are incentivised to learn only what matches the current needs of the labour market. Cultural issues, literature, music, the arts, geographical knowledge, social studies or higher mathematics are regarded as superfluous for the conventional citizen.

Furthermore, a decline in universities and other knowledge-producing institutions, due to drastic budget reductions and lingering institutional distrust, continues to push R&I talent to the private sector. Companies teaching specific knowledge (like mechanical engineering or programming) profit from this development.

Disparities in society and a lost generation

Missing education lead to a **lost generation** (those who were under 20 in 2020), which was aggravated by the economic and social shifts caused by the 2020 pandemic. Many in this generation have become marginalised, having received only partial education or training during the pandemic. As unmotivated adults in 2040, many have learned how to survive without formal education. A variety of people who came of age during the pandemic only know pessimism and recession, and their motivation to learn or engage is very low. Of course, not all young people got lost in the last 20 years of economic turbulences, and the generation that is retiring now, in 2040, has their own problems with health, Long Covid, and lower or lost pensions.

Inequalities in society have drastically **increased** since 2020. Economic recession and unemployment hit vulnerable populations the hardest during the pandemic, especially in countries without a functioning welfare state or fiscal policy flexibility. In 2040, women, minorities, non-citizens, and other traditionally weaker groups have become much more marginalised, and poor economic conditions reinforce this trend.

Many people moved ...

In the 2020s, following the first pandemic wave, many people moved to the countryside. We first saw the phenomenon in major metropolitan areas (i.e. Paris, Rome and Madrid), where citizens moved to smaller, rural communities or sub-urban areas that were seen as safer, healthier places to live during the crisis. People were encouraged to move away from cities by remote working opportunities - and those who left, never returned. As those who left were those who could afford to leave, urban economies became depressed and **urban social disparities** were amplified. Cities have lost large parts of their 'bourgeois' populations with a stable income and consistent spending habits, and in 2040 many urban areas are decaying from the lack of tax support and depressed markets.

Many people **no longer dare to live in dense urban neighbourhoods** (because of safety, security, viruses and bacteria spreading, noise pollution, etc.). In 2040, many global populations have become increasingly de-urbanised and distributed, including those in the EU. This has influenced property markets - raising the prices of living in rural areas, and depressing the formerly expensive city centres. People commute for work and for culture - but cultural exhibits and centres are no longer concentrated in urban areas. Some of the attractive events still take place in the cities, but many have become accessible in digital media. Many people are considering migrating to China, to escape from the **depressed economies and unstable social conditions in Europe**, now, as China is open for immigrants.

And climate change?

... is going on. Humankind did not manage to turn the metaphorical 'tanker' of consumption, resource exploitation and emissions around in time, and climate change related catastrophes accelerate. The earth passed one climate tipping point after another, setting off a cascade of environmental degradation and collapse. Even though many governments and strong actors, such as the EU with its green deal policies, set incentives for society and economy to change paths, these efforts proved insufficient. At those places where human life is still possible, social unrest is unfolding. This is due in part to climate change induced migration, continuous conflict over resources (clean water, arable land, clean air etc.).

Fact is, since the beginning of the recession, there was and is no investment for climate neutral alternatives, neither for research nor for societal or technological solutions or a transition towards more sustainability. We struggle to keep the economy and ourselves alive, research and innovation are not in the forefront. Since the 2020s, important ecosystems (e.g. many forests, Antarctica, permafrost regions) have already been irreparably damaged, making certain spaces uninhabitable for humans. Droughts, heatwaves, and increased frequency of natural disasters changed entire landscapes around the world, including many parts of the remaining core EU nations. There are large regions in Europe where agriculture is no longer viable, and some regions where human life is essentially impossible. People do not demand quality food when they are starving, but the slogan of 2040 is: 'some humans will always survive'. 'Nature' as such will survive because it is able to adapt to shifts, but the future of the human species is not so clear.

Back to 'normal'

- Citizens want their old 'normal' back
- Nationalism
- increasing disparities between member states of the EU
- consensus a scarcity
- continued growth paradigm
- wealth and consumption are highly valued
- increasingly unequal society
- tied economic recovery to industrial production
- worsening 'offshored' emissions
- increase of food insecurity




Figure 5 - Back to 'normal'

In this scenario, people are trying to go **back to** their old '**normal**', getting their old lives back – at least those who liked their old lives. But the old routines are gone: So what is 'normal'? The popular desire to return to the old state of affairs was not the same across all EU nations or demographic clusters, nor was the capacity to do so evenly distributed. It took a while to recover economically, but economic growth is still the prevailing political objective and the economy is back to the 'business as usual' cycles. From an economic perspective the 'new normal' looks very much like the old 'normal' where policy and political success are judged almost exclusively on the basis of macroeconomic indicators.

As the Covid-19 crisis wore on, it became evident that the economic and political will to bring Europe out of the pandemic was strongest when people were able to believe that a **return to ,normal'** was possible. Initial economic support policies that kept business afloat during the early years of the pandemic were received with broad public support, despite the evidence that fundamental economic shifts were rendering some niches obsolete. As SMEs continued to disappear after the pandemic broke - through insolvency, acquisition, or consolidation - the majority of employed people were relieved to have an income and there was little concern about market power and the rise of large-scale business entities.

In countries with strong economies, the recession of the year 2020 was over relatively quickly, GDP growth returned to pre-pandemic levels and the 'new normal' was declared. Other parts of Europe were slower to arrive at the recovery rates of the top performers, while in the weaker economically parts of Europe, pre-existing economic disparities and more severe pandemic repercussions meant that 'normalcy' was not realised until the 2030s. Thus while the overall EU economy has clawed its way **back to 'normal' in terms of GDP growth, economic activity and social conditions** met with reinforced pre-pandemic disparities.

Given these unequal conditions, and building from some of the popular rhetoric that had gained momentum before the pandemic, the already upcoming **nationalism increased** even more. The EU was able to persist by extending concessions to powerful nation states and private companies, in terms of revised labour policies (fewer guarantees and securities for most employees). Though important structural changes were underway (digitalisation, the influence of developing economies in Asia and Africa, etc.), for many the return to relatively stable income, familiar modes of commerce, and reliable institutions (education, recreation, religion) brought the peace of mind that the pandemic waves had disrupted. Efforts to counter Covid-19 through concerted Member State action were undermined by disagreement on appropriate strategies and finances. Intra-state politics were brought onto the main stage of European political deliberations. The failure to enable EU wide strategies for the benefit of all citizens, eroded trust in EU capabilities to cope with future crises and disasters, particularly the growing climate crisis.

How do we live?

Social and economic disparities can be seen in cities, where different socio-economic strata are situated in close proximity to one another and interact often. **Urban areas remain strong attractors** for many different demographic clusters: opportunity seekers from rural communities, immigrants, explorational younger generations, and those preferring the convenience that urban proximities allow for. Economic aid packages and funding support that benefited wealthy 'job makers' over 'job-doers', created deeper divides across EU societies, most prominently in urban areas. In cities, the range of choices for health care, education, and other social services is very broad for those with money (less so for those without), with wealthy, affluent neighbourhoods successfully lobbying for, and receiving, more advanced infrastructures and higher quality services. The invisible walls between rich and poor quarters that cut across every metropolitan area, are more strongly enforced through tangible markers and security presence.

Equal options for all?

As **wealth and income disparities** determine the opportunities people from different social strata are presented with, 'bubbles' of differing knowledge and skills become far more prevalent, and social segregation becomes sharper. The ways that education is delivered has changed - rapidly after 2020 and with slight changes, thereafter. Although the state remains a key actor in the educational system - by defining minimum standards and conducting monitoring activities - private schooling, public-private hybrid education systems, and some home-schooling options have emerged and become popular. The EU has passed legislation recognising access to information as a human right, and powerful industry lobbying ensured that universal access to information was not free from advertisements, privacy focused, and available at bandwidth speeds necessary for good utilisation of information networks by all. Thus, opportunities for remote work, micro businesses, and self-guided online education are affected by disparities in access. Costs and accessibility to (fast) internet are very different wherever you are.

During the lock-downs, in some countries, people left the cities for the countryside as their job and normal living were not bound to the cities, anymore, and home office and home schooling allowed for longer distances.

Statement 6 (Delphi survey): **In 2040, urban areas remain attractors for talent and hotspots of research and innovation.**

Urban areas attractive

The statement was seen as both **very likely and very important**. Many participants mentioned the incentives that both institutions and companies have to locate near urban areas, and the urban affordances for an innovation ecosystem (infrastructure, facilities, diverse intellects, etc.). Experts viewed urbanisation as a long-running, historical trend, while others highlighted the efficiencies of cities.

Some experts cited overpopulation, pollution, and health, and safety issues as drivers of de-urbanisation, alongside the capacity for some types of R&I research to be conducted through digital communication technologies. One respondent pointed out that the acceleration of digital technologies (immersive virtual spaces, etc.) could nullify some of the conveniences attribute to cities. There were additional negative agglomerations in urban like high cost of living, and the need for deep urban redesign (construction disrupted services, etc.) that could make cities less desirable in the long run.

Within these conditions of inequality, healthcare has become an issue of growing political concern. Access to hospitals is not always possible and treatments are costly - too costly for many. Healthcare services are more and more internet-dependent, and thus not an option for all. The increased demand for healthcare services in space-scarce urban environments has driven a decentralisation of the health and medical systems. The 'lean and agile' approach to health system development has created **new trust issues**, particularly in the lower income social groups. Additionally, the modular 'health centre' approach to increasing infrastructure capacities continues to highlight the differences across the citizenry - with modern equipment and facilities being delivered to more affluent communities, while poorer communities inherit dated but functional technologies for the most part.

These shifts have only fuelled increasing political polarisation within the EU, with some Member States' liberal democracies confronting a crisis of governance. **Political tribalism** owing to both information bubbles and the hardening of socio-political ideologies has made effective governance very difficult - particularly in states where coalitions define governmental leadership. New types of coalitions have cropped up, if only temporarily, between dramatically oppositional groups whose singular commonality is their will to overturn the status quo. These coalitions create governance deadlocks that can span years.

Economic growth is back - any changes?

For many, the Covid-19 crisis demonstrated that the type of rapid lifestyle changes necessary to address anthropogenic climate change were possible. While

net energy demand had been reduced during the peak of the lockdowns, the concurrent reductions in GHG emissions were still insufficient to align with the needs and plans for emissions reductions. Even when the world grounded to a halt in 2020, human dependency on heavy industrial systems could not be greatly reduced. If anything, the lockdowns demonstrated the **resilience of consumerism, waste, and emissions of the continued economic growth paradigm** as organisations adapted to asymmetric policies of Member States, disrupted supply chains, and dramatic shifts in consumer behaviour.

As the dust from the Covid-19 crisis finally settled, the companies and industries that survived found themselves even more entrenched and critical to daily life. In the meantime, unable to compete with larger businesses, many SMEs vanished from the market place through acquisitions, mergers, or bankruptcy. The private sector actors that survived are able to exert a strong influence on the direction of technological development. Reductions to publicly funded R&I allow private investors to set the agendas and priorities of public research and play a stronger role in regulatory processes. This further incentivises a concentration of the R&I institutional landscape – hand in hand with a loss of autonomy in the scientific enterprise. Some R&I institutions, particularly academically situated ones, have been diminished in their stature and capacities, pushed into an increasingly subsidiary role to the service of economic powers.

This back to 'business as usual' scenario, entails an important risk of catastrophic climate change, the manifestation of which becomes ever more evident during the coming years, without however generating the political will for change before it is too late. We speculated that when the magnitude of the challenge is realised, humanity will attack it with all its resources.

Statement 7 (Delphi survey): **In 2040, because of collapsing ecosystems all available research and innovation is directed towards slowing or reversing environmental degradation and addressing the effects of climate change.**

Ecosystems collapsing

There is broad consensus among the Delphi participants that this is **an important or very important** issue - the possibility of action against the effects of climate change. But the assessment of likelihood is scattered. Some experts thought that the time horizon of 20 years was too short for ecosystem collapse as stated here, and that other political priorities will remain higher or on par with addressing climate change and other environmental issues.

Others thought that tipping points of ecosystem collapse, and the complex relationships of ecosystems with human society were important arguments for the possibility of really catastrophic events within a time frame of 20 years. Many experts stated that this situation could become reality given the current wealth of climate change data that we do have, that seems undervalued or not addressed by current policy work. Some experts argued that **societal procrastination on climate change and ecosystem protection policies** could lead to the sudden - wake-up call - mass mobilisation of knowledge and resources as described here - even in a 'back to 'normal' scenario.

Exceeding planetary boundaries

Though people are aware of climate change and the increasing severity of its impacts, few seem able to commit to the individual changes that a green lifestyle demands. The **slow and uncoordinated shift towards more sustainable systems and consumption patterns** has done very little to address the global challenge of climate change. Within the EU, conservation policies to maintain ecosystems and their biodiversity were widely popular, but they were often at odds with incentives reinforced by economic recovery policy. As major economies of the EU relied on revitalising traditional economic behaviours in the return to GDP growth, the post-Covid-19 world increasingly resembles the pre-Covid-19 status with respect to levels of emissions, waste, and ecologically damaging practices.

Nevertheless, comfort and convenience are outdated. Anthropogenic climate change remains a powerful driver of unpredictable change, and piecemeal policy by some international actors proves insufficient to combat global warming and environmental degradation around the world. Climate change impacts are being felt globally, with an accelerated loss of biodiversity and the collapse of important ecosystems. Fisheries depletion and unreliable staple crops, have created highly volatile food market prices, creating significant socio-political disruptions, and destabilising some markets and supply chains. The EU faces an increased frequency in droughts, heat waves, uncontrollable fires, catastrophic storms and flooding. The broader impacts of climate change have inspired the EU to channel all R&I activities and funds into ecological and climate change research areas, but these efforts have yet to change industrial inertia and the popular NIMBL (Not In My Behaviour or Lifestyle) social response.

The symptoms of climate change - weather irregularities, natural disasters, and the extinction of key species for agro-ecosystem health - are starting to have severe consequences in the world in 2040. The fuzzy science around tipping points, and the uncertainty veiling precise measures of critical thresholds, leaves the EU (as well as many other countries) struggling to garner and coordinate an effective response of humanity to climate change with the international community.

Food supply at risk

Disruptions to environmental conditions have undermined regional food security for many parts of the EU, not to mention the rest of the world's population. Within the EU, food supply chains have maintained a certain level of reliability unlike other parts of the world where shortages in agricultural yields have become frequent. Availability of many different foods has become limited, but within the EU risks of malnourishment remain under control. Nutritional availability is maintained across the EU by coordinated efforts by Member States to provide logistical support to get food where it is needed, and to reuse food to a greater degree. However, the struggles facing the EU are dwarfed by the cascading problems in the global food supply chain, which has become dramatically unreliable and prone to extreme swings in prices for staple goods (rice, wheat, soy), meat, and dairy. Parts of the world have been hit by famine, and food supply issues have caused multiple socio-political disruptions, and

intense regional conflicts - sometimes between large powers on the world stage (China and India). Such volatility does little to build the trust and support needed to face the ecological problems that are driving these issues, but the EU retains hope that an international solution can be found.

3 *Big tech shapes Europe Scenario*



Figure 6 - Big tech shapes Europe

In 2040, The **EU hosts a number of globally competitive multi-nationals supported by a dynamic network of innovative SMEs**, and the Commission utilises its legislative power to promote the Union’s standards and regulations across all major industries around the world. The successful development of a multi-faceted EU innovation and technology ecosystem of 2040 emerged from policy and investment responses to the fear that US and Chinese based multinationals would soon dominate critical industrial sectors. This development has seen the private sector become increasingly potent in policy and governance, particularly with respect to the development and management of numerous social services within Member States. How did it start?

Years of transition started in 2020

In the beginning of the 2020s, the pandemic crisis accelerated the manifestation of the **digital turn**, and underscored the need for the EU to advance its plans for the development of a competitive, technology-focused, economic ecosystem. As the COVID-19 crisis prompted widespread adoption of teleworking, integrating automation within industries, and the digital provision of public services (education, etc.), the widening gap between European and foreign digital business power became increasingly acute. As the influence and market dominance of Google, Amazon, Facebook, Apple, and Microsoft (GAFAM) and other foreign-based digital technology companies continued to make gains during the pandemic-driven digital transition, the EU implemented a number of programmes to kick-start a sovereign digital development ecosystem.

However, these funding efforts did not offer an immediate return on investment, as the planning, incubation, and growth of such ecosystems takes time. To gain more time for these efforts to pay off, the EU sharpened its policies on digital technologies to maximise the influence of its market power. The EU Commission

achieved this, in part, by doubling down on an airtight expansion of the GDPR, adopting anti-monopoly measures for multinational digital companies, and sharpening the taxation code for digital business activities within EU borders. EU-based industry leaders and SMEs alike applauded and supported these measures, and with each successive policy step, the dominance of foreign-based digital companies was reduced. This gave the EU's digital R&I ecosystem the time to develop, and to utilise its advantages as a native entity within the European digital regulatory sphere.

In retrospect from 2040, the blooming of the EU digital garden had been primed in advance, and the **R&I ecosystem made rapid progress fuelled in part by the urgent and ongoing needs caused by the pandemic**. Initial successes were tightly focused on addressing numerous weaknesses in healthcare systems Covid-19 had laid bare, and the exploitation of EU-funded scientific research that had lain dormant until the pandemic. The resulting benefits for public health and productivity resulted in huge popularity for new EU-based companies and the Commission. Additionally, lessons learned during these initial experiments in public-service/private-start-ups - private sector entities managing public services with partial public ownership - would establish a successful framework for developing digital R&I ecosystems to be applied across all major economic sectors. As the pandemic subsided, the EU digital technology industry began to realise the important gains it had made, by expanding the framework in two directions.

In a world of strong corporatist economic powers, the positioning of the EU as a technological superpower amongst the US and China is not to be taken for granted. East Asia including Japan, Russia and even India could overtake the EU in the race to control the technologies of the future.

Statement 18 (Delphi survey): **In 2040, the EU, China and the USA make up the top 3 most advanced research and innovation entities in the world.**

EU, China and USA as top 3

The assumption is considered **very likely and very important by 43% of the respondents**. Less than 2% of the respondents regard this development as not important, less than 1% of the respondents indicated a very low probability of occurrence. These data suggest a strong consensus on the future leading role in R&I of China, USA and EU.

However, single arguments in the survey consider Russia, Japan, UK, Singapore, Canada and India as important potential future candidates for R&I leadership, too. Single Delphi participants argue that Europe could lag behind China, India or the USA in the future.

First, the **dynamic start-up ecology** had begun drawing the attention of the EU's perennial industrial powers in mobility, bio-engineering and production, and specialised industrial manufacturing. Drawing from lessons learned during the pandemic, small- and medium-sized AI and automation companies partnered with large and medium sized industry leaders to address sector specific uses for

artificial intelligence integration and increasingly automated systems across all industrial sectors. With numerous EU and state-backed tax incentives in place to build open and strategic autonomy, EU-based partnerships flourished to fill the numerous niche spaces either neglected by GAFAM scale enterprises, or abandoned under new policy measures. As these partnerships took root during the EU's post-pandemic push towards a more sustainable economy, again many were pleasantly surprised to see their efforts reflected in growing global market demand. By 2030, these new partnerships allowed EU companies to advance the state of the art with AI assisted biotechnological design, integrated urban mobility systems, and increasingly automated agriculture. As a result, a fair number of EU-based companies emerged as leaders in what were formerly niche markets, but in 2040 have since become trillion Euro markets, and the EU's technology sector now stands as a peer with the US and China.

Secondly, led primarily by private investors, in the late 2020's the EU made a **new round of regional development funding** available to scale regionally based digital public service solutions across the EU. This allowed for the creation of larger public-service oriented businesses through expansion and conglomeration. These newer, more nimble digital service providers, found themselves in a strong position to guide the further development of public service provision, and prepared the EU-based, digital governance private sector to address a growing global market. These companies' previous experiences in addressing niche public service areas enabled an approach to product development that was more applicable to this global market than the one-size-fits-all approach that GAFAM companies had adopted. This strong position in providing digital governance design and systems, in combination with the increasingly strong EU industrial landscape, enables EU-based companies to work together profitably.

Despite these successes, there are worrying signs within the EU and around the world, that not all is right in the year 2040. At a planetary scale, the complex network of ecologies we call our global **environment is still suffering**. The EU's **economic growth has been sustained by strong, continuous consumer-based exchange** that is resource intensive, wasteful, and ecologically damaging. The Covid-19 pandemic reinforced damaging consumption patterns, e.g. by promoting single use of plastics and excessive packaging, and demonstrating the profitable nature of the behaviours digital commerce enables. The geopolitical landscape has become far **more competitive** with tensions flaring between long held rivalries, further complicated by new constellations of developing nations emerging as resource management coalitions. Within the EU, the development of the digital economy has not been fully aligned with the Green Deal of the 2020s, nor has it addressed the full spectrum of social inequalities, as was once hoped. Value-based societal divisions remain quite powerful socio-political drivers, and have even resulted in the withdrawal of more States from the Union.

EU 2040

The advanced digital and industrial economic sectors of the EU now stand as peers of their US and China counterparts, with **numerous multi-national companies** having grown in the the wake of European green and digital transition the twin pillar initiatives of the early 2020s. EU-based companies are market leaders across many major industrial sectors, and are considered global

innovators of digitalisation and automation processes across numerous R&I fields. Given that private institutions are also the leading financial supporters of R&I funding, they exert enormous influence over the Union's agenda setting and related policy. EU-based companies continue to enjoy their popular reputation as important actors in saving the EU during the pandemic, and in building the EU's return to economic parity with the US and China. In turn, these companies make small, strategic public investments to maintain and exploit this image. Even though the quality of services and infrastructures is not the same for everyone, and purchasing power of individual groups largely determines the quality of the services citizens have access to, the general public attitude towards the private sector remains quite positive.

In a world of companies shaping the public sphere, corporations can also take more responsibility for research in the EU, a goal that the EU has been pursuing for years. The respective Delphi statement asks for a very high share:

Statement 15 (Delphi survey): **In 2040, multinational corporations are responsible for the vast majority (90%) of the funding, implementation, and management of research in the EU.**

Multinationals responsible for research funding

When asked whether multinational corporations will be responsible for the vast majority (90%) of the funding, implementation and management of research in the EU in 2040, **72% of respondents said this was very unlikely to somewhat likely**, although the question was given **great relevance** (33% expressed very important). The arguments for this assessment do not question the general assumption that multinationals can take over more research funding, but rather relate to the extent of the development: the 90% portion of funding by multinationals is considered exaggerated - especially with regard to the time horizon of 20 years.

The fundamental developments that are currently observed, such as the growth of multinational corporations and their ability to evoke 'winner takes it all' dynamics, are certainly perceived as a risk. The already pervasive presence of global MNOs in education and dependencies built through the use of software and services is acknowledged. The **incentives for MNOs to invest in Blue Sky research and research for societal needs** are perceived as **limited**. Still, there is hope that the EU's regulatory capacities can productively guide MNOs and that future European institutions and structures can provide a counterbalance. If the statement is taken as a given, some experts suspect this will **mean the end of democracy** in Europe.

Private interests hold an influential position across branches of societal governance, having gained critical positions of power and influence across the public service spectrum. Given their integration with public service systems, technology companies have brought their own innovative frameworks to the table for experimental projects in critical and underfunded public sector services. The use of SMEs as spearhead initiatives into each public service venture, enable more dominant EU-based technology leaders to maintain an unsuspecting distance from singular projects while maintaining important voting power within these new public-private structures. The ability of the private sector to nimbly

transfer this 'soft power', shields larger tech interests from antitrust legislation. Thus, the private sector continues to exert a quiet influence across public services, such as internet access, rent and living space, mobility options, education, culture and healthcare, while enjoying broad popular support and few legislative checks.

Private influence in public policies

Given their tremendous economic importance, and popular reputation, **private interests have learned very well how to utilise their position** across the 'public' services to shape policy to safeguard their advantages and promote their future ambitions.

In the scenario, companies increasingly take over state duties and exercise control over the direction of public knowledge creation efforts.

Statement 16 (Delphi survey): **In 2040, global corporations have captured governments, and channel important parts of public research and innovation budgets towards purposes that serve the interests of multinational companies.**

Multinationals captured governments

44% of the Delphi survey respondents think this future development is **very important**, compared to 5% saying it is not important. The likelihood that global corporations will capture governments is rated **high at 31%, with 13% rating it even very high**, while at the same time 9% think it is not likely. The argumentative results show a polarising assessment. Many respondents state, that the development in this direction has already begun and that in the future, global corporations will have the power to govern research and promote their interests.

But there are also **clear doubts**: Some expect that other stakeholders (SMEs, NGOs, etc.) will reshape the development, e.g. the Flagship R&I project 'Europe' – attractive, decentralised but connected and competitive AI platforms for commerce and communication and a Universal Basic Income to strengthen MS, democracy and sustainability on a global scale. Others stress that global corporations are driven by market forces and customer demands, and a few see **EU cohesion as a competitive advantage over multinational corporations**. A strong future vision of unfettered research without specific applied goals, supported by a civil society with culture, education, and the ambition to understand, will most likely continue to be funded through a non-market mechanism.

This situation has allowed EU-based companies to maintain **favourable regulatory conditions and a low tax burden for operations within the Union**. It has also enabled the shaping of public procurement policy, limiting competition and ensuring that public funding continues to flow to the private sector in a pre-ordained manner. This includes the role of the private sector across publicly funded R&I activities, where they play both agenda-setting and primary beneficiary roles.

It also enables the private sector to utilise public governance institutions as a buffer for any service shortcomings that threaten to unravel the perception that EU-based big tech serves the public good. Since EU states are beholden to the technological systems developed by the private sector, and these companies outsised influence on economic factors, the political sphere is where public criticism goes to be put to rest.

Across state and EU-level governance layers, the **Union's home-grown economic giants have taken up a strong role in shaping policy that serves public (and private) interests.** In order to maintain the EU's economic position, EU policy-makers have been hesitant to take up any positions that would cause harm to EU-based multinationals or the SME network that enables their profit-seeking activities across important public services.

Daily life and work in the new EU

Urbanisation has continued unabated across the EU, driven in part by the advanced digital infrastructure (publicly funded, but privately controlled) across the continent's network of 'smart cities.' For the most part, this urban network consists of pre-existing metropolitan areas that have been retrofitted with the necessary technologies for zettabyte connectivity speeds to support numerous layers of data collecting sensors, data sharing across infrastructure layers, and edge computing orchestration.

However, **'smart cities' remain unequally distributed across the EU,** and not all urban areas have seen the infrastructure investments to make them competitive locations for the EU's technology sector. As automation has continued to advance across industries, and remote and virtual work modes have become increasingly normalised, when human input is needed, workers are expected to be available - at any day, time, or place.

Most jobs in the EU economy of 2040 are composed of digital task execution, but automation has undermined job security in many occupations, accompanying the declining strength of worker unions across the EU. This situation has made 'net neutrality' and 'equal internet access' points of political friction between citizens and city governments. **Quality of the internet and its various sub-services** is increasingly contingent on socio-economic power and capacity, and some elements of digital culture have become so necessary, that it is considered a **privilege to not go online.**

Stemming from radical changes in work cultures, **new consumption patterns emerge.** There is a vocal minority population that insists on buying locally or regionally, renouncing ownership to a large extent and increasingly making use of sharing services and platforms. While this group remains small as a percentage of the EU citizenry, they remain one of the more cohesive socio-political groups, and consistently 'win' new members when privatised services fail to deliver. At the same time, the range of consumer goods and services is constantly expanding under the pro-business policy environment, with noticeable effects on increasing material resource demands. The hybridised physical/digital need spectrum brought on by new systems amplifies certain inequalities and creates social friction. Furthermore, these developments prolong sustainable transitions to the

detriment of ecological systems, a burden that continues to affect more marginalised communities more strongly.

Community and politics in the Digital Union

With so many aspects of daily life now intricately tied to privately run digital infrastructure, **companies are 'creating the world' for individuals**, sometimes quite literally. The effects of this privatisation gives the private sector influence over determining who and what people see, employment prospects, social rankings, credit ratings and price offers, and various types of public service access. Increasingly, state organisations buy or lease company data to fulfil their public missions: maintain public safety and security, monitor environmental variables, and ensure sustainable economic growth. These information and access asymmetries between business and individuals create highly fragmented and partitioned social conditions.

As all individuals are situated in their personal digital bubble, these bubbles create communities in which citizens do not know, or necessarily care, where they or other members of their community are located. Maintaining digital communities, and status therein, keeps people busy and occupied, so individuals spend little time questioning the systems they are subject to. This increased atomisation of the EU citizenry has created a situation across all EU Member States, in which there are no stable **majorities**, and as a consequence the foundational **principles of democracy are being questioned**. However, new political groupings and business-sponsored coalitions emerge to support specific policies or individual politicians, though the rather temporary nature of these arrangements makes long-term policy-making difficult to support.

Communities are also viewed **as a highly exploitable resource**, with co-creation projects now professionally organised by the private sector. Such initiatives have proved to be a lucrative model for exploiting profitable innovation from inclusive, participatory practices. For relatively low costs, private companies have been able to monetise numerous community developed designs, products, and services. Given the fractured nature of the social landscape, and the SME model through which many of these 'engagements' take place, there are very few instances of communities realising that their co-created efforts are fuelling private profits.

Persistent inequalities and service shortfalls

Despite the many public 'goods' that EU-based companies can point to from the **new public-private service model** that has emerged, inequalities persist in many parts of society and not everyone is able to participate in social activities or profit from services. In the health sector in particular, digital technologies have contributed to the reinforcement of two-tier medicine that favours those who can buy personalised health services. In parallel, large technology-oriented companies expanded their digital infrastructures, thereby significantly disrupting established power relations in the development, construction and use of public infrastructures: henceforth, responsibility for the infrastructures of our society was tied to the successful cooperation of public authorities, public companies, and private providers of public infrastructures and services. Whether

governments and big tech companies will work together to reduce the unbalanced societal burden and narrow the social gap, remains highly questionable.

In 2040, the young people of 2020 are adults. They have grown up learning to adapt fast to any changes and know how to access information and how to learn new skills. As the public sector struggles with budgetary constraints across Europe, students have adapted - creating their own educational path while mastering various techniques through new instructional media. While the state is still responsible for primary education, **high-quality vocational services provided by large technology companies compensate for the relative lack (or lack of quality) in public education.** Individualised solutions and freedom of choice prevail in the sector of professional education, with courses offered online and offline, and students expected to build their own curriculum. The increased flexibility and privatisation of the education system is appreciated by talent hungry companies, but it has **widened social divides.**

Given that this is a scenario of massive privatisation and growth in the importance of corporations in society, we speculated that companies may also completely take over education systems.

Statement 17 (Delphi survey): **In 2040, education is entirely in private hands, training students for the requirements of work in their client industries.**

Education as a business

This future-related statement was considered less likely than others to occur (very low to moderate likelihood comprised 91% of the assessments) and it ranked low in importance (72% ticked 'no' to 'medium' importance). Some respondents noted that public education might head in another direction in 20 years - redesigned to serve the scope of a fully automated economy and a jobless society or influenced by the significant part of education in private hands. Future developments in education entail visions of a **more inclusive education** with contributions of **different institutions and stakeholders** profiting from social technologies, e.g. MOOCs, education as a common good under the SDGs, non-targeted education based on scientific research or free/at-responsible-cost public education to ensure opportunities for the needed mass of talents and social cohesion. **Sufficient differentiation** is demanded for the future of education: Basic education is likely to remain in public hands, because of the fundamental social need for universal access, whilst, for some, higher education as well as vocational training could be offered predominantly by private institutions.

Solidarity and health system

Privatisation has changed the health system, with an **emphasis on efficiency** brought in by company management thinking, and a new view of healthcare as an epicentre for various types of technological development. Disruptive innovations from the private/public service model - like real-time detection, big data for health monitoring, and AI advising on diagnostics and treatment decision-making - cascaded through national healthcare systems and care provision praxis. Small, efficient health centres, managed and staffed in collaboration with various types of R&I focused SMEs, profit from testing new

medical techniques and technologies as part of co-creative corporate ethos. AI and machine learning play an increasing role in (tele-) medical decision-making, diagnostics, treatment plans, and cure development.

In parallel with these systemic changes, across the EU, people are expected to pay directly and upfront for the treatment of their illness, fuelling a new health paradigm of personal responsibility, prevention, and self-care. On the one hand, this practice leads to a new social responsiveness to health and wellness behaviours - encouraging the broad use of affordable test-at-home kits for all types of monitoring. On the other hand, self-care and habitual health monitoring become an indicator of social status. Personalised medicine with sensors, markers and AI for monitoring are available, but costly. Meanwhile, more vulnerable communities remain susceptible to easily treatable conditions. As a result, **the health divide has increased**, solidarity and empathy among citizens is decreasing.

Global politics

In 2040, Europe, the **US and China remain the strongest economic regions** of the world and each of these powers seeks to gain or maintain influence over the more youthful and resource-rich areas across the developing world. However, India's economic progress, democratic underpinning, and youthful demographics, make it a strong competitor across SE Asia for partnerships with its robust security forces providing a useful hedge against Chinese aggression. The US continues to maintain a global presence with its military, though it has strategically withdrawn personnel, equipment and operations from areas across central and SE Asia, relying instead on compacts with Australia and friendly nations in the Middle East.

As climate change, migration, and resource conflicts continue to grow more severe, attempts by the **EU to form a pragmatic alliance with China** for the purposes of addressing 'global problems' continue to be fruitless. Advocates within the EU view such a development as an opportunity for the EU to be more influential through regulation, whereas opponents view such alliances with distrust and alarm. Sub-Saharan African nations remain open to overtures from the EU, but maintain an accommodating stance towards US and Chinese interests as well, hedging their allegiance to any single power, given the regions relatively underdeveloped status.

Climate change and food insecurities

The EU economy of 2040 remains wedded to unsustainable activities, despite the many attempts to merge economic development with environmental protections and climate mitigation policies. The strength of the EU's industrial innovation and technology economy has encouraged further exploitation of the Earth's material resources, though much of these resources are sourced from outside the EU. Despite some advances in recycling technology and reusability, the continuing economic competition between the EU, US, and China has resulted in an overall expansion of various extractive activities.

In some regions – mainly outside of Europe - species extinction has been rapid, and critical ecosystems have failed to adjust to climate change. These developments have had huge impacts on the natural surroundings of human beings, food production, soil health, and further warming in sensitive ecologies. Though these developments have their biggest impact outside of Europe, our dependence on foreign livestock and biodiversity **brings these ecological issues back** to our market prices and dinner tables. All three of the global economic powers exceed the planetary boundaries with respect to annual consumption, and 90% of the global population still views the lifestyle afforded within these advanced economies as the aspirational future. These behaviours have resulted in recognition that ecosystem-tipping-points have been passed, and that a choir of short-, medium-, and long-term destructive implications for various ecologies is unfolding.

With large companies dominating the Europe of 2040, critical ecosystems around the world are in danger and 'natural' ecosystems are increasingly losing integrity and function. **Increased demand for energy and technology accelerates the trend** by incentivising destructive exploration and extraction practices. Furthermore, the energy demands spurred by the EU's advances in a more integrated digital industrial base have far outstripped the energy saved through efficiency and the ability of renewable energy sources to make up for the gap. While advances in emissions control and capture have been implemented widely across the EU, the same cannot be said for other advanced or developing economies. As a result, the effects of climate change continue to grow in strength and number around the world and inside of the EU.

Despite the technical and economic development in the EU, many regions remain susceptible to nutritional deficits given food market disruptions around the world driven by climate change. While the EU has instituted some buffers between its internal food supply and the global markets, the **long-term supply of food remains uncertain** in many regions. While EU-based bioengineering and advanced agriculture companies continue to work on new farming practices, food production methods, and numerous trade chains interventions, there remains problems with scaling and distributing these innovations. Multilateral efforts towards EU food resilience are taking effect, and **agriculture in general has improved**, providing populations in Europe with access to high quality nutrition.

The **rise of innovative agriculture start-ups**, and the increased uncertainty regarding water availability in the EU, has driven many European countries to transition away from meat to plant-based agriculture. Precision agriculture technologies are co-developed with farmers, scientists, technology companies, interested citizens and conservation organisations to support the regeneration and robustness of important habitats and reverse trends towards species extinction. While patents that emerge from such collaborations remain with the private sector, they are often licensed to communities with similar environmental conditions to promote technology adoption. This only partially resolves the problems of **disparity between urban and rural areas**, and environmentally-focused social fissures that are emerging.

Managing crisis and transitions with innovation?

Innovation is increasingly taking place in SMEs, which find high-value business opportunities by specialising in the commercialisation of R&I via intellectual protection rights, namely patenting and licencing. These trends coincide with an increase in diverse collaborative arrangements with large corporations, for instance, in sectors such as pharma, IT and machinery. Many SMEs provide innovative high-quality solutions and products that are purchased and distributed by large EU-based corporate structures, or by EU or state procurement processes. Product and service profits are particularly high during crisis situations, as demonstrated during the Covid-19 and Covid-25 pandemics, because of the EU's codified emergency funding distribution. Lessons learned from managing previous crises has created **new permanent practices for government institutions to make purchases or commit R&I funding** in a streamlined process that includes private sector actors. For instance, entrepreneurial committees for operational crisis governance consist of a mix of existing elected officials and nominated responsible leaders from global companies.

Behind the majority of SME's, one or more larger EU-based companies provides critical funding through contracts or research projects. The private sector guides both the EU's R&I agenda from a policy level leveraging its influence as service provider and its popular public image, and at the operational level by utilising its stakes and interests in the SME ecologies that take on the majority of R&I risk. Funded primarily through private sector partnerships, research at academic institutions is essentially a training apparatus for future private sector labour needs.

Circular trials and real-life errors

- circular economy
- a further acceleration of the consumption of products and resources
- Europe is on a 'green path'
- values changed, 'European values' of 2020 forgotten
- emphasis on national self-sufficiency
- New and safe modes of interaction at the work place
- some critical ecosystems have already been lost
- Access to the internet is a means of power and still unequally distributed
- bubbles create communities




Figure 7 - Circular trials and real-life errors

During the Covid-19 pandemics, resource availability became a sudden and widespread concern. Material inputs, even those previously considered boringly reliable, became sporadically available, sometimes with costly delays. Everything from food to microchips and paper to aluminium, saw value chains broken or disrupted for extended periods. Some chains could not be re-established when the companies who provided the service or production went bankrupt. Other supply chain logistics were deeply effected by natural disasters, trade route interruptions, port delays, and the unavailability of containers due to trade disparities.

This was the time, when people and policy-makers became aware of the limits of resources on the planet (again), and the concept of a **circular economy** - living with the material resources in circulation already - gained momentum. The idea of a circular economy goes back decades within policy circles, but it needed a pandemic for the concept to become one of the basic notions underlying **EU policy-making**¹².

The path to 2040

After the Covid-19 pandemics, the European Commission was very successful in launching new policies and programmes to incentivise reduced resource use by a **new kind of economic thinking**. The Green Deal¹³ and the Circular Economy

¹²https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO0560_3/circular-economy-definition-importance-and-benefits and https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573899/EPRS_BRI_%282016%29573899_EN.pdf

¹³https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en; <https://www.europarl.europa.eu/news/en/headlines/priorities/climate->

Action Plan¹⁴ for a cleaner and more competitive Europe, both launched before the crisis, were the important starting points. Since 2022, both were taken seriously, as people noticed the impacts of unreliable resource availability and sudden scarcity, coupled with the fragility of value chains. That is the reason why citizens welcomed the idea of the circular economy, and actors across society were mobilised to fight for the transformations necessary to create a more self sufficient and resilient EU prepared for future crises.

The idea of solving PostCovid-19 problems in the use of resources and energy with a circular economy is based on new policy directions of the European Commission since 2019 and a new movement in European societies.

Statement 20 (Delphi survey): **In 2040, more than 90% of all materials and waste is physically recycled or re-used energetically in the circular economy.**

Circular economy

The Delphi statement of the circular economy is at the core of the scenario. The assessment is in **average a moderate likelihood** with as many people judging on a low and on a high likelihood. That means **some of the participants in the Delphi survey are sceptical** about the realisation, others very optimistic. The sceptics do not doubt the necessity to reduce waste by recycling or energetical reuse, the reasons they give are mainly time- and ambition-related. Many regard the circular economy as something that needs generations to be built up. It needs a policy change - also in R&I policy - and a culture change, according to comments from Delphi participants. Therefore, 2040 is argued to be too early to have it fully evolved. To sum up, the circular economy remains an uncertain matter.

90% recycling and reuse seems too ambitious according to participants. Nevertheless, a circular economy is rated as being very important (by the majority of the respondents) to deal with the limited resources on earth. One argument stresses that the recycling industry needs to be strengthened. Another participant argued that this is only possible in the 'wealthy West' (citation from the Delphi survey), and only in a growth economy - in other regions of the world, it is impossible.

The EU began the transformation of its production and consumption system, with public authorities supporting the circular economy with **strong regulatory,**

[change/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu](https://ec.europa.eu/economy_finance/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu)

¹⁴https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf; <https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits> and <https://www.europarl.europa.eu/news/en/headlines/society/20210128STO96607/how-the-eu-wants-to-achieve-a-circular-economy-by-2050>

financial, and environmental guidance. Complimenting public policy moves **industry adopted practices** rather early in the 2020s, sometimes even driving and shaping public policy to better align to upcoming products, supply chains, and strategic systems. The primary aim of such a circular economic system is to achieve a closed cycle of all matter, adherent to the principle that what is 'waste' in one part of the production chain is the resource for another one.

However, the **circular economy transition has progressed slowly.** Regulatory and financial support was supposed to incentivise research and innovation towards technical solutions, and simultaneously help **build new material networks, create new business models, and foster necessary services** (e.g. expansion of a 'repair-first' economy). All these objectives proved to be more difficult than expected - to measure the effects remains difficult even though new indicators were developed.

Even though people are willing, they often fall back into their old behaviour of just throwing away what can be useful for others. It also needed time to convince people that recycled products are not bad. Each transition phase proved more difficult and costly than had previously been imagined. With each disruption in one of the systems or circles, unforeseen cascading effects added hardship to individuals, businesses, and governments. Now, in 2040, thanks to different policy activities, we have advanced into the direction of a circular economy, but are still far from having closed the loops in production, material usage and in energy provision.

Why Circular Economy?

The circular economy is no complete new economic model but aims to use all resources as much and long as possible and to avoid any waste. The European Parliament defined it as 'an **economic model based inter alia on sharing, leasing, reuse, repair, refurbishment and recycling, in an (almost) closed loop**, which aims to retain the highest utility and value of products, components and materials at all times.¹⁵ The **life cycle of products is drastically extended** aiming to minimise waste. When a product reaches the end of its life, its materials are kept within the economy wherever possible. These can be productively used again and again, thereby creating further value. There is no waste, only secondary and tertiary (raw) material.

But it was a departure from the traditional, linear economic model based on a take-make-consume-throw away pattern¹⁶ that relied on large quantities of cheap, easily accessible materials and energy. The new movement in European societies supported this model and forced policy-makers to **ban throw-away consumption, mining the last resort resources and planned obsolescence**

¹⁵https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573899/EPRS_BRI%282016%29573899_EN.pdf

¹⁶<https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits>

(when a product has been designed to have a limited lifespan to encourage consumers to buy it again).

The environmental and ecological crises around the planet provide strong incentives to drastically limit resource extraction, which in turn provide strong incentives to reuse and recycle waste material.

Statement 19 (Delphi survey): **By 2040, international agreements have drastically reduced non-renewable resource extraction and led to substantial increase in support for research and innovation towards finding substitutes.**

Reduced non-renewable resource extraction

This Delphi statement is regarded as **very important** by the vast majority of respondents, the **likelihood is high to very high**, and only a few participants say low or very low. Many participants of the Delphi survey think that 2040 is too early for it to be realised. Some **doubt that the international agreements will be successful enough**. ('International agreements are vulnerable if one of the major powers disapproves ... With responsible leadership, international agreements have a chance of surviving ...' - citations). In this case, we might need new agreements, even forbidding some extractions. Scepticism ranges between 'difficult to arrange' and 'wishful thinking'. This seems to be more than a question of R&I policy but of pure diplomacy, foreign affairs and an international R&I policy coordination.

Regional or global circles?

Today in 2040, **closed loops of the circular economy are often rather regional** (to save transport costs and energy, and because exporting 'waste' to other countries is forbidden), and in Europe, many new facilities have been built up. In case of need for specific resources (rare resources, e.g. for our mobility devices), the circles **remain also global**, but the export of 'waste' to other countries needs a permission and is thus mainly given up. Since 2025, we have to treat our material here in Europe. However, we are still far away from closing the loops.

Energy costs, efforts in collaboration and coordination make all actors in the circle reflect carefully how they use materials and energy. They are very creative in this - and new research and innovation focus on solving practical problems - from the recycling of composed material to substituting missing resources or developing new production processes and chains. Digital technologies and platforms for exchange are standard in daily life and keep the logistics running.

Preparedness for ...

Did we learn enough from the dirty and dark 2020s? Are we prepared for the next crisis? Leadership and the entrepreneurial state were seen as elements of a new culture of preparedness, but that was an illusion. The system was never coherent so that the leaders, state institutions and companies were never able to exploit their abilities. At EU level, some measures were taken to balance the investment differences between regions and Member States, and to ensure a more coherent

crisis response system across Europe. National systems started to adapt to Open Science models, and to cultivating the responsibility and competence in political leadership, which is crucial for managing crises successfully. Spurred by a string of crises, constitutional mechanisms have been introduced to activate special crisis governance institutions in a relatively transparent manner. A newly established institution - **EU committee of 'wise persons'** - consisting of a mix of existing elected officials and nominated responsible leaders, and randomly selected citizens can be called upon to declare a crisis if signals turn critical. Only this committee can activate an operational crisis government.

In a world that takes seriously the idea of leaving resources for the next generations and the problems of environmental damage, would we be prepared to engineer living elements of the natural environment?

Statement 21 (Delphi survey): **In 2040, research and innovation in genetic engineering in the EU is used for reversing damages caused by the loss of biodiversity.**

Reverse damages in biodiversity with genetic engineering

Responses to the statement were polarised. It got similar ratings for low/very low and high/very high likelihood. Yet most respondents found it very important. 'Biodiversity is part of well-being on earth.' was one of the arguments. But it is also discussed what 'progress' means in this case. Is it a progress to solve a problem by high technology (genetic engineering) instead of low-tech (breeding) approaches in combination with other means? 'The world is too complex to understand.' and human beings are 'playing God' are some other remarks, here. The **missing lobby for biodiversity** is mentioned in the survey, too.

Some participants doubt that genetic engineering is the right approach or that the loss of biodiversity is reversible at all, even though it includes much R&I, evaluation and assessment. Others see it as a solution and even a 'must-have' in agriculture ('genetic engineering is necessary for agriculture and sustainable plants. It is also necessary for curing diseases.'). Some Delphi participants hint to the **scientific difficulties** or pointed out that the statement is just naive to think genetic engineering will be a solution at all. Others mention the political aspects: 'Genetic engineering is not well received in public.' or more drastic 'EU policymakers and public are allergic to genetic engineering'. **If genetic engineering is applied, it needs to go 'hand in hand with the developments in the EU legislation on GMOs and GM food'**.

A series of disasters (environmental, natural, economic, and geopolitical) have Europeans continuously fighting against destabilising situations while attempting a dramatic socio-economic transformation. While the EU officially acknowledges **nature's intrinsic value, and has vowed to protect it**, individual nations and communities constantly challenge these principles. Ecological conservation efforts are more prevalent in the EU, while other nations have taken different approaches to dealing with climate change effects. Coordination, cooperation and management on the global level still require rigor, and leave room for improvement, but attempts to create international coordinating agencies (e.g. Global Environmental Agency) demonstrate that humans retain hope.

The question is, whether the efforts succeed in time. Already some **critical ecosystems have been lost**, even as the species extinction rate has been reduced. Ecosystems that are necessary for the survival of human beings struggle to adjust in pace with climate change. The impacts of climate change are evident in our natural surroundings, food production, soil health, our forests and further warming in fragile ecosystems. Of course, many species were saved, especially livestock and plants used in agriculture, those that were necessary to close food circles or other cycles in the bioeconomy or in industry, but many heritage strains of life have gone extinct and regeneration has proven to be a difficult task. We have to adapt to the reduction in genetic diversity and exhausted arable land and find new ways to safeguard essential ecologies under pressure.

Societal support for a sustainable, circular economy needs a mind-shift

It is **difficult to overcome traditions and culture** for shifting behaviours and creating a more resource-caring way of living. People needed time, and possibly still need generations to change the general mind-set towards 'circular thinking', to be aware what can be thrown away and what is a resource for others. They always need reminders for this. Economic thinking also changed towards a new balance: on the one hand profit-seeking in circular practices and on the other hand in sharing or giving away instead of pure economic profit generation. It also changed in accepting mistakes, the fault tolerance increased.

It took time to change the agricultural sector back to a circular business, away from planting monocultures, to more diversity and new ways of cultivating land. Luckily, due to climate change, many farmers in Europe harvest some grains twice a year. As we had to diversify plants and livestock in agriculture to create new loops, our European **food selection is more varied** than ever before, given that the practices of regionalised agriculture and more sustainable agro-ecologies thrive via polyculture farming practice. The longest periods of time for change need agro-forestry and establishing new multi-species orchards. People learned from the 2020 pandemic that local food helps if supply chains are broken, and they are ready to pay a premium for food security and to support their local economies. Where they can afford to, **consumers ask for quality and demand trust in what they eat**. Here in Europe, the quantity of food is no problem, but the quality and the nutritional share remain a challenge. A social shift towards **healthy diets** with mixed foods is supported by politics. Learning about healthy diets is integrated with the education curriculum, local lifestyle promotion, and economic incentives.

While some claim that the **circular economy is window dressing** for a dated sustainability discourse, Europeans continue to work towards the creation of a more internally resilient and ecologically sensible social organisation. While changing consumption patterns has been a delicate and frustrating process for many people used to get what they want immediately and without thinking about any effects beneath the short-term needs satisfaction, the current generation of decision-makers grew up striking and standing with their schoolmates in solidarity with an endangered planetary ecology - vowing to fight for a different point of view. They share the values with the aim of saving the future of humankind on this planet. Protecting the resources of the earth for them means human security.

Companies redefine themselves

Mining for new resources is strongly regulated in the European Union and most countries of the world, so we have to live with what is available. Strong **emission restrictions and penalties** have **incentivised a number of industries to innovate for survival**, and a number of clever and nimble companies have stepped in to assist, or replace aging industrial giants. Research and development, new technologies - especially in materials, chemicals, energy-efficient production processes and recycling technologies - and innovation in business models or social innovation, each play their role in this latent attempt to establish the circular economy as the central tenet of the EU economy.

Despite the challenges of building and maintaining a cascading circular supply chain, some industries have taken the challenge head on, and been rewarded for their innovative efforts. 'Economic efficiency' has taken on new connotations within circular economies, with **a focus on making chains resilient**, and **raising the quality of products and services** to include more players in the markets, to provide many jobs, and to play on a level field, small and medium-sized companies hand in hand. In emergent circular economies, **adaptivity to find new customers and flexibility** to react to offers or changing circumstances are more important principles than efficiency and lean production process optimisation. Small family companies thus have an advantage - they acted this way for a long time, already, as they do not have to hire and fire but take on their own responsibilities.

To keep the economy running circularly, new services are offered by **SMEs - services** that bring different partners together, promote circular thinking, and provide digital services (craft production, Do-it-yourself repair, support for the 'right to repair' etc.) to remain more sustainable. SMEs are the intermediaries in the system; they keep it running and have an important facilitating function. In the last 20 years, a new corporatist model with a new innovation eco-system developed, fostering those with creative new ideas, flexibility and working with what is available. Others are the brokers in the system - between companies and the new consumers. Some entrepreneurs and smaller companies offer cultural services, though it took many years for the creative 'industry' to come back after suffering in the 2020s. **Actor coordination, network maintenance, and operational management** are all essential components of a circular economy, as the logistics to handle material and energy have to run fast, flexibly and always different for the different materials.

The development of **new, often simple products** that can fully be recycled is supported by R&I. Industry tries to use a limited number of materials or components in their products. They consider it from the beginning already. Composites that are fixed and cannot be recycled are forbidden since the 2030s, and companies would not use them. The same for many of the advanced technology of the former 'high tech' category (e.g. complex production machines, vehicles, household appliances). Some of them were less usable in real situations like heat or dust, or impractical for everyday use. Simple but high quality materials from recycling are still booming. More and more uncomplicated technology and simple tools ('3 buttons are enough principle') are offered. People dare to reuse products without losing their social status, it is fashionable to utilise

reusable or recyclable materials, often made from natural resources (wood, plant-based etc.), further driving areas of the rising bioeconomy.

People find their living - somehow

It was helpful that since 2025, **all products must be repairable as per EU regulations**. These regulations created jobs that, while not well paying, enabled people to make a living fixing all types of consumer products, and reducing many types of waste in the process. The rising incomes and wealth in the 2030s - at least in some European countries - brought some stability, but not more 'equality' for all, neither in income nor in gender equality. In fact, the persistent income and wealth disparities that are found across the EU have caused the small sums of public funding to focus on improving lagging infrastructure to relatively impoverished areas, and the wages of workers were increased while wealth taxes increased. There were some improvements in general social attitudes regarding gender roles that reflected the lived realities of women across the EU.

There are still some experiments with new policies to address 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. However, while these policies were necessary in the 2020s in reaction to the pandemic and the ensuing economic crises, they immediately came under fire as economic conditions began to improve in the 2030s. Despite the overwhelming scientific evidence that net returns from social assistance programs were clearly positive, these measures were targeted for repeal and most have been crippled by withdrawn funding.

Is urban living more efficient?

In 2040, Europe has a scattered landscape with nice rural regions, small villages, and many medium-sized cities that complement the few large metropolitan areas.

Statement 6 (Delphi survey): **In 2040, urban areas remain attractors for talent and hotspots of research and innovation.**

Urban areas attractive

See also scenario **Back to 'normal'**: urbanisation continues as people value social interactions, convenient access to services, and proximity of diverse cultures and talent pools that cities offer. The statement was viewed by survey participants as having overwhelmingly high or very high likelihood. However, many experts viewed urbanisation as a long-running, historical trend, while others highlighted the efficiencies of cities.

For a majority of the population, **smart cities remain attractive**, as urban living and its conveniences (proximity to culture, facilities, and superior amenities) are preferable to a life in countryside. Collecting remainders (former 'waste') is more efficient - but transport to the recycling facilities or of food to the cities and bringing the remainders back is still inefficient. Cities adapted to the Covid-19 pandemic quickly, and prepared the way for safer, cleaner, and more sustainable forms of transport, and the establishment of new social norms (distancing, sanitation, hygiene). Old cities and villages

have been undergoing redesign and refurbishing with infrastructure to serve the 21st century. The continents aging population doesn't retain as much zeal for extended commuting times or even for global voyaging as it once did, but immigrants drawn to the European values and circular economy experiment keep the population stable and vibrant. As such, relatively quiet and convenient urban lifestyles define the desires for most Europeans.

Hopes fulfilled?

The efforts to move towards a service-based circular economy have led to **a further acceleration of the consumption of products and (re-used) resources** rather than to a gradual decrease, which was the initial hope. Even with some success in closing material resource cycles, other loops remain broken, or undermined by people's behaviour or profit-seeking attitudes. The success of the circular economy is relative, and there are many improvements to be made in order to meet all targets and goals. The EU remains on a path towards limiting the consumption of resources in a circular economy with less and less environmental impact, but now recognises that **these transitions are slow**, and that **citizen buy in and support must be cultivated. To build up a system that is sustainable, needs a long time and persistence. Maybe fully running in 2050?**



Figure 8 - Green Utopia new hope

In the year 2040, citizens, private companies, and national governments across the EU have established a set of mutually beneficial social, economic, and ecological values - societal principles that promote and incentivise sustainable living patterns and climate change mitigation. This ecologically focused **social movement** cuts across traditional political party lines, resulting in consistent political pressures that have turned policy-making and private sector activities into powerful instruments towards the creation of a more 'green' society. The EU and its Member States, having embraced and encouraged citizen participation in a green transition, are strong leaders in the global push to address the drivers and impacts of climate change.

European nations have led the way with respect to re-engineering their economic engine - diversifying accounting metrics to integrate environmental, social, and governance metrics in economic health assessments, and adopting a strict approach to enforcing penalties on companies that participate in detrimental behaviour. While some outside critics have argued that the EU has created a mode of 'benevolent eco-authoritarianism', across the Union's Member States people have taken up 'sufficiency' and 'quality' as guiding principles with little tolerance for private sector activities that seem to undermine them. Citizen participation is highly valued both as a mode of distributed monitoring and enforcement, and for the necessary innovating and promoting of more sustainable behaviours, businesses, technologies, and governance process that make this new society possible.

Towards green values: The path to a Green 2040

Societal turmoils set off by the Covid-19 pandemic - increasing inequalities in wealth and in access to reliable social services, growing anger over failure to address climate change - became pivotal in the emergence of a new social movement for a more equitable society. Working in tandem, citizens and

companies were and are the driving forces behind this change in fundamental societal values emphasising a) environmental and social sustainability, b) the acknowledgement of the intrinsic value of nature, and c) a new morality with strict rules and ethical considerations for environmental damages and social inequalities. This increased new social pressure on politicians and governing institutions to develop a new path with ecological and fiscal considerations at the forefront. European activities around the year 2020 generated many tangible effects, especially the European Green Deal, Farm to Fork and Circular Economy strategies.

The Covid-19 crisis made systemic resilience a topic of conversation across governments, companies, organisations, and communities, and pointed to the need for strong, perhaps painful, transformations needed to better withstand the next crisis. The continent's healthcare systems, for example, had been under stress long before the Covid-19 crisis, with personnel capacities scarce and expensive, and jobs viewed as under-compensated, exhausting, and dangerous. This changed during the 2020s in response to the ongoing pandemic, with the creation of **new care jobs with high salaries**, and regulation limiting working hours in healthcare systems, and mandating robust compensation packages for accidental injury or death. It took years, but governments and industries continued to build up resilience and crisis management capabilities. It would not have been possible without the recognition that responsible, competent, and trusted political leadership are crucial for managing crises successfully.

Trust in democratic institutions was undermined during the pandemics of the 2020s, with severe consequences for political systems. **A new generation of political leaders**, having been embraced by the new societal movement, have developed new ways of policy-making and governance. Their political power and prowess have only increased, as successive policies in the late 2020s led to tangible improvements in everyday life, community well-being, and the environment. The eco-movement cuts across traditional party and society lines, and new ad hoc coalitions emerge that do not fit into the established categories. Members of these coalitions are passionate about their political battles. Traditional political parties do not play any active role under these new modes of organising or the direct modes of participation in societal governance.

As a result, a **more equal and united society** emerged in the late 2020s. Gender role attitudes were gradually adapted to lived realities, and 'essential worker' wages smoothly went up while wealth taxes increased. Public funding focused on improving lagging infrastructure - digital, mobility, and public space - in an environmentally friendly manner, with an emphasis on prioritising impoverished areas and rural communities. Social solidarity has proven to be more than a buzz word. In response to inequities laid bare by the pandemic - access to healthcare, vaccinations, income, opportunities - new communities emerged during the pandemic. Supporting others and building solidarity and empathy among citizens, politicians, and companies, these communities continued to increase in size and popularity even after initial inequalities were addressed. Membership in one or more mutual aid community became a sort of egalitarian status symbol, making possible a more dramatic shift in the formation of societal values, and their manifestation in policy and action.

Societal change was pervasive in cities, suburban areas, and the countryside, and ubiquitous lifestyle changes shaped the emergence of new social norms, behaviours, and expectations. Tangible manifestations of a 'greening society' could be seen as readily in urban settings as in rural communities, creating an underlying sense of unity and social momentum behind the ecological shift. Strong regional **municipalism**, combined with **open-science models** were a successful approach as they combined the best available science with localised knowledge into regional specific practice. Regions within the EU act much more independently, while adhering to EU standards, and create their own R&I 'circles.' As knowledge is shared across these regional networks, in innovation and in science, new systems are built up to address localised needs, even as the European Commission remains the primary source of funding.

To compensate for the decline in private R&I investments caused by the Covid-19 crisis at the beginning of the 2020s, some countries prioritised public funding for R&I. At EU level, measures were taken to balance the investment differences between regions and Member States, and to ensure a more coherent R&I landscape across Europe. A well-endowed common European fund was established to invest in small R&I companies, drawing from both public and private contributors. This fund led initial investments at the beginning of the 2020s, with hundreds of billions of Euros boosting sectors essential to the 'green' shift. This initiative created new companies and facilitated innovation networks, created links between old and new technologies to enable the sustainable transition, and thus boosted demand for employees in these fields. In R&I fields, sustainable frugality - the idea of finding simple and renewable solutions to problems - became a guiding conceptual platform, particularly in light of the environmentally driven problems that aggravated in the 2030s, e.g. droughts or floods caused by climate change are part of our 'normal'.

The Covid-19 crisis has been one of the factors triggering a rethinking of the **ways we consume**, but we also know much more about our consumption (and its consequences) than in the past, including the recognition that prior consumption patterns exceeded planetary boundaries. After the 2020 pandemic induced panic buying and unveiled nutritional inequalities, the complex issue of food was given more attention. **Availability, affordability and sufficient quality of food for all** was an important and overwhelmingly popular social and political priority, especially between 2025 and 2035. People learned from the 2020 pandemic that local food sources are important if supply chains are broken, and consumers who can afford it are happy to pay a premium for locally sourced food to ensure its availability in times of crisis.

Lastly, the Covid-19 crisis catapulted Europe into a dynamic new digital age with digital learning and agile working. First, the widespread shift to working from home began establishing new relationships between employers and employees. Concurrently, automation, spurred by the pandemic, was introduced across most major industrial sectors, with machines replacing most forms of standard manual labour.

Getting prepared for managing crises

The Covid-19 crisis has made systemic resilience a topic of conversation across governments, companies, organisations, and communities, requiring important and painful transformations. Responsibility and competence in political leadership were recognised as crucial for managing crises successfully. It took years, but governments built up emergency and crisis management capabilities in Europe, and globally we are better prepared for next crises.

Governments learned that prospective management strategies are crucial for containing crisis-induced economic and societal consequences. National governments and citizens alike expect joint European efforts to respond to emergent crises, as no one desires to relive the very heterogeneous crisis response that the Covid-19 pandemic initially provoked. Training for stronger coordinated and collaborative responses is an important component of Member States and EU preparedness.

Towards green values

After some societal turmoils following the Covid-19 pandemic, the rising inequalities in society were a major issue for policy-making. A movement for a more equitable society emerged in the late 2020s, and many regulatory and small practical steps were taken to fight rising poverty and introduce more equal incomes. Citizens and companies are the driving forces behind this change in values towards more environmental and social sustainability, the acknowledgement of the intrinsic value of nature, a new morality with strict rules and ethical considerations in terms of environmental damages, and inequality. They are supporting 'green values' in this strong societal movement. Thus, due to the new social pressure, policy-making and the private sector have turned towards a strong green track: ecological and fiscal (public budgeting) considerations are both in the forefront.

European activities around the year 2020 generated many tangible effects, especially the European Green Deal, Farm to Fork and Circular Economy strategies. Since then, Europe has been on a fast track to sustainability, and the values driving this transformation are widely shared. People support the new rules with small shifts in personal behaviour (e.g. recycling, minimise waste, use of not carbon emitting forms of transport), businesses are incentivised to make all operations ecologically responsible, and religious groups and social organisations support these developments and join forces with political green parties.

Economic paradigm change

The ambitious sustainability goals could only be achieved through **tough regulatory measures** demanded for by the people, including fiscal policies, resource-linked taxes, and changes in life styles everywhere. Economic growth is no longer the overriding goal of policy agendas. We saw a paradigm shift, and instead of using GDP as the main indicator for the success of economic policies, socio-ecological indicators are used to measure the progress towards SDGs, including the goal of reducing harmful emissions and counting species for their

preservation. Just as the Covid-19 restrictions for containing the epidemic put health above economy, today the EU and Member State governments, supported by society, rank safeguarding essential ecologies above economic growth.

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Despite 'Green successes', climate change is still a huge threat and research and innovation about climate change are still high on the agenda in the future.

Statement 9 (Delphi survey): **Research and innovation about climate change are still funding priorities in 2040.**

R&I funding against climate change

The majority of respondents assessed this statement as of **high or very high likelihood and as important to very important**. They strongly confirm that research and innovations on climate change will reveal new findings and inventions, thus new problems and solutions will be explored. The need for funding is likely to increase. The strategy needs to be **directed not only towards accumulating more knowledge but even more to find mitigation and adaptation schemes as well as innovations for more climate friendly products and processes**. New transdisciplinary approaches and cooperation between science and practice will **need stimulation**. This change will also need to **include private investors, society and regulatory bodies. Post-climate STI policy needs to transcend traditional 'research establishment'**.

The success of the approach towards a transition will depend on social and economic stability. Ultimate solutions will not come from tech science alone. It is very important to conduct **research on options for consumption reduction, circular economies and adequate democratic options**, drawing on the expertise of social sciences research and public participation.

Corporate responsibility is now the expected norm, and corporate failures are not tolerated. Accountability and transparency have become the cornerstones of legitimacy for governing institutions and officials, and new monitoring and reporting mechanisms were put in place.

In the EU there are more and less powerful and economically strong Member States. They are able to coordinate the different EU policies for new ways of producing, transporting and using energy (called '**new energy paths**'), e.g. through emission-free mobility, heating, and production processes. R&I spending is high on the political agenda as it helps to fight climate change, prevent

biodiversity losses and build environmentally friendly technologies and businesses.

Europe in 2040 has a **diverse and vibrant SME landscape** that was under pressure during PostCovid-19 times. Though many SMEs were forced to close or merge, the changes created new strengths and **political incentives and financial support gave impetus for new start-up ecologies to emerge** in the food, health, agriculture and other sectors. Many start-ups from the late 2020's are now stable, established businesses. Though many companies initially hesitated at the start of the 'green track' economy, it gradually became a huge movement with **many ideas for new businesses**. This momentum, including shifting consumer sentiment, forced existing companies to shift to more sustainable practices. Consumers were demanding more quality, trustworthiness and better information about the production chains and conditions. Companies - large and small - supported this movement, having understood that their customers changed. Branding to be 'green' sells - and the digital companies got under pressure by regulation for energy-saving and reducing CO₂ emissions.

The digital transition is an important part of the green transition in the EU, but the energy needs of the digital applications are high and the lack of synchronisation between the digital and green transitions may undermine the realisation of the scenario.

Statement 10 (Delphi survey): **The digital transition has made societies in the EU more sustainable by 2040.**

Digital transition

This Delphi statement is seen as **very important** but of **moderate likelihood** (40% of the participants). There is a strong consensus in the assessments that digitalisation will not automatically lead to more sustainability in the future and some doubt that it is the way towards sustainability. Many Delphi respondents warn **that we do not yet understand the impact of the rebound effects**, and are concerned about the environmental impact of the digital transition. They point out that the digital world may in part even require more energy (e.g. bit coin mining) and new materials that are rare - their excavation should not lead to more societal or environmental problems. Some respondents are even alert that the digital transition in the long run is creating more (sustainability) problems than it is expected to solve (think of the consequences of blackouts if everything depends on electricity and digitalisation). Participants in the survey say that the digital transition has the potential to destabilise societies through negative effects (spread of misinformation, surveillance, ...).

New digital work-world

The work environment shifted from physical to digital settings wherever possible. The Covid-19 crisis catapulted Europe into a dynamic new digital age with digital learning and agile working. Automation has not permeated all spheres of life, and there are still many jobs that require a human touch. While automation is largely co-ordinated and monitored by Artificial Intelligence systems, people are aware that they need to maintain control over AI technologies and utilise them as a tool for a fast journey into a new 'Green

World.' AI-enabled systems contribute to economic or data-driven activities where fast tracking and monitoring are essential, by tracking emissions along a supply chain for instance. **Working hours were reduced to a maximum of 6 hours per day** in the European Union (only very few exceptions are allowed) so that a better distribution of employment and income could be achieved. That partly compensated for job losses due to automated, standardised processes.

Agriculture is the most automation-supported sector with large to small or adaptive, cheap machines widely available to support the hard work of small-scale farming. For example, adaptive, thin exoskeletons allow human operators to carry heavy weights without being a burden for the human skeleton, and enable people beyond 50 years of age to continue working. Many of them like to work outside in the fresher air of 2040. Contrary to 20 years earlier, workers in agriculture and other industries reliant on manual labour are compensated with generous, liveable incomes achieved by fair prices. A new kind of circular bioeconomy - with a focus on reuse, recycling, and upcycling in all fields of the economy - offers plenty of well-paying jobs and enables consumers to purchase higher quality products.

The new necessities for working at home and connecting virtually have led to **establishing guaranteed internet access as a right** (similar to the right of access to water). All citizens in Europe have nearly equal access to internet - in many regions, there are hubs for free internet without costs. In urban, sub-urban or rural areas, digital currencies handle most economic transactions. With the increasing conversion of public transport to autonomous driving and the comprehensive implementation of Industry 4.0 and the Internet of Things (IOT), **the need for high-transmission bandwidth is great**. It has also become a **citizen's right to NOT participate in digital life** by opting out of digital platforms and services.

How did our lifestyle change? Do we really live in Human-Centric Cities?

Cities benefit from network effects and can offer a wide variety of digital services close to green parks. The circular bioeconomy in the countryside is dependent on subsidies, but offers ecological and sustainable lifestyle variations. Cultural and artistic events have become a hallmark of a high quality living, and access to these are guaranteed, regardless of the location you are living in. Some lighthouse regions have achieved the near-total integration of a new kind of circular bioeconomy - sustainable and based on new research knowledge, combining the amenities of urban life with those of the rural life and always treating waste as a resource for others. In other regions, foremost industrial regions reformed their 'brown zones' to reflect and contribute to green goals.

Many European cities have opted to transition towards the '**15 minute city**' - where inhabitants can reach all main infrastructures in 15 minutes by bicycle, on foot, or using public transportation. This is being supported by the migration of many activities for employment, training and education, shopping, and entertainment having to online platforms. Thus, the delivery of goods and services has increased in amount, but within short distances, and intensity of smart and clean transportation has increased offering widespread availability. Those people who have to travel use smart and clean transportation based on

innovations made in EU, from light-weight cargo bikes to e-trikes. Europe has become a global forerunner in introducing ticket-managed tourism innovation and balancing ecological interests with the global passion to experience the classical 'West.' This is accompanied by growth in virtual tourism and complimented by a 'slow' tourism ethos - travelling slowly, enjoying the journey, and exploring smaller, 'unknown' places as opposed to the 'hype' places that are managed by the tourist ticket system.

Curiosity-driven education

In the education sector, policy makers and opinion leaders have come to understand that education institutions are the key to rapid green transition. Ecological education starts early in life and the schools are now, in 2040, equipped for it - with capacities, knowledge and techniques. Improved education systems provide basic instruction and stress curiosity as a positive value. Supported by research, curiosity-driven learning has been widely adopted to bolster creativity, independent thinking, and innovative practices in students.

Personal experiences and individual learning are highly valued under this pedagogy. Education systems are mostly public, but private institutions also exist. All institutions are expected to implement the nationally certified (and EU approved) 'general curriculum' (the basis for further learning). Curricula have undergone quite radical reforms since 2020, utilising innovative pedagogies and focusing on more transdisciplinary teaching outside school buildings and (sustainable) problem solving rather than on fixed canons. Education is not a matter of age as learning institutions in all areas of Europe, also in the less populated ones, offer inter-age curricular and innovative blended learning services online and offline.

Green, greener, greenest...

As EU policy shifted to incentivise sustainable societal developments, 'green' also became the symbolic colour of change for issues involving climate change (counter-measures) metrics, biodiversity and new foods. Planetary boundaries are recognised, and the resilience of ecosystems is a top priority. Measures to avoid planetary tipping points and to adapt to climate change were implemented, but it remains unclear if already damaged ecosystems will be able to recover to the state of the year 2000.

We humans have learned to limit ourselves and to take care of the resources that are available, as our societies move back within the 'safe and just' space of living (as per the 'doughnut' in Raworth's terminology of the 'doughnut economy', Raworth 2017). We Europeans know that we have to take care of both our natural and social environments, and policy measures to remain in a sustainable state are taken. The fast recovery from pandemics and the development of the European Green Deal went hand in hand with the pandemic lockdowns demonstrating that a new way of life is possible. Citizens in the EU as well as companies support this path.

The scenario for 2040 describes a certain model of being a 'sustainable society' or 'green society', which relates to stated EU aspirations for leadership in the Green Transition.

Statement 13 (Delphi survey): **In 2040, the EU is still a world leader in the pursuit of the Sustainable Development Goals (SDGs) with major contributions from its research and innovation programme in achieving this position.**

EU as world leader in pursuit of SDGs

The vast majority of Delphi survey respondents consider this statement as likely, very likely or at least moderate likely. And more than 80% of them think it is important or very important. But some ask why Europe should be the leader and why it is good to be a leader. Some argue that it is more important to have **world-wide activities towards achieving the SDGs**. Whereas the USA and China are often mentioned as other leaders, some doubt that China will fulfil this role or develop fast enough for the role. The **European Union has the goals on the agenda already** - some regard the EU as (currently already) leading because Europe is investing heavily, here - others **question if the measures taken are sufficient**. It also depends on the question of an integrated EU. With more disintegration, there will be less power to focus on the SDGs.

Contribution of research and innovation is 'essential for achievement of SDGs 3, 8, 9 and 10 - for healthy life, vaccines, economic development, sustainable infrastructure and avoiding the inequality' (citation from the Delphi survey).

The EU still struggles to maintain biodiversity in its countries, but utilises a patchwork of 'natural' and 'managed' ecosystems to stabilise overall ecological health. During the last ten years, many species were saved from the brink of extinction. On a positive note, a number of culturally important species - species whose existence serves one or more recognised roles in cultural traditions (from agricultural and industrial practice to social narratives) - have been preserved or recovered technically. Many wild species died out, and only a few of them could be genetically recovered.

R&I supported us in this path ...

It took time to understand how important bees, spiders, and other insects are for our eco- and food systems, and the cultural role some species play in historical narratives and community identity. The road to recovery included strict 'no net loss' policies, and targeted protection and restoration activities, that taken together led to a net increase in 'natural' ecosystem area and integrity.

In such a green world, one would expect a different attitude towards science, research and innovation. Is it still a priority or does 'less' also mean less R&I? To verify if the expectation that STI is still a key for wellbeing in the future, the following Delphi survey was formulated:

Statement 14 (Delphi survey): **In 2040, there is a global consensus that science, research and innovation are the key factors for a sustainable world and human wellbeing, and citizens engage in science and participate in research and innovation projects.**

Global consensus that STI is key

In the Delphi survey, there is a moderate consensus that science, technology and innovation is key (46% of the respondents judge high or very high and 37% moderate likelihood). Nearly 90% of the Delphi survey participants rate the statement as important or very important. But two Delphi respondents question, **if a 'global consensus' is enough** or what it means. They argue that consensus does not necessarily mean activity.

During the pandemic of 2020, citizens turned their eyes to science, listened to scientists. However, citizen involvement in further activities as well as in research activities (e.g. with citizen science) is not only desirable but also necessary to gain the data necessary for research. A **change towards more citizen-involvement and appreciation** as well as a **better understanding of science** is needed.

It is also a question of R&I policy-making that needs to **change 'from single corporate interest to public welfare concerns'**. Public welfare is more important in this view than STI for companies' profit. Another recommendation is to **lead by examples** instead of investing in consensus-building around the globe. Global consensus is not necessary when all companies or states follow an interesting example or a role model.

Applied research then helped us to keep the level of biodiversity: Large numbers of species and genetically diverse ecosystems were saved or restored. This stabilised the species abundance that underpins the complex interconnected ecologies of the natural world. Additionally, Artificial Intelligence applications (combining thousands of gene data, retrieving information from old databases and calculating the right positions for gene edits) help humans with the simulations needed to identify potential candidates worth experimenting on (breeding or genetically re-structuring) more quickly. This saves time and resources, and with improving algorithms the processes are increasingly better.

Our food - healthy and tasty

Food and agriculture are so important that we immediately see effects of disturbances in the system. After the 2020 pandemic induced panic buying and unveiled nutritional inequalities, the complex issue of food was given more attention. **Availability, affordability and sufficient quality of food for all** was an important and overwhelmingly popular social and political priority, especially between 2025 and 2035. Now in 2040, we pay a lot of attention to

food, taste, and healthy diets. **People ask for quality**, having understood that small amounts of high-quality food already cover the need for nutrients so that large quantities (of rather low quality food) are not necessary.

While the Green Transition is very important for this scenario, the scenario group speculated that progress may unfold with different speed in different sectors and areas. In 2040, energy, sustainable mobility and housing may need more time than agriculture and still rely heavily on the R&I agenda.

Statement 8 (Delphi survey): **In 2040, the EU has achieved uneven progress between countryside and urban areas in its 'Green Deal' objectives. In the countryside, the green transition has been achieved in agriculture, whereas in urban areas energy, sustainable mobility and housing are still EU R&I priority.**

Research priorities for green transition

Nearly 80% of the respondents assume a **moderate, high or very high likelihood** of the statement and the overwhelming majority assesses it as **medium to highly important**. However, respondents expressed a lot of scepticism as to whether 20 years of European Green Deal policy will be sufficient to turn the mode of agriculture of 2021 into a sustainable, 'green' one. Respondents identified it as a **crucial policy field for EU and Member State level, for R&I**, and other fields as well. A lot of resistance in urban areas needs to be overcome and people will have to change their habits. The young generation might be more open for this. **This will not stop at technological research but needs to include human sciences, specifically anthropology, sociology and urbanism** so that factors of resistance to changes can be addressed.

As many issues this one is also **dependent on income security and social stability**. Some respondents think that it is more likely that the scenario future will be declared 'green', but it will green in name only (GINO). Yet another question is if a Green Deal agriculture can be achieved evenly across the EU. Regions that are struggling with low living standards will not make the EU Green Deal a priority. It must be ensured that other parts of the world won't pay for our forthcoming (e.g. with regard to waste management).

This shift has led to rising life expectancy in many European countries particularly in combination with other important health behaviour changes. The immune systems of people are better prepared for new challenges - in part because the importance of chronobiology is accounted for in **preventative health guidance**, as reflected in new lifestyles and work patterns. With a more balanced lifestyle and enough sleep, the **condition of mental health in the population has also increased significantly**. Depression and stress-based disorders are on the decrease.

Changes in food production and consumption are central to this scenario.

Statement 12 (Delphi survey): **In the EU of 2040, policy, incentive schemes, and campaigns have created changes in food consumption patterns towards a sustainable society.**

Changes in food consumption

This statement is rated as **likely or very likely by the majority** of Delphi survey respondents as well as **important or very important**. The arguments given vary between 'unimportant hype' and 'signs are obvious' and many participants comment on adaptations of policy and the reactions of consumers: It depends on the question if consumers change their behaviour and consumption patterns. There are remarks that policy is not effective, if **consumption patterns** do not change. **Education and psychological changes** are necessary to support change. Nudging is not sufficient. First signs of changes can be seen, for example, in the **reduction of meat consumption in Europe** (but not elsewhere on earth). The **prices of food** are also an issue of discussion - food is too cheap (compared to other goods) and the price has to rise until 2040 if people working in food production want to make a decent living with producing and eating qualitatively good food. It is stressed, that the issue is not about feeding people in Europe but to feed all people in the world and if possible - with high quality food.

According to a respondent Europe needs to

- 1. regulate the monopoly of agrifood companies,**
- 2. align the reform of the Common Agricultural Policy (CAP) with the Farm to Fork Strategy and biodiversity targets**
- 3. strongly regulate the reduction of the use of pesticides, and support local farmers' ability to make a decent living.**

Regionally sourced food is a priority, and plays an important role in newly composed healthy diets for both home cooked meals and the dining industry. People learned from the 2020 pandemic that local food sources are important if supply chains are broken, and consumers who can afford it are happy to pay a premium for locally sourced food to ensure its availability in times of crisis. In 2040, the **quantity of food across the EU is no problem**, because the quality of food provides a better nutrition score and overall consumption. There is enough food with high quality and a fair price for all - providing decent incomes for the primary producers.

Meat is no longer considered essential to a healthy diet, as new consumption patterns and animal protection are high on the agenda. **It is not forbidden to eat meat**, but policies (and prices) consider the effects of meat production agriculture on water, land, and air in a more informed way, and culturally, people frown upon meat consumption. This shift affected trade chains, agriculture in general, and the potential for both high quality and quantity nutrition for most of the populations in Europe and the world. Countries with livestock production have changed to plant-based agriculture and offer artificial meats.

Getting to grips with our consumerism

The Covid-19 crisis has been one of the factors triggering a rethinking of the **ways we consume**, but we also know much more about our consumption (and its consequences) than in the past, including the recognition that prior consumption patterns exceeded planetary boundaries. Thus, in 2040, consumerism is looked down upon as we still have to reduce our general consumption - and more and more people are asking themselves whether they really need all the products and services on offer.

In the scenario of 2040, consumption, lifestyle and work patterns play a large role to make the European societies 'green and sustainable' - and it remains a constant effort.

Statement 11 (Delphi survey): **In the EU of 2040, the shift in work and consumption patterns towards local economies has had a strong influence in making the EU green and sustainable.**

Shift in work and consumption patterns

Nearly 40% of the respondents assess the statement as **likely or very likely**, another 38% judge a moderate likelihood. More than half of the participants consider the issue as **important or very important**. Even though consumption and production patterns are connected, a change in consumer behaviour or policies does not mean the two can be altered in the same manner or timeframe. First of all, according to the Delphi participants, **a lot more research is needed on studying consumer behaviour**, and **develop behaviour of responsible consumption**, which in turn will **necessitate strong engagement with citizens** (beyond science). But there are a number of obstacles that the anticipated changes will need to encounter, like economics of scale and advantages of world trade will continue as the dominant paradigm, so there is no room for a massive change towards regional economies, like the interconnected nature of current trade and production at a global scale. There are political fears that local community production and sustainable consumption in Europe would lead to underfeeding of the rest of the world with the consequence that people from other places would come to Europe. Local economies do not equal per se more green or more sustainable economies and they are competing globally, e.g. with USA and China.

One way to overcome obstacles would imply **to alter the value and supply chains**. Supply chains don't necessarily have to be local ('environmentally sound global value chains'). There is some doubt that producing in our own backyard will be an effective or efficient means to make Europe green and sustainable. **Grassroots action is necessary for both ecology and innovation**. The 'environmental movement' is a good example: If the movement is going on, small communities can bring their innovations to mainstream markets and users.

Green communities and ecological movements can be very important in implementing climate actions on state and EU level. **Their social innovations are especially needed when bringing scientific ideas to real markets.**

We are still living in a world of **intense international exchange** where people, companies, and countries are interconnected and hyper-connected on different levels. The trade of ready-made products drastically decreased during the last years, but certain essential resources are only available in specific regions of the world. **Mining**, for example, **is internationally monitored** - it is still an important sector, but the conditions for workers, trade volumes, and environmental impacts are tightly regulated to prevent any form of exploitation. **Multilateralism** remains the leading paradigm in enabling international relations. The world is politically open for trade, because former G7 and G20 leaders rose to overcome nationalistic impulses and forged an agreement on a coordinated economic recovery plan, including the lifting of border closures and the relaxation of tariffs and other trade barriers.

At the same time, local and regional self-sufficiency has become a common value across the EU, meaning more goods are traded locally, regionally, or nationally, and only the necessary resources are bought on the international markets. Apart from ecologically sensitive innovations in international waterborne and airborne shipping, **a global kerosene tax** made sustainability-focused investments possible, and exposed the comprehensive costs of globalised transport systems. The overarching purpose for international relations is clear - cooperative governing takes time but works well.

Mobility needs to be **energy-saving and 'clean'**, and e-mobility is much cleaner now. There was a hype of e-mobility in the 2020s, but then it was observed that the global emissions are not universally reduced by e-mobility. In most cases, the higher demand for electricity resulted in more emissions. Initially, cities were cleaner, but urban outskirts and regions where the resources were from, suffered. Now, with better production sites, the control of mining and production places, and new kinds of engines (hydrogen-based, fuel-cells, and new ideas), our e-mobility systems are fulfilling their initial promise to reduce emissions, noise pollution, and contribute to a more healthy environment.

A new health system - lessons learned

Long before the Covid-19 crisis, personnel capacities were already scarce and expensive as work in the care sector was seen as under-compensated, exhausting, and dangerous. To increase capacities, professional care schools and universities in the 2030s made the job more attractive and carried enough social momentum to effect change. **Labour conditions in care systems were changed by law:** regulation introducing basic salaries, limiting working hours especially in care, and mandating robust compensation packages for accidental injury or death changed the situation of personnel. Costs for this were distributed in a fair and new way between public and private providers as well as the citizens themselves. It took one generation, but now these changes are evidenced by an excellent reserve of trained and certified personnel who have time to make 'care' a central component of health system work.

Care is decentralised and not only concentrated in the large hospitals or care centres of big cities. You can flexibly book in-home care services, or enter the nearest care centre to receive the assistance and treatment you require. People have taken on **more responsibility for their own health.** The

individualisation of health includes **taking care of one self as part of the collective** and the widespread utilisation of inexpensive testing facilities to monitor general health, genetic mapping, and practice preventative care turned into a societal duty based on the new values developed after the pandemics in the 2020s. Public funding and public responsibility for drug and vaccine research as well as for setting of prices for medication and treatments (e.g. the yearly Covid-19 or flu vaccinations) have to be transparent. Research and innovation are still high on the agenda in public health.

Energy and many new ideas for innovation needed

The question of sufficient **energy supply at places where needed** (e.g. the transfer of wind energy from north to south in Germany, to have a stable energy net when regenerative sources are main or storing energy from photovoltaics) as well as the food, water and energy nexus (providing enough energy and avoiding the use of fossil fuels) are still not fully solved even though we invested a lot. During the last years, we have seen many **innovations** in energy (e.g. grids, energy distribution, storage, harvesting energy from the environment etc.), new efficient photovoltaics, and innovations in food production, for example meat can be lab-grown.

The Bioeconomy related sectors - from agriculture to regenerative resources for industrial inputs, new combinations in mobility and automation, etc. - benefited from the cyclic use of materials, where the resources were used again and again and transported from one sector to the other. These sector systems share knowledge and capacities, and are now able to create buffers (like more time for a job or more personnel for flexibility) and resilience. We need energy for our machines, food and water, and we need personal energy. We keep on fighting climate change symptoms (heat, drought, storms, heavy etc.) with a mix of simple solutions like for example biomimetic buildings made of traditional materials or leaving certain regions uninhabited and advanced technologies like geoengineering, new biotechnology for making plants more robust, Artificial Intelligence for better forecasting or new sensors combined with sophisticated warning systems.

3 Common Findings and Recommendations: New R&I Policies Ahead?

Strategic Foresight scenarios are meant to be utilised to help policy decision-makers of the present broaden the scope of future possibilities that are taken into consideration during the design and implementation of policies. They are not predictions about what *will* come - they are images of future worlds that *may* develop. The above scenarios were developed as 'context scenarios' - broad images of the future that outline a comprehensive view of the world, deploying ambiguity to provoke useful dialogue.

In the scenarios we see different futures emerge from deviating developments across a limited number of factors. They are all *possible*, some more feasible than others, but they are not necessarily desirable futures. To utilise these context scenarios within a more specific policy interest, it is necessary to provide a mode of scenario analysis that is geared to that policy interest. Such analysis of the ramifications of scenarios for a specific policy area should be organised to address both contemporary and anticipated concerns and desires. While there are many ways of organising these discussions, we concentrate in the subsequent chapter on three main questions of relevance to **European R&I policy**:

- Do one or more of the scenarios raise a truly novel feature or argument that might change the nature or the direction of future EU R&I policies in a significant way?
- Are there any novel understandings in the scenarios that may affect our views of what developments are worth pursuing?
- Are there any novel understandings in the scenarios that may affect our views of developments that should be avoided?

The analysis presented in this section is based on a comparative reading of the scenarios with regard to some key themes of EU R&I policy, in order to derive normative policy implications. The key themes are:

- 'Control' over technological development
- Resilience, adaptability and crisis preparedness
- The key role of education
- EU level financing for R&I
- Regional disparities in R&I performance, and
- Defining future priorities for R&I policy

3.1 'Control' over technological development

Issues at stake

Technological development takes place on very different levels and in different sectors - from the companies to universities, from citizens' single experimentation to large scale networked consortia, on the global and the local level. Exerting influence on the pace and direction of technological development in Europe is an important concern of EU policy, both for safeguarding the competitiveness of EU industry, but also for ensuring that new and emerging technologies are shaped in a way that is compatible with key values that the EU promotes, such as the right to privacy and digital self-determination, or the protection of the environment and the fights against climate change. Overseeing what is happening and having a kind of 'control' over the developments and their influences is thus an important part of EU interest in science, research and innovation policy.

There are (at least) two dimensions of how control over these technological developments might be challenged in the future. First, there is the **global dimension** in the growing dependence of Europe on technologies developed and produced elsewhere in the world, most notably in the US or China. This debate covers in particular so-called 'key' technologies (e.g. advanced manufacturing, microelectronics, photonics, Artificial Intelligence, gene-editing and others), the access to which is either vital for our current industrial activities or for the future economic potential of Europe. Second, there is a matter of concern regarding the massive influence of **private firms** on technological development, and of large multinationals in particular, which invest heavily into novel technologies and shape their trajectories, but remain largely outside of any public or political control as regards potential societal consequences of the deployment of those technologies. Taken together, they raise questions concerning whether or not the EU, as part of a global network of knowledge producers and technology creators, is able to defend a leading position in important areas of S&T, and whether the EU is able to shape the unfolding of these technologies in such a way that Europe's interests and public values are protected. Both concerns are matters of political leverage, the availability of financial and human resources, and time constraints. Does the EU have the political influence, the people and the means to mobilise finance to foster or monitor these many ongoing activities? And which would be the priority areas to focus on? Research and innovation are just one lever to ensure Europe's influence on technological development; others relate, for instance, to its industrial strategy, its regulatory powers and the ability to speak with one voice.

Scenarios discussion

The five scenarios differ in terms of level of control exerted by the public sector over technological development. A very difficult socio-economic situation across the board (**The long recession**) may slow down the advancement of technological development, with limited possibilities of both public and private sector to invest in R&D, and shortages of skilled labour due to a poorly resourced education system. This differs from those scenarios where the private sector finds itself in a stronger position to accelerate technological development, while the

public sector continues to operate under severe financial constraints. This is the case, when global companies dominate the scene, but it can also be the case of the private sector or single companies within the EU. We see this struggle in **Big tech shapes Europe**, even more than in **Back to 'normal'**.

The two remaining scenarios **Circular trials and real-life errors** as well as **Green Utopia – new hope** draw a different picture in this regard, with a financially well-endowed public sector building up strong capabilities and capacities to govern system transformations. In both scenarios, a clear vision and direction towards a more 'green economy' and sustainability exists and is followed by different trials - with more or less success.

Related to the balance between public and private sector influence over technological developments (which is increasingly exerted by large multinationals), the scenarios point implicitly to concerns over a growing dependence of Europe on critical technological knowledge and competencies. In addition, it is important to take the – sometimes quite fundamental - differences across the US, Europe and China into account, as regards the purposes behind technological developments and associated standard-setting efforts. These are rooted in national interests, including trade, but are also associated with the societal ends to which technology shall be employed. The scenarios may not be very specific about these matters, but in-between strong technological and industrial dynamism in the US and a continuously growing influence of China globally, on its citizens and on key technological areas, the EU is sitting in a rather uncomfortable 'sandwiched' position of struggling for global influence and leadership while defending its values – even though to varying degrees in the different scenarios.

R&I policy options

In R&I policy terms, the first three scenarios mentioned (**The long recession**, **Back to 'normal'** and **Big tech shapes Europe**) imply that given the financial constraints of the public sector, its possibilities to influence technological development are limited. It may be more promising to retain or enforce regulatory policies for maintaining a certain level of influence over technological development rather than to focus on public funding for developing the desired technologies.

Maintaining public infrastructures is another critical priority that the public sector may still be able to invest in, including R&I infrastructures. However, in the **Big tech shapes Europe** scenario, the discrepancy between private and public sector capabilities turns out to be so strong that it would effectively lead to a kind of demise of the state – and thus of the EU – in trying to exert any significant influence over technological developments. The state hands over a lot of control to the private sector and restricts itself to some degree of monitoring of R&I developments in order to keep the major public services running. It leaves for example the education sector mainly to the private hands - with all the consequences of one-sidedness in what people learn. Companies control each other in this scenario - they are not very much controlled by the states.

The two scenarios **Circular trials** and **Green Utopia – new hope**, with their more powerful public institutions, call for an active ('pro-active') and collective policy approach of concerted and aligned efforts across policy areas and levels. R&I policy plays an important role to achieve this. Here the ambition to shape or at least co-shape technological developments can be realised, as well as a pacemaker function at global level.

These considerations also point to alternative strategies regarding the global positioning of Europe. The first three scenarios leave little room for manoeuvre and are likely to reinforce Europe's dependence on global partners. From an R&I policy perspective, it seems advisable to maintain good collaborative relationships with both the US and China, in order to avoid unilateral dependence. This, however, may clash with attempts to establish dominant standards by either the US or China or anyone else in the future. The **Big tech shapes Europe** scenario would be compatible with big tech companies having their base in Europe, which, however, would require the establishment or rise of such European big players in the coming years; certainly a very challenging ambition. It would also be compatible with the rise of medium-size technology companies that are global players and currently still the 'hidden champions'. The **Circular trials** and **Green Utopia – new hope** scenarios indicate more room for manoeuvre, and thus also a possibility to play a more influential role at global level, though in competition with US and China.

3.2 Resilience, adaptability and crisis preparedness for times of crises

Issues at stake

The Covid-19 pandemic has brought matters of resilience¹⁷, adaptability and preparedness to the forefront in public policy debates, even though these issues have been under discussion for quite some time. The lockdowns have demonstrated the fragility of numerous systems essential to the functioning of modern society. There will certainly be additional crises in the years ahead. For instance, the 'climate crisis' threatens to create a wide-range of problems with very uncertain consequences - ecosystem collapses and biodiversity losses (addressed in all scenarios), forced migration and displacement, extreme weather and food system disruptions, to name a few. Additional disruptions and crises include the possibility of new infectious disease pandemics, intra-state warfare (regional or worse), or naturally occurring phenomena (volcanic activity, earthquakes, etc.). The attention to these issues is enhancing the fear of further crises, growing sensitivity to the need to prepare for the consequences of climate change and recurring global conflicts.

Preparedness does not mean knowing the exact nature of the next crisis. Rather, it entails making sure that essential system components are both robust and have clear fail-safe measures. For R&I ecosystem management, this means assessing the performance of the current system during the Covid-19 crisis, and fixing,

¹⁷In the sense of the quality of being able to return quickly to a previous good condition after problems (Cambridge Dictionary: <https://dictionary.cambridge.org/dictionary/english/resilience>)

adapting, and building resilient infrastructure. Furthermore, it means assessing the impacts that possible threats, like those outlined above, would have on the R&I ecosystem, and using rigorous imagination to better prepare for worst-case scenarios.

Scenarios discussion

All of the scenarios outline the possibilities of future crises or major systemic disruptions, and identify accompanying risks to EU interests that could occur. The entirety of **The long recession** scenario is dedicated to exploring the ramifications of a longlasting economic downturn initially caused by the pandemic, and prolonged by a cascading series of follow-on crises of various kinds. Due to the complex relationships that underpin our modern societies, such 'domino' collapse scenarios remain viable possibilities. So how do we prepare for a threat spectrum that seems so broad and varied?

The scenarios differ in terms of their 'in-built' preparedness and resilience depending on their financial ability to manoeuvre, the attitudes of the policy-makers in the EU and the awareness of the threats the EU and its people are facing. The **Green Utopia – new hope** scenario is a prepared world and starts with this notion. Being aware of an ongoing climate change and the experiences of the Covid-19 pandemics, people changed many attitudes and ways of thinking. They regard disasters as primarily man-made and something that can be anticipated and avoided, mobilised by social and ecological movements, such a 'prepared' society cultivates awareness of uncertainties, emerging developments, and noticeable challenges like declining biodiversity or climate change. By reverting to frugal solutions and avoiding excessively complex and risk-prone technologies, the world of **Green Utopia – new hope** is less vulnerable to crises.

The two scenarios **The long recession** and **Back to 'normal'** lack possibilities of both public and private sectors to develop resilience and preparedness in any significant way. Societies remain highly vulnerable to crises in these worlds.

In **Big tech shapes Europe** responsibilities are mainly shifted to the private sector as the public budgets are exhausted by the crisis, and whatever cost has to be taken over by companies. That means, we see a world where certain aspects of preparedness, resilience and adaptability are taken care of by the private sector, but this may of course imply a slow erosion of other public values that Europe has been trying to promote for decades.

The **Circular trials and real-life errors** world is vulnerable to any negative change. The society in this world maintains its flexibility, openness to collaboration, and awareness of vulnerabilities, potential threats and man-made problems in-between. However, the society's attempt to rapidly change highly inter-connected systems, exposes these systems' sensitivity to disruptive change and presents numerous challenges to transformational efforts. As we have seen in the Covid-19 and 20 lockdowns - when the delivery chains were interrupted and some goods were not available for a long time - awareness does not necessarily lead to preparedness. Vulnerability is the new normal in this scenario.

R&I policy options

In **The long recession** and **Back to 'normal'** scenarios, preparedness and adaptability are crucial, but R&D funding is directed at striving for a world that is no longer, and this makes the EU particularly vulnerable to being out-innovated and becoming less resilient. These scenarios underscore the need for special attention and motivation to equip countries and their citizens for disruptions. This implies that public R&D, within limited public resource availability, should be directed precisely towards exploring new approaches for strengthening preparedness and adaptability, even when the room for manoeuvre is extremely limited. As consequence, in these scenarios, especially during a long-term recession, it is very unlikely that there will be enough resources to actually build truly resilient structures and establish adaptive processes.

In **Big tech shapes Europe**, public R&I policy has a limited role to play, just covering some of the gaps that are not commercially interesting (e.g. social innovation). At best, public R&I policy can try to make sure that resilience and preparedness aspects are taken into account ('watchdog function' of public R&I). It is rather private R&I policy the EU is dependent on - as the companies may have an interest on their own to keep a kind of awareness and preparedness for things to come.

In the scenario **Circular trials and real-life errors**, R&I policy puts priority on the design and development of distributed and decentralised circular approaches and solutions to resource management and industrial production. Distributed and decentralised systems, in comparison to integrated and centralised versions of the same, are more robust and less susceptible to comprehensive system failures in case of disruptive events. R&I policy can also contribute to the development of collaborative and possibly redundant network structures, underpinning circular systems. At least, experiments and projects should be supported as free spaces or real-life laboratories to test what is feasible and what is not.

Green Utopia – new hope is by definition having a comparatively high level of 'resilience' ('in-built'). Here, R&I policy is clearly directed towards an awareness of upcoming crises and preparedness for their management and finding solutions.

Overall, the scenarios demonstrate a concern that resilience, adaptability and preparedness require much more attention in R&I policy than in the past. This includes ways of **identifying, monitoring and addressing threats**. The EU R&I 'system' is susceptible to threats towards the EU from events beyond our control and in sectors unrelated to R&D, such as migration, emergence of new viruses, and natural disasters. External factors include, but are not limited to, changes in the EU 'neighbourhood' that can impact social solidarity and security, geopolitical forces that shift allegiance and positioning of the EU, or global environmental shifts and megatrends. Technological threats (e.g. state-sponsored cyber warfare) might disrupt R&I systems. Again, these might have indirect, but substantial, impacts on the EU R&I ecosystem and should be accounted for in building systemic resiliency. By establishing clear modes of identifying and monitoring internal and external threats, R&I policy can contribute to resiliency building by providing a testing ground, both for the broader EU and for the R&I

ecosystem itself. Other generic options to strengthen resilience, adaptability and preparedness include the following:

- Develop new emergency response capacities based on an analysis of R&I responses to the pandemic.
- ‘Wind-tunnel’ new plans, policies, and institutions through worst-case scenarios for alternative crises.
- Explore new modes of assessing threats and trialing emergency responses, which offer the possibility to explore hidden opportunities. This kind of regular practice and performance auditing could be a method for future R&I policy, and for other Commission policies, to enhance societal preparedness and resilience.
- Engage with non-R&I focused branches of EU governance and research to share findings about threats and opportunities, to foster more integrated and coordinated responses to changing environmental conditions.

3.3 *The key role of education*

Issues at stake

Education is of major importance for society’s responses to the different scenarios, and in two regards: it is a pre-condition for the ability to conduct high-quality R&I, and it is crucial for capitalising on the potential of R&I for improving the human condition, quality of life, policy and the uptake of innovations in society and economy. It is a critical issue across all scenarios, with each scenario illuminating a different pathway for education’s future. Some scenario paths hint at more individual-based learning systems, some outline education as directed by and for private interests, and other scenarios present education systems with a renewed influence from public policy and government guidance.

Education gained special attention during the Covid-19 lockdowns when schools and universities were closed and most of them were unprepared for homeschooling. Some managed to solve the issues, while others were unsuccessful leaving young students with little to no guided education for some time.

Education is a key line of defence against widening social gaps and declining societal cohesion. Numerous OECD reports state that the social gaps are widening (OECD 2020b, 2020c, 2021)¹⁸, and the OECD itself began research into new

¹⁸These are just examples, see the PISA report discussions, <https://doi.org/10.1787/ca768d40-en>, or the four scenarios for the future 2020 or the Education at a Glance series in <https://www.oecd.org/education/education-at-a-glance-19991487.htm/?refcode=20190209ig>.

models for education in 2019, just before the onset of the Covid-19 pandemic¹⁹. This runs in parallel to UNESCO's *Futures of Education* research initiative²⁰ and other UN projects with an educational policy component including the Sustainable Development Goals.

Scenarios discussion

In each of the scenarios, we find the changes to the institutional structures of education and the pedagogical approaches that such changes bring. **'The long recession'** keeps major parts of education in the public realm, but with limited possibilities due to fiscal constraints; thus contributing to the relative decline of the EU as compared to some Asian countries. National and regional responsibilities for education, in conjunction with serious financial shortfalls across Member States, contribute to deepening educational differences within Europe as well. This leads to further widening of economic disparities between Member States and regions of the EU, and amplifies social and political ramifications. In such a scenario, education cannot contribute to high-quality R&I or improve human conditions. Instead, the social gap of educated and non-education at all is widening under such conditions.

The **'Back to normal'** scenario offers more room for the private sector influence on the shape of pedagogy and thus on the way education contributes to future R&I, with the public sector keeping and exercising some level of control on schools. For its part, public institutions work to ensure access of wide range of social strata to reasonably good education, and impose curriculae that develop a foundational level of shared knowledge. However, this scenario also explores how limited public budgets hamper broadening education, and develops the idea of private sector investment in education that enables training and instruction in more skills if they align to private interests. As before the crisis, it depends on the different education systems in the EU if the potential of R&I for improving human conditions, quality of life, policy and the uptake of innovations in society and economy is supported by and in the system.

In the scenario **'Circular trials and real-life errors'**, public budgets in education are limited, but schools and universities are kept open and free in most countries. These public education institutions provide industry specific knowledge by adopting life learning modules, designed and paid for by industry, to reflect changing skills needs - also for R&I issues. Companies - often SMEs with specific business offers - drop in and teach content that address both current market needs for skills, and is reflective of their R&I activities in the future.

¹⁹ <https://www.oecd.org/education/2030-project/about/>

²⁰ <https://en.unesco.org/futuresofeducation/initiative>

This situation of private influence on pedagogy through fiscal support is further enhanced in the **Big tech shapes Europe** scenario, where companies essentially take over the education sector. This has the advantage that everybody can choose what and where to learn, and reflects on the possible impacts of a more limited public policy role in setting education standards. But it has the disadvantage of being expensive, meaning that the investment in education is done by parents or the individuals themselves. A kind of basic standard education (canon) does not exist, and 'continued learning' only exists if companies are interested in educating their staff and elect to pay for it themselves. This bears the danger that only those themes and topics are taught which enhance the ability to conduct necessary or high-quality R&I where a capitalisation in the respective companies is expected. Other - more general themes, e.g. R&I for improving human conditions, quality of life, policy and the uptake of innovations in society and economy may be neglected.

As a final counter point to these situations, the **Green Utopia – new hope** scenario, illustrates an approach to highly designed and standardised education that is implemented in a top down fashion, but still reflects a societies shared ethos. In this scenario, sustainability and 'green' themes are reinforced by the principles of sufficiency and frugality that permeate the curriculae. This fosters the shared social vision that drives the scenario's overarching transformation, while shedding some light on other implications of education constrained by ideology. Education for high-quality R&I thus means teaching R&I supporting the social green movement and topics that are aligned with it.

R&I policy options

Maintaining a key public role in education policy is essential in all scenarios, but the possible approaches to ensuring public institutions remain. Relevant stakeholders vary significantly across each scenario world. Moreover, the abilities of public institutions to address changing educational needs are highly dependent on the present day state of education and funding capacities in different countries and regions. The scenarios present a spectrum of public/private education configurations - from a large public role with major investment in schools, infrastructure and teachers, to limited public institutions that support private education companies in their efforts to offer tailored education for specific purposes. The scenarios outline the political aspects of decisions that impact education systems. For instance the public support of standardising curriculae that follow a more holistic approach, as opposed to open systems that enable students and their parents to decide what to learn, or a privately funded systems that seeks a return on its investment.

However, in the first three scenarios and **Green Utopia – new hope**, this role is inevitably restricted to maintaining a certain level of quality of basic primary education (to ensure equality of chances for young people) and to taking care of other than short- to medium-term needs of the private sector. As in other fields, this cannot be achieved by massive financial resources, but by regulatory means (e.g. through curriculae) and guiding principles (e.g. Responsible and Resilient Education - RRE).

In the scenarios **Circular trials and real-life errors** and **Green Utopia – new hope**, possibilities for targeted policy actions in terms of education are much wider, and they can be driven by public funds in line with the (public) ambitions of moving towards a circular economy and frugal, decentralised and climate-friendly solutions, sometimes even developed by individual experimenting. Education in these two scenarios might be supported by **local and experimental initiatives**, supported by public funding.

3.4 EU level financing for R&I

Issues at stake

EU funding for R&I projects has been the main instrument of European R&I policy since the beginning, and has seen continuous budgetary increases with particularly large funding growth over the past two decades. These increases have implied a stronger leverage of EU R&I policy in terms of triggering institutional reforms of R&I systems in Member States, on top of the soft power of the Open Method of Coordination. Whether the financial and political influence of EU R&I policy remains relevant in the future is a question each scenario explores.

In the scenarios, there is also exploration of different ways in which the benefits of discoveries being made with publicly financed research are being realised within the EU. Who are the major beneficiaries of R&I activities, and how are outputs like patents and Intellectual Property (IP), databases, and toolkits (among others) being managed and exploited? Given that the source of R&I funding could change, and that public funding transparency is important to building and maintaining citizen trust and support, consideration of the possible developments for this issue serve as important components of each scenario.

Scenarios discussion

The five scenarios point to some futures where European R&I policy and funding do not play a significant role any more, either for simple scarcity of public budgets in **The long recession** or for an overwhelming dominance of private sector R&I funding in **Big tech shapes Europe**, possibly by large multinationals.

One extreme is that public as well as private funding are scarce in **The long recession** leading to a general decline of R&D activities in Europe. In the Delphi survey this is discussed a lot - in bad times, it is better to invest in R&I and with it in the future, but when the budgets are empty, also R&I budgets may be cut, like in the scenario.

In the other scenarios, there is still funding available. The **Back to 'normal'** scenario sees a growth in private funding, but dedicated to short- and to medium-term needs, the long-term is often neglected as the whole scenario is rather backwards-oriented. To compensate for budgetary deficits, the limited public funds are to be concentrated on basic research as well as on key societal needs issues, crises preparedness (see above) and especially the impacts of a highly probable climate change with severe implications on people's lives in the long run.

Big tech shapes Europe brings an abundance of private funding, which also allows for application oriented basic research to be driven forward. If the companies really care and take their role in society for granted, they may also invest into their future and into fighting climate change symptoms. But as the state is not responsible for this, anymore, it is difficult to say if they may do that in a libertarian state. It is up to them to decide - and they will rather invest where there is a profit.

The scenarios **Circular trials and real-life errors** and **Green Utopia – new hope** are worlds where there are enough public resources for R&D funding.

R&I policy options

The scenario **The long recession** will force remaining Member States to pool their financial resources into joint programmes to enhance the benefits they can derive from public R&D funding. It may lead to either a strengthening of EU R&I policy or of multilateral arrangements among Member States

In the **Back to normal** and **Big tech shapes Europe** scenarios, R&I policy needs to put emphasis on patching at least some of the gaps left by private sector R&D: basic research, social innovation, SSH. However, in the absence of sufficient public funding, EU R&I policy can rather mobilise its soft power to trigger institutional changes in Member States, but which are of limited influence on their respective R&I systems.

In the scenarios **Circular trials and real-life errors** and **Green Utopia – new hope**, EU R&I policy has the possibility to set the agendas, and it does so in line with its overarching political priorities. This entails risks that need to be watched, such as the neglect of basic research in **Green Utopia – new hope** where the emphasis is put on 'sustainable solutions', simple and sometimes non-technical solutions, or even sufficiency. Possibly, EU R&I policy will need to compensate for this emphasis at Member States level by focusing on more fundamental research. In addition, EU R&I policy, which is expected to be also well endowed with financial resources, these two scenarios open up the possibility to underpin initiatives to trigger institutional reforms in Member States by coherent funding impulses.

3.5 Regional disparities in R&I performance

Issues at stake

Regional disparities in R&I performance in Europe have been a concern for many years, both within and across Member States. Some of these discrepancies reinforce pre-existing disparities like the urban/rural divide or differences between Member State economies. The initial north-south gaps in the EU have been complemented by concerns about growing discrepancies between the R&I hotspots in the EU, and many of the Central and Eastern European Member States in particular.

In spite of a reorientation of structural funds towards smart specialisation strategies and some success stories, the economic and innovation disparities between core and periphery of the EU continue to persist (Behrens et al. 2020). Negative repercussions on under developed areas' human resource base (e.g. braindrain) raise concerns over the longer-term economic and social development prospects for towns, regions, and countries lacking R&I capacities. Currently, the knowledge ecosystems perspective that underpins policy efforts within the New ERA framework seeks to better connect the knowledge production and exploitation activities across different locations in Europe.

Scenarios discussion

The prospects for reducing regional disparities in R&I performance vary significantly across the five post Covid-19 scenarios. In the scenario **The long recession** the situation is worsening in line with the general economic downturn in the EU, and existing disparities are widening due to lack of public funds to strengthen knowledge ecosystems in regions that were struggling to keep up with the leading regions already before the crisis. The situation is only slightly better in the **Back to 'normal'** scenario, not least because solidarity with other EU Member States is limited as a consequence of growing nationalism. Also in this scenario, regional disparities are likely to widen.

Although the overall economic situation of Europe is brighter in the **Big tech shapes Europe** scenario, regional disparities are likely to grow due to unconstrained agglomeration effects in relation to knowledge production, which cannot be counter-balanced by public policies. The incentive structures for the private sector are conducive to investing in regions where there are promising economic opportunities; this is mainly the case in the thriving urban centres. The more disadvantaged regions in Europe are likely to be faced with underinvestment in R&I in general and knowledge infrastructures in particular.

The situation is different in the **Circular trials and real-life errors** and the **Green Utopia – new hope** scenarios. Local solutions and actors play a key role in realising circular systems and thus favour economic development, because these kinds of solutions need to be embedded in the respective local contexts. Similarly, sustainable solutions for addressing climate change and other environmental and social challenges require action and investments all over Europe. This requires decentral capacities and capabilities to develop and realised 'frugal' solutions. This shift is supported by stronger government policies, which are also underpinned by corresponding public investments.

R&I policy options

The first two scenarios **The long recession** and **Back to 'normal'** provide very limited room for R&I policy action, and a widening of R&I performance gaps can hardly be avoided. To avoid the worst, emphasis needs to be put on securing basic functions and activities of R&I systems in all regions, in order to prevent a collapse of knowledge ecosystems with their R&I institutions and human resource base. The ambition would be to maintain the foundations for a re-start once conditions have improved.

The **Big tech shapes Europe** scenario offers more room for manoeuvre given the improved possibilities of the private sectors, and of some multinationals in particular. EU R&I policy has to strike a delicate balance between offering attractive conditions for these firms on the one hand, and pushing them towards investing not only in the leading agglomerations in the EU, but also in those that are in a more difficult situation. Policy attention thus needs to be directed to incentivising Big Tech firms' investments into these regions' knowledge ecosystems in particular.

The two scenarios **Circular trials and real-life errors** and **Green Utopia – new hope** are by definition offering more attractive conditions for R&I investments, because the new solutions to be implemented are more local and regional by nature, and all regions in Europe need them. R&I policy may therefore be less oriented towards the latest high-tech hype, but rather towards strengthening the absorptive capacities in all European regions. The **Green Utopia – new hope** in particular favours an R&I policy that supports a wide range of innovative solutions, including in particular 'frugal' and social innovations. Both scenarios may also suggest a departure from large-scale European programmes, but rather EU and national R&I policies aiming at strengthening local knowledge ecosystems.

3.6 Defining future priorities in R&I policy

Issues at stake

There are very different ways to understand how future priorities in R&I and R&I policy are defined by EU Member States and the EU itself, and this situation is at the heart of the limited ability of Europe to concentrate its R&I spendings on joint priorities. This diversity of priority-setting and the priorities themselves have their origins in differences between Member States with respect to R&I capacities, business ecosystems, and available capital, as well as in differences in political cultures and agenda-setting processes. In some countries, present day conditions in these areas lead to an outsized influence of emerging socio-political issues, private sector interests, and disruptive events (like Covid-19, migration, and economic downturns) on shaping national strategy and R&I agendas.

At the same time, the R&I funding from the EU influences national level agendas, and raises questions around the use of thematic programmes to define the EU's long-term R&I strategy. Might a concentration of basic funding mechanisms at the EU level be an effective mode of supporting the Union's collective R&I efforts? Or can non-financial instruments (i.e. regulation) be applied without EU-level funding to promote and shape an R&I ecosystem that is primarily backed by private sector actors? These are just some of the questions that the scenarios bring forth, encouraging a deeper exploration of the different possible futures for setting R&I priorities for the EU and its Member States.

Scenarios discussion

In each of the scenarios, different modes of R&I priority setting are implied through the description of the R&I ecosystems that have emerged from the scenarios' divergent environmental conditions. In some cases, R&I ecosystems are very much under the influence of private corporations, whereas public institutions play a stronger role in others. R&I ecosystems might be more decentralised or fragmented under certain conditions - like a focus on more local or regional needs - whereas, other scenarios paint a picture of more organised R&I systems with implicit hierarchies. In all of these situations, changes in the mode of R&I prioritisation become a subsidiary of broader economic, social, and political change that impacts R&I ecosystems. That said, the scenarios also implicitly point towards the importance of the prioritisation mechanisms that are developed, and the way such processes can have longer term ramifications on the larger scenario world.

In the **The long recession** scenario marked by dramatic economic depression and multiple crises, a reactive mechanism is implied as only short-term priorities can be set in direct response to each successive crisis. A splintering EU is both cause and effect of a disunity in decision-making and a failure to find agreement upon long-term strategic planning. As such, R&I priorities only emerge as possible within the remaining EU core, while they are lost in the mayhem of socio-political fractures in other regions.

In the **Back to 'normal'** scenario, the policy focus on strengthening existing economic powers and positions, and on returning things to a pre-pandemic state, drain public institutions of some of their ability to fund R&I projects. As such, R&I prioritisation falls further under the domain of those surviving private entities, many of which hesitate to cause disruptions and thus pursue more incremental R&I projects. Some R&I priorities persist with links to mission-orientation of ecological and climate-related research, while strategies prioritising 'resilience and security' become more entrenched as linked to climate challenges and a fragmented geopolitical climate.

In the **Big tech shapes Europe** scenario, private companies have created numerous modes of influencing the R&I prioritisation process. First, private companies have established an important popularity, allowing them to more easily shape public discourse, and political decision-making, with regard to the optimal 'direction' for R&I endeavours. Additionally, private companies are now thoroughly embedded within a number of social service providing institutions, and thus have a more direct link to outlining 'needs' and strategies from within governance. Lastly, the scenario builds from a position that public funding has been drying up due to economic hardship, and that while the EU economy is now recovered, R&I efforts have been given over to system of startups and private investments which may not represent all R&I priority areas.

The scenarios **Circular trials and real-life errors** and **Green Utopia – new hope** have their own specific logic with new 'social companies' serving the needs of the society. These scenarios imply two routes for more publicly directed R&I prioritisation. The **Circular trials and real-life errors** scenario points towards a mode of R&I that is more focused on developing local or regional needs and

capacities as part of a network of decentralised systems. This would imply that public and private voices at this level of governance have more power to decide R&I priorities than national or EU level institutions. The **Green Utopia – new hope** scenario, on the other hand, implies a stronger central EU governing power, with the capacity to shape R&I priorities across the union. While this scenario starts with a broadly popular shift in societal principles, and relies on citizens and private companies supporting one another in creating the new EU, the scenario also shows an EU-level governance structure that wields tremendous power and influence on the distribution of funds, and implicitly, the setting of priorities.

R&I policy options

In the **Back to 'normal'**, the **Circular trials and real-life errors** and **Green Utopia – new hope**, there are clear priorities to be set and mission-oriented policy-making is in the forefront. But the other two scenarios offer little room for public R&I policy and thus, it is difficult to financially support missions.

For **Circular trials (without real-life errors)** R&I programmes need to include possibilities for experimenting and Citizen Science to find out where connectivities may be created, where reuse is possible or where recycling is adequate. Thus, programme priorities need to be on the one hand in the technology area, in resource efficiency and in particular in new circular system and value chain designs as well as focussing on people with business ideas, networking, as well as everything that helps to close loops by management, organisation or institutionalisation. Specific R&I programmes can foster creativity in replacing certain materials or production modes that avoid mining new minerals or use completely different approaches or materials for the products that are needed and produced. Programmes to make recycling fashionable, 'in' or a public duty as well as promoting the use of 'old' or 'used products' is also important - they still have a bad image of being unfashionable or dirty, which has to be overcome.

The **Green Utopia – new hope** has full flexibility for priorities towards achieving the SDGs, gaining in sustainability and preserving ecosystems. Programmes for that need to be first on the agenda together with means, instruments and measures including indicators for fighting climate change and fostering biodiversity. Whatever helps the environment and brings back 'nature' in a natural way is high on the priority list of European programmes, here. Even genetic engineering may come back when it helps to restore biodiversity. Reducing the ecological footprint, and CO₂ footprint in particular, needs to be incorporated in all programmes.

When **Big tech shapes Europe** companies have their own priorities, there will be no need (and no resources) for major public funding programmes, anymore. The scenarios **Circular trials and real-life errors** and **Green Utopia – new hope** are the opposite, here EU R&I policy has the possibility to set the agendas and identify own priorities. In both cases, the priorities will be defined by people and their needs. Derived from needs, there are clear missions that define the agendas. In the **Green Utopia – new hope** the agenda is matched against SDGs, sustainability and ecosystems preservation, fighting climate change, fostering biodiversity and bringing 'nature' into the focus of all activities. Reducing the ecological footprint, and CO₂ footprint in particular, is key.

In the **Circular trials and real-life errors** world, the general agenda may be similar, but less strict, with less strict rules, and R&I programmes focussing on business ideas, networking, recycling and reuse as well as everything that helps to close loops (in delivery chains and in production or agriculture, avoiding 'waste'). If possible this should be performed in a sustainable way, but environmental issues are not in the forefront, closing the loops is the programmatic goal - and by this hopefully bringing a certain sustainability. Specific R&I programmes to replace certain materials, especially to avoid mining new minerals, foster innovative approaches.

Lastly, '**social companies**' - societies or communities organised for co-ownership under a formal private legal structure - present a different institutional model for R&I coordination. Some of these 'social companies' already exist as part of complex, interwoven structures at large companies. Such arrangements tend to create jurisdictional difficulties for governance actions like taxation, or IP enforcement. Meanwhile, other social companies operate under a simplified cooperative model (e.g. the Swiss Coop Healthbank or Midata, both providing health data hosting for citizens²¹), reducing the amount of complexity, but adding to the challenge of scaling up solutions or ensuring long term benefits for members. More importantly, either social company model can help foster new ways of organising and collaborating to innovate.

3.7 Final Remarks

At the end of this post-Covid-19 scenario-building exercise, we would like to draw attention to some cross-cutting issues that may deserve particular attention in the coming years and require further monitoring:

- Several scenarios suggest the need (and the willingness) of **Member States to collaborate more closely on matters of R&I policy**, not least to cope with the budgetary constraints raised by recession (**The long recession**) or stagnation (**Back to 'normal'**), but also to realise systemic changes.
- The **widening of the range of actors as well as of policies that matter for R&I** is apparent in most scenarios. This widening has its origin in the growing attention to system change as expected outcome of innovation activities that address scientific-technological as well as social, organisational and institutional dimensions. And it will require **more attention to innovation- and transformation, inducing effects of EU legislation and regulation** in particular in scenarios characterised by scarcer public R&D funding.
- With their strong emphasis on competitiveness and growth objectives, the established rationales underpinning EU R&I policy have been increasingly questioned over the past years already. The development is reflected, for instance, in the orientation of major parts of Horizon 2020 towards societal

²¹<https://www.healthbank.coop/>, exists since 2013, or <https://www.midata.coop/>.

challenges as well as in the current 'Green and Digital Transition' and 'Green Deal' policies of the EU.

- Across the board, the scenarios point to a **growing need to address socio-economic disparities and environmental concerns as guiding purposes of R&I policy**, and which need to be taken into account in policies to nurture the evolving landscape of knowledge ecosystems in Europe.

All scenarios suggest the need for **stepping up collective capability and willingness to actively engage in open and collaborative R&I relationships, both within Europe and with the world beyond Europe.**

This is obvious in relation to some of the global challenges Europe is aiming to address, but also with regard to emerging technologies where international alliances are decisive for establishing common standards and regulation. In order to ensure a relevant global role of Europe in the world, it is essential to build upon a strong, stable and coherent home base in R&I.

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5 Annex

5.1 *The Methods applied in different steps*

Step 1: Horizon Scanning and Scoping Workshop

In the Horizon Scanning, 128 documents from different sources were analysed and summarised in a first background paper for the first scoping workshop (for the concept of Horizon Scanning see e.g. Cuhls 2019a). Multiple criteria for the search and selection of Horizon Scanning sources were applied to codify research, including:

- 1) influence on the Future of Europe until 2040,
- 2) relation to the EU in Post-Covid-19 times, and
- 3) connections to R&I policy.

Most sources were from 2019 and 2020, some megatrends and long-term developments were taken over from older sources because they were regarded as still 'valid'. The approach was a broad search taking the systems perspective and including those factors that may shape the environment of our worlds in general and R&I policy specifically. The results of the scanning were described in a background paper for a first scoping workshop and adapted later on as an input into the scenario generation. This background research was an important input for the scenario development processes, and was revisited during the process to ensure identified factors were accounted for in the scenario texts (see Annex).

Factors that should be considered for the 'skeleton' formulated in a neutral way were searched for as well as single developments (in alternatives, diverging directions, contradictions possible). Factors were chosen if there is much uncertainty how they may develop and if they were considered to be impactful. They were grouped in a STEEPV structure (science, technology, economy, environment, policy/politics and values) to keep the systemic overview and work systematically.

The data and sources were handled in a data base. One has to consider that this was performed on the basis of sources available until October 2020. The references from the Horizon Scanning can be found at the end of the Annex.

Step 2: Workshop II (Factors and Alternative Developments)

The scenario development process was conducted in collaboration with members of the client team and with officials involved in EU R&I policy from a wide range of European Commission departments in several steps. Through multiple workshops this process generated context scenarios: relevant, coherent, and plausible narratives about divergent possible futures.

The draft scenarios were written and revised in preparation for two phases of external testing. Additionally, the draft scenarios were also utilised to create the foundational statements of the Dynamic Argumentative Delphi survey.


Alternative developments were discussed in more detail as a starting point for the scenario work. For each of these topics, different alternative trajectories for their future development were formulated through expert dialogue. After the workshops, the prioritised influencing factors, and their respective alternative development pathways, were formulated and included in a second background paper.

The **19 factors** used for the scenario creation and the following influence evaluation were explained in a background paper:

- 1: Globalisation and connectivity
- 2: Patterns of Consumption
- 3: Democratic rules and political divides
- 4: Government strategies in managing crises
- 5: Digital Cultures
- 6: Ways of Working
- 7: European values - society - political stances
- 8: Social Solidarity
- 9: Urbanisation versus ruralisation/sub-urbanisation
- 10: Equality
- 11: Capacities in the health system
- 12: Financing health treatments and vaccination
- 13: Individualisation of health and prevention
- 14: Economic paradigm
- 15: Economic structure and competition
- 16: Climate, Environment and Planetary Boundaries
- 17: Biodiversity
- 18: Food and agriculture
- 19: Universities and Homeschooling

Step 3: Influence Matrix (identification of the most influential factor)

To be systematic and keep the systemic view on potential developments, we used an influence matrix to define the most influential factor as a starting point. The Foresight team together with one of the responsible European Commission officers matched the 19 factors in the influence matrix (for the result see figure A1) with the question of what has an influence on the other factors - and if this influence is strong or weak. This was an internal virtual workshop.



Influence
no => 0
weak => 1
strong => 2

Influence
no => 0
weak => 1
strong => 2

Factor	Factor	1: Globalisation and connectivity	2: Patterns of Consumption	3: Democratic rules and political divides	4: Government strategies in managing crises	5: Digital Cultures	6: Ways of Working	7: European values - society - political stances	8: Social Solidarity	9: Urbanisation versus ruralisation/sub-urbanisation	10: Equality	11: Capacities in the health system	12: Financing health treatments and vaccination	13: Individualisation of health and prevention	14: Economic paradigm	15: Economic structure and competition	16: Climate, Environment and Planetary boundaries	17: Biodiversity	18: Food and agriculture	19: Universities and Homeschooling									
1	1: Globalisation and connectivity	0	2	2	2	2	2	1	0	1	1	0	1	0	1	2	2	2	2	1								24	
2	2: Patterns of Consumption	2	0	1	1	0	0	1	0	1	2	0	2	2	2	2	2	2	2	1								23	
3	3: Democratic rules and political divides	2	0	0	2	1	0	2	0	0	1	0	0	0	2	1	1	1	1									15	
4	4: Government strategies in managing crises	2	1	2	0	1	1	1	2	1	1	2	2	2	1	1	2	1	2	2								27	
5	5: Digital Cultures	0	2	2	1	0	2	1	0	1	1	1	0	1	0	2	0	0	0	2								16	
6	6: Ways of Working	2	2	1	2	2	0	2	1	2	2	0	0	1	1	2	1	0	1	1								23	
7	7: European values - society - political stances	2	2	2	1	2	0	2	2	2	2	2	1	2	1	2	2	2	2									33	
8	8: Social Solidarity	0	1	1	1	0	1	1	0	1	2	0	0	0	0	1	0	1	1	1								12	
9	9: Urbanisation versus ruralisation/sub-urbanisation	2	2	1	1	2	2	1	2	0	2	2	0	2	1	2	2	2	2									30	
10	10: Equality	2	2	2	1	2	1	1	2	1	0	2	1	2	2	2	2	2	2									31	
11	11: Capacities in the health system	0	1	1	2	0	1	1	2	2	2	0	0	2	0	0	0	0	0									14	
12	12: Financing health treatments and vaccination	0	0	0	2	0	0	0	0	0	1	2	0	2	0	1	0	0	0									8	
13	13: Individualisation of health and prevention	1	1	0	0	0	1	0	2	1	2	2	1	0	1	1	0	0	1									14	
14	14: Economic paradigm	2	2	2	1	2	2	2	2	2	2	2	2	2	2	0	2	2	2									35	
15	15: Economic structure and competition	2	2	1	2	0	2	0	1	2	2	1	1	2	2	0	2	2	2									27	
16	16: Climate, Environment and Planetary boundaries	2	2	2	2	0	2	2	1	2	2	1	1	0	2	2	0	2	2									27	
17	17: Biodiversity	2	2	1	1	0	1	2	0	2	2	2	1	0	2	2	0	2	0									24	
18	18: Food and agriculture	2	2	1	2	0	1	2	0	2	2	1	0	1	2	2	2	2	0									24	
19	19: Universities and Homeschooling	2	2	2	2	2	1	2	2	1	2	2	0	1	2	2	2	2	1									30	
20																													0

Figure 9 - A1: Influence Matrix

A1: During this process, previously identified priority factors were further analysed to assess their overall influence on the development of possible futures. This process relied on expert input and dialogue, and was formalised in the influence matrix (Figure A1). Using this process, it was determined that the factor 'economic paradigm' would be the starting point for each scenario path developed in the scenario sprint.

The starting factor was the Economic Paradigm:

Factor 14: Changing economic paradigm

Economic growth does not only have a rate that is mainly counted in GDP growth. The (GDP) growth paradigm can be questioned as a good indicator of societal development and should also convey a direction. Are there new ideas of assessing the economy, valuing commons etc.? What is the role of 'growth' in economic

debates of the future influenced by pandemic experiences? How does the capitalist system evolve?

A1: Economic **growth is back**, also in figures, and GDP continues to be the major reference. Covid-19 was not an apocalypse, not a depression, no magic – just a slow and marked decline of health and wealth of vulnerables. While the vulnerables were exploited or just forgotten, the Covid-19 crisis made the **super rich around the globe even richer**. So, the statement 'crises as opportunities' obtained a sarcastic connotation.

A2: **Large AI companies, science, start-ups, and public health expertise come to rescue** the economy. We truly enter the digital fourth wave era – genomics plus AI help monitor and then prevent. The economy recovered. Young people are no longer the future, but the present. Evidence-based science and technology inform public policy, not the whims of particular leaders. The insights from fighting Covid-19 are applied to climate change (in economic terms). While digitalisation and automation have created for many new working opportunities, they have also caused others to work less or not at all having more leisure time. Taxation of automation imposed to ensure broad income distribution in society.

A3: Alternative to the current linear economy model, the **circular economy** is a conclusive strategy that is based on the analysis of the physical flows of resources, and increasingly supported by governments and business alike, e.g. the European Green Deal. Local urban farming and other circular economy cooperatives with autonomous ecosystems are reshaping consumption patterns around the world. Concepts such as cradle to cradle are naturally embedded in people's everyday lives. Commons, which are public goods or spaces (air, space, water, ground..., Allmende) play a large role, they are shared and maintained. Economies changed from economic efficiency to resilience: instead of mass markets, we see more quality of products and services, adaptivity and flexibility instead of efficiency and lean optimisation in production processes. After instabilities, they react and improve autonomously.

A4: The mutation of SarsCov2 plus xenophobia plus panics led to uncertainty in populations and continued market/growth ups and downs including crashes from time to time in the 2030s. Supply chains, tourism, travel, and conferences are all disrupted and no major economic factor, anymore. People are saving and not spending their money, at least those with decent jobs. A **severe and long-term recession**, if not depression, resulted and lasts until 2040. Failure to act leads to a number of regime changes, as in Iran and the USA, to begin with. Wherever there are system stresses, they break. Not only economic collapse but humanitarian collapse is observed.

Step 4: Workshop III (Scenario Sprint)

Building on the two previous phases, a 'Scenario Sprint' board was designed (digitally) to facilitate the creation of four coherent scenarios from the prioritised factors. All factors and their alternatives were displayed (in brief) on a board. The scenario teams were organised using a colour coded pathfinding methodology to outline the core elements of each scenario (red-A1, yellow-A2, blue-A3 and

violet-A4) starting on the left-hand side with the factor 19 Economic paradigm and the respective alternative A1, A2, A3 or A4.

The scenario paths were build up in a dialogue-based workshop with the participating experts, mainly from the European Commission Horizon Europe Network (see figure A2) by discussing factor alternatives that could form a coherent scenario thread across all priority factors. If possible, alternative factor developments should only be used in a single scenario, though this is not always necessary nor appropriate.



Figure 10 - A2: Illustration of creating the scenario path (board)

Internal development of a fifth scenario (additional)

As some of the scenarios were regarded as 'too negative', the desire to have a more positive one for discussing the research & innovation policy potential was formulated. That was the reason why a fifth scenario was added in a kind of policy 'windtunneling' approach (Ramos 2019), by picking out those alternative developments into one path that seemed to be rather desirable and fit together (green scenario, not included in figure 2). This procedure used the same template and board as the workshop before (see figure 2) and created a new path starting with 'a new economic way' and a 'fast green track driven by a social movement'. In this workshop, some members of the Horizon Europe Network participated, chose the developments included and discussed the path. The scenarios were then formulated by the Foresight on Demand team.

Step 5: Scenario writing

From the scenario sprint process, the resulting scenario cores were then used as the basis for creating coherent scenario narratives for more clearly communicating the relationships between factors that animate each scenario (Milojevic & Inayatullah. 2015). The scenarios were generated in a creative cycle, with each scenario being drafted on the basis of the 'alternatives' selected. The

raw scenarios were reviewed, and revised multiple times by members of the Foresight team and project members from the Commission. The final scenarios introduce five coherent worlds of from the year 2040, providing explanation and clarification on how the factor developments influence one another and the wider societal context. As with all scenarios, these should be considered as speculative accounts concerning *what is possible*, and not declarations about what will, or should, happen.

Step 6: Real-time Delphi

In each of the scenarios, R&I and R&I policy may have different roles. There are many uncertainties in the unfolding of the specific scenarios that have different consequences for research and innovation, e.g. if there will be a long-term recession or how the R&I collaboration in the European Union may develop. The consequences in and for R&I policy or specific uncertainties derived from the scenarios were internally formulated in short statements and assessed in a Real-time Delphi survey with more than 170 participants in April 2021. The Delphi results were analysed within the context of the scenarios (see boxes in the scenario descriptions).

Step 7: Sense-making workshop

The last workshop in the project was dedicated to sense-making for the European Commission services, within the frame of utilising different images of the future to examine pathways and principles for future RTI policy and funding. In breakout groups, participants discussed three of the five scenarios in-depth, with the remaining scenarios briefly discussed, and further elaborated in a follow up internal workshop.

The sense-making workshop was organised to utilise the scenarios, in conjunction with the results of the Delphi survey to assess the possible futures for R&I activities and policy within the EU. Organisational sense-making processes (Weick 1995, 2005) are highly dependent on context and focus area, in this case, stakeholders in R&I and R&I policy, and are contingent on key questions that guide activities.

Each of the small group discussions started with a Mental Time Travel (Cuhls 2016) to dive into the scenario. The first discussion topic asked participants to consider their group's scenario world from a personal point of view. Then they changed their perspectives:

- Personal perspective: How does the world around you look like in 2040?
- Societal perspective: What are preferable/avoidable elements of this scenario for the European societies?
- R&I (policy) perspective: What are key R&I (policy) activities (structures institutions and procedures) to achieve or avoid these elements?

This activity aimed to enable participants to formulate a personal understanding of that scenario, and to better engage with the scenario's implications.

Participants were then asked to identify preferable or avoidable elements of the specific scenario for European societies and then to discuss the potential key R&I policy activities (structures, institutions and procedures) to achieve or avoid the developments (see figure A3).

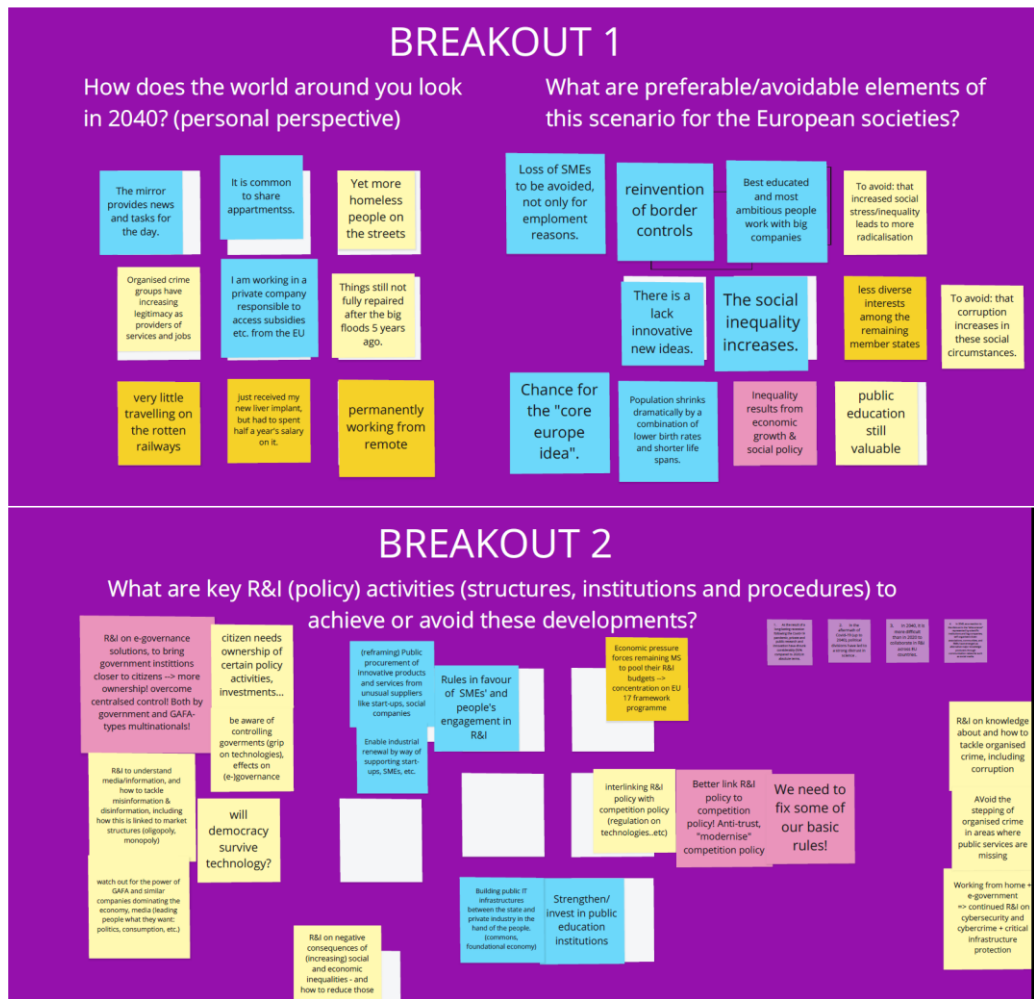


Figure 11 - A3: Key R&I issues derived from the scenarios - board sense-making workshop

In this workshop, sense-making activities revolved around three of the scenarios and their overt or implied ramifications for R&I practice and policy landscapes across the EU. Three of the five scenarios could be discussed in working breakout groups, taking out the **Circular trials and real-life errors** (here, similar discussions as in **Green Utopia and new hope** were expected) and the **Back to 'normal'** as this indicated little change as compared to pre-COVID times. Each of the small group discussions started with a Mental Time Travel (Cuhls 2016), followed by questions from different perspectives:

In sharing and discussing each of these questions within the small groups, the sense-making activities were structured to achieve three things: First to encourage participants to immerse themselves within the scenario world and

reflect on the implications described in the text. Having established a cognitive relationship with the scenario, participants were then asked to identify elements of the scenario that were desirable or undesirable from their perspective. Lastly, participants were encouraged to reflect on the scenario's implications for R&I, given their present-day expertise in the field. These final reflections then served as initial inputs for the plenary discussion centred on the present state of R&I policy and how it might be wielded with respect to the desirable and undesirable elements of each reviewed scenario. In the plenary, sense-making involved discussions about potential research and innovation policies or instruments, with respect to the different driving forces, societal developments and actor groups outlined in each of the scenarios. Thus, the discussions not only addressed new thematic R&I areas, but also new ways of acting with, and upon, existing R&I policy, including new processes, instruments and actors.


5.2 Table A1: Scenario and Delphi statement connection (1-direct, 2-indirect)

Statements (1 = original connection; 2 = connected, too)	BACK TO 'NORMAL'	THE LONG RECESSION	GREEN UTOPIA NEW HOPE	BIG TECH SHAPES EUROPE	CIRCULAR TRIALS AND REAL LIFE ERRORS
1. As the result of a long-lasting recession following the Covid-19 pandemic, private and public research and innovation have shrunk considerably (50% compared to 2020) in absolute terms.		1		2	
2. In the aftermath of Covid-19 (up to 2040), political divisions have led to a strong distrust in science .	2	1		2	
3. In 2040, it is more difficult than in 2020 to collaborate in R&I across EU countries.	2	1			
4. In 2040, as a reaction to the distrust in the "elite science" represented by scientific institutions and big companies, self-organised citizen associations, communities, and SMEs have emerged as alternative major knowledge producers through communication networks such as social media.		1		2	
5. In 2040, EU research and innovation programmes support only EU missions and policies.	1		2		2
6. In 2040, urban areas remain attractors for talent and hotspots of research and innovation.	1		2	2	
7. In 2040, because of collapsing ecosystems all available research and innovation is directed towards slowing or reversing environmental degradation and addressing the effects of climate change.	1		2		2
8. In 2040, the EU has achieved uneven progress between countryside and urban areas in its "Green Deal" objectives. In the countryside, the green transition has been achieved in agriculture, whereas in urban areas energy, sustainable mobility and housing are still EU R&I priority.			1		2
9. Research and innovation about climate change are still funding priorities in 2040.	2		1		2
10. The digital transition has made societies in the EU more sustainable by 2040.	2		1	2	2
11. In the EU of 2040, the shift in work and consumption patterns towards local economies has had a strong influence in making the EU green and sustainable.			1		2
12. In the EU of 2040, policy, incentive schemes, and campaigns have created changes in food consumption patterns towards a sustainable society.	2		1		2
13. In 2040, the EU is still a world leader in the pursuit of the Sustainable Development Goals (SDGs) with major contributions from its research and innovation programme in achieving this position.	2		1		2
14. In 2040, there is a global consensus that science, research and innovation are the key factors for a sustainable world and human wellbeing, and citizens engage in science and participate in research and innovation projects.	2		1		2
15. In 2040, multinational corporations are responsible for the vast majority (90%) of the funding, implementation, and management of research in the EU.	2	2		1	
16. In 2040, global corporations have captured governments, and channel important parts of public research and innovation budgets towards purposes that serve the interests of multinational companies.	2	2		1	
17. In 2040, education is entirely in private hands, training students for the requirements of work in their client industries.	2			1	
18. In 2040, the EU, China and the USA make up the top 3 most advanced research and innovation entities in the world.	2	2		1	2
19. By 2040, international agreements have drastically reduced non-renewable resource extraction and led to substantial increase in support for research and innovation towards finding substitutes.	2		2		1
20. In 2040, more than 90% of all materials and waste is physically recycled or re-used energetically in the circular economy.	2	2	2		1
21. In 2040, research and innovation in genetic engineering in the EU is used for reversing damages caused by the loss of biodiversity.	2				1

5.3 Questionnaire - Research Design

A Delphi survey is a survey with feedback (see for classic Delphi surveys e.g. Gordon and Helmer 1964, Thuroff and Linstone 2002, Cuhls 2019b), in two or more rounds or in our case as a Real-time Delphi survey (Gordon and Pease 2006; Aengenheyster et al. 2017; new example BMZ 2020 or European Commission 2017) giving feedback when a certain number of participants is reached - and here, when the participants went through the survey once. In a second go or when re-entering the survey, statistical feedback and feedback on the argumentation texts was provided. Participants (experts in a broad definition with different backgrounds) were then able to change their assessment and give additional feedback.

With the invitation, the experts received a personal link to enter as often as they liked. The questionnaire asked about the experts' background and then started with a statement, which had to be assessed and commented on. For the questionnaire, see below.



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Page 2

Please answer a few questions about yourself first

In which sector are you working?

Academia

Industry

Public sector

NGO or individuals from civil society

other, please specify:

Which country do you live in?

What is your age?

up to 30 years

31 to 50 years

51 to 65 years

66 years and older

What is your gender?

female

male

diverse

no answer

What is your dominating disciplinary background?

- Natural sciences
- Technical sciences
- Economics and business administration
- Social sciences and humanities (including law)
- other, please specify:


Note:

If you click the "go ahead" arrow your responses will be saved and you can proceed with the first statement.



Save Pause

One example page (same design for all statements, statements in random order):



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Page 3

Shrinking R&I budgets

As the result of a long-lasting recession following the Covid-19 pandemic, private and public research and innovation have shrunk considerably (50% compared to 2020) in absolute terms.

1. What is the likelihood of this occurring? -

- very likely
- likely
- somewhat likely
- unlikely
- very unlikely
- not likely

2. How important is this potential development for research and innovation policy?

Note: Please answer this question even if you do not think the development is likely.

- very important
- important
- medium important
- less important
- not important
- I don't know

3. Please give reasons for your likelihood and importance ratings:



My Answer All Answers

Note:

If you click the "go ahead" arrow your responses will be saved and you can proceed with the next statement.

If you need to interrupt, click on the "pause" button. All answers up to that page have already been saved and you can come back to the survey with the same link whenever you have time to continue.



 Save  Pause

last page



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Page 24



Your comments

Are there any topics or aspects regarding the statements that you would like to add?

My Answer

Note: If you click the "go ahead" arrow your responses will be saved and you can proceed with the last page.



 Save  Pause



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Page 25

Thank you for your participation.

The responses of all Delphi participants are accessible to you anytime as the Delphi progresses with its evaluations. To that end, you only need to click on the 'Graphs', 'Stats', or 'Comments' tabs next to your own explanation to access the views of other participants.

We encourage you to revisit the survey as often as you like over the next three weeks that the survey is open to review the responses made by other participants.

You may consider, in the light of your peers' responses, whether you would like to go back to modify your answers and comments.

During the period that the survey is open, we will be sending you additional notifications inviting you to review the aggregated responses of other participants, and to comment or change your responses accordingly.

Note for revision or results:

You can access the group's responses by clicking the red arrow, choosing a specific thesis below or selecting a statement at the top 'page selector'. You will proceed with your evaluations and the results of all participants.

If you modify your answers or comments please click on the "save" button at the bottom of the page. Your responses will be saved and the results refreshed.

Again, please do not include any confidential, personal, or company information in your comments.



Table of Content: theses title

[Shrinking R&I budgets](#)

[Distrust in science](#)

[R&I collaboration in EU difficult](#)

[Major knowledge producers](#)

[Missions and policies](#)

[Urban areas attractive](#)

[Ecosystems collapsing](#)

[Research priorities for green transition](#)

[R&I funding against climate change](#)

[Digital transformation](#)

[Shift in work and consumption patterns](#)

Figure 12 - A4: Delphi Questionnaire - different pages

5.4 Demographic data Delphi survey

- Experts: 401 individuals approached
- 111 participants in the EU-28 countries
- background diverse, general, Foresight, R&I policy experts
- Mailing: between March 24 and April 13, 2021, 2 reminders
- Due to strong spam filters, 43 did not receive the invitation
- Platform: E-Delphi platform Calibrum for the realtime feedback

- 111 experts took actively part
- Gender: slightly unbalanced with 61 male and 40 female participants
- Country distribution: more from Austria than from other countries but representatives from nearly all EU countries participated

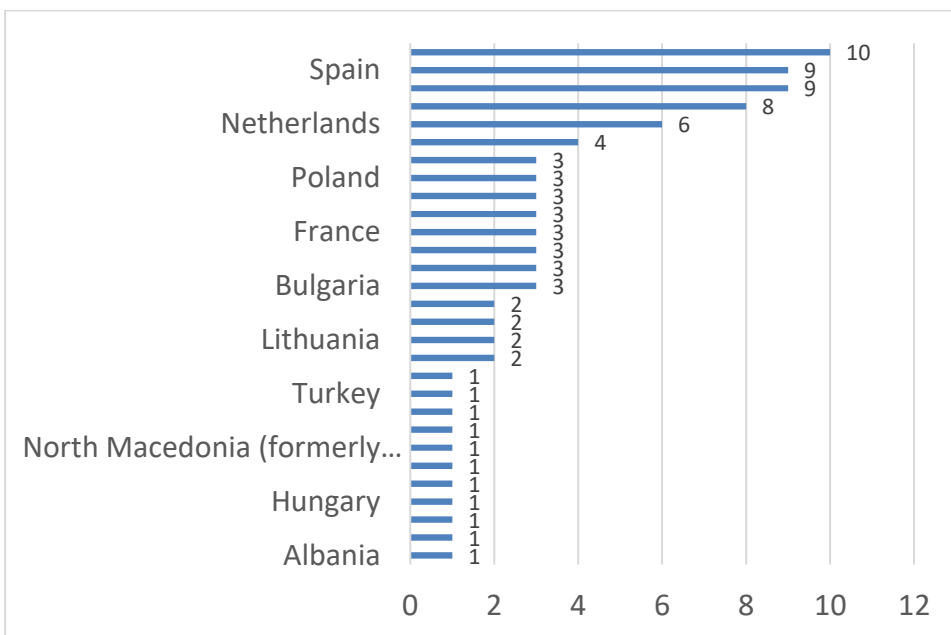


Figure 13 - A5: Countries where the Delphi participants work

Background: most participants from academia, and here: social sciences and humanities but also participants from the public sector and industry, here: economics and business administration also well represented

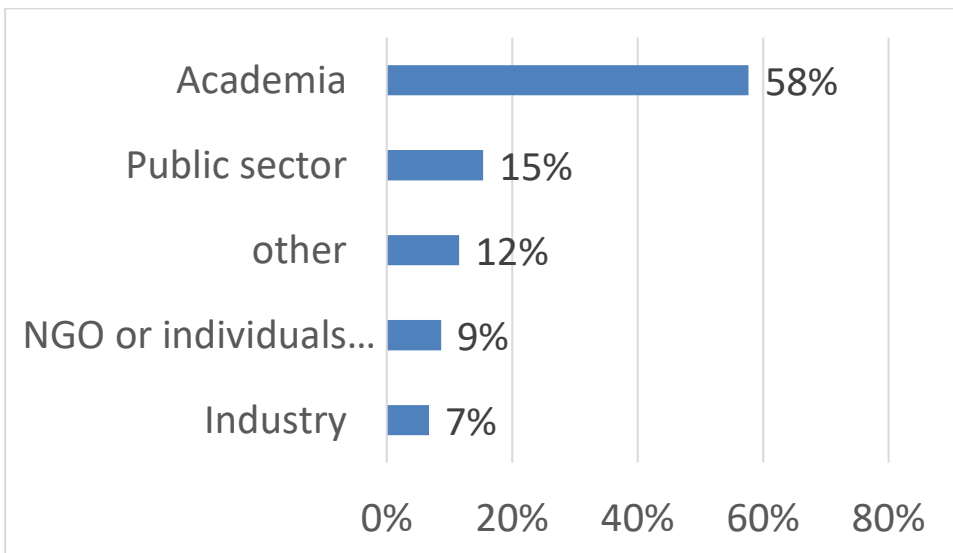
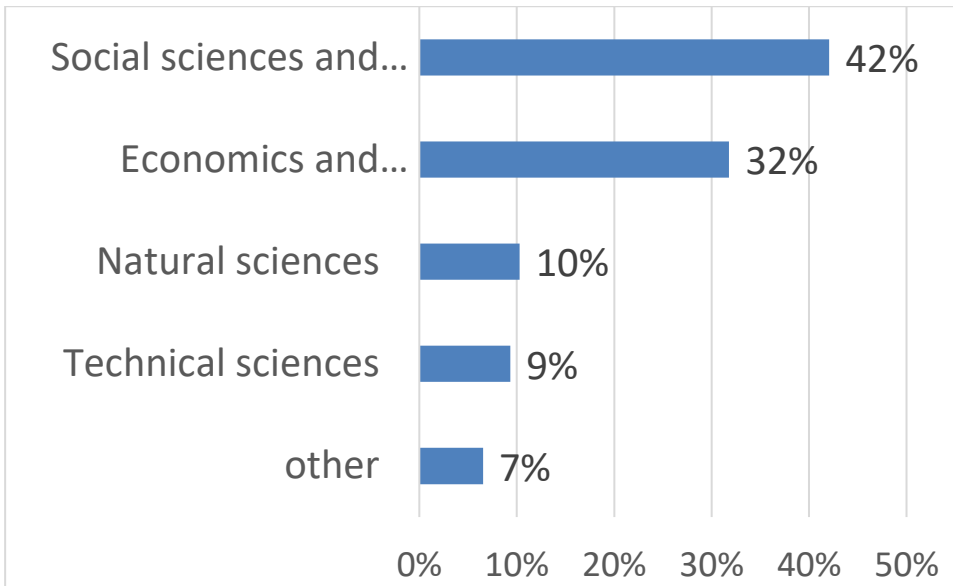


Figure 14 - A6: Backgrounds of the Delphi Participants

Experts representative for the knowledge field of R&I policy in general

5.5 The Delphi Results in detail: Single Statements - Likelihood and Importance

The following graphs in figures A 7 show the results for the questions on likelihood and importance for each single statement. n is the number of respondents for each answer.

Statement 1: Shrinking R & I Budgets

As the result of a long-lasting recession following the Covid-19 pandemic, private and public research and innovation have shrunk considerably (50% compared to 2020) in absolute terms.

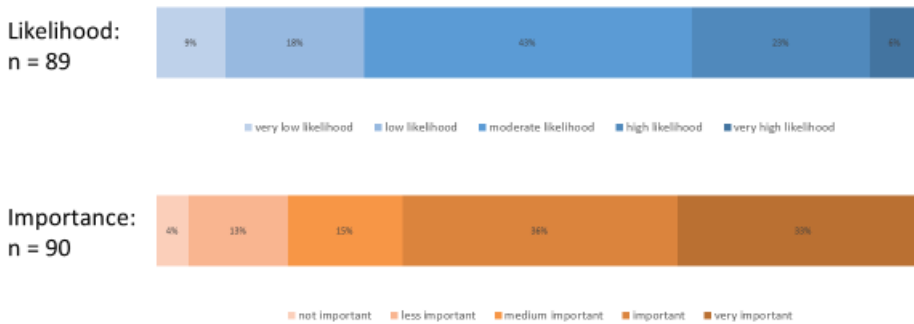


Figure 15 - A7: Delphi Statement 1 (Likelihood and Importance)

Statement 2: Distrust in Science

In the aftermath of Covid-19 (up to 2040) political divisions have led to a strong distrust in science.

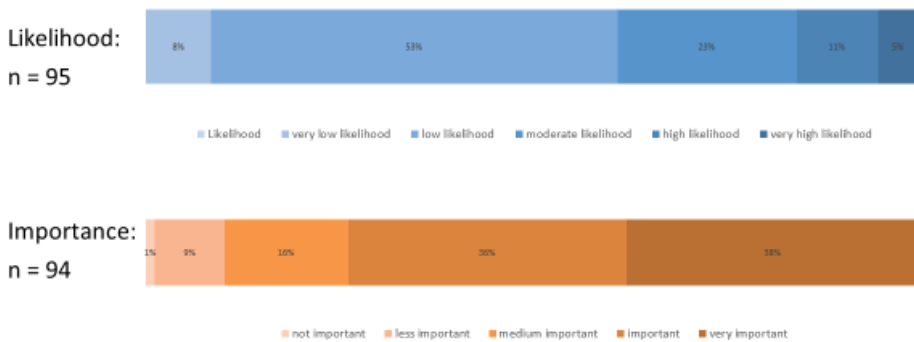


Figure 16 - A8: Delphi Statement 2 (Likelihood and Importance)

Statement 3: R&I collaboration in EU difficult

In 2040, it is more difficult than in 2020 to collaborate in R&I across EU countries.

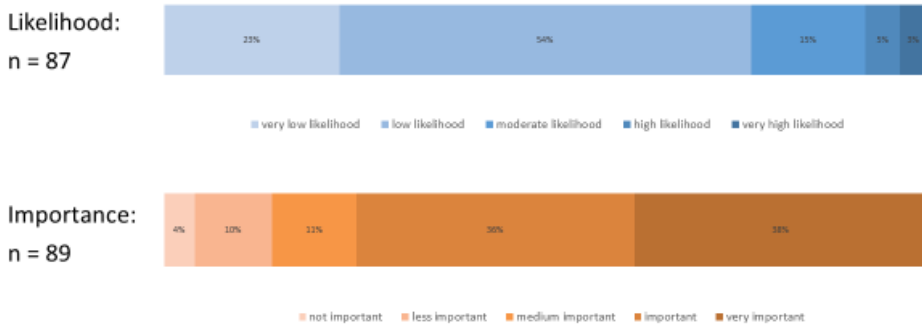


Figure 17 - A9: Delphi Statement 3 (Likelihood and Importance)

Statement 4: Major knowledge producers

In 2040, as a reaction to the distrust in the 'elite science' represented by scientific institutions and big companies, self-organised citizen associations, communities, and SMEs have emerged as alternative major knowledge producers through communication networks such as social media.

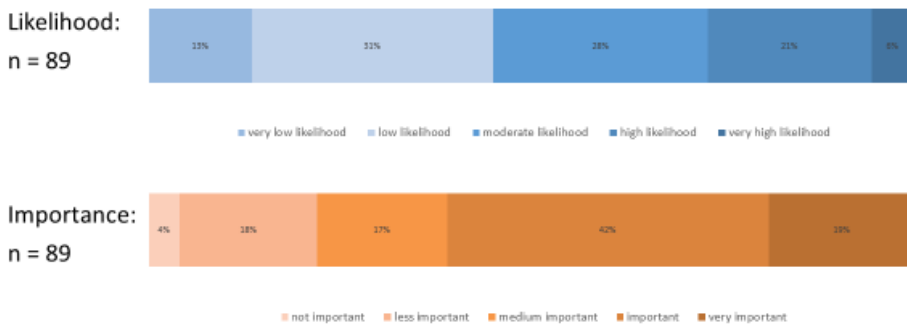


Figure 18 - A10: Delphi Statement 4 (Likelihood and Importance)

Statement 5: Missions and policies

In 2040, EU research and innovation programmes support only EU missions and policies.

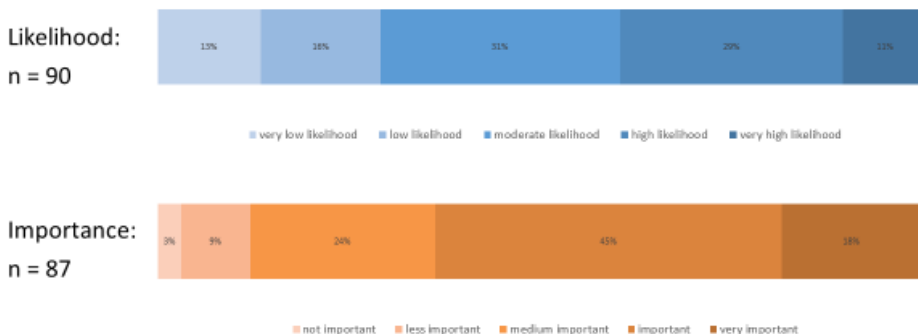


Figure 19 - A11: Delphi Statement 5 (Likelihood and Importance)

Statement 6: Urban areas attractive

In 2040, urban areas remain attractors for talent and hotspots of research and innovation.

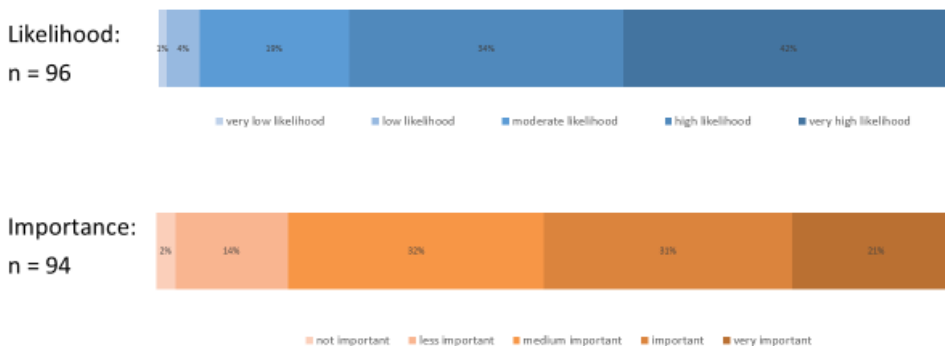


Figure 20 - A12: Delphi Statement 6 (Likelihood and Importance)

Statement 7: Ecosystems collapsing

In 2040, because of collapsing ecosystems all available research and innovation is directed towards slowing or reversing environmental degradation and addressing the effects of climate change.

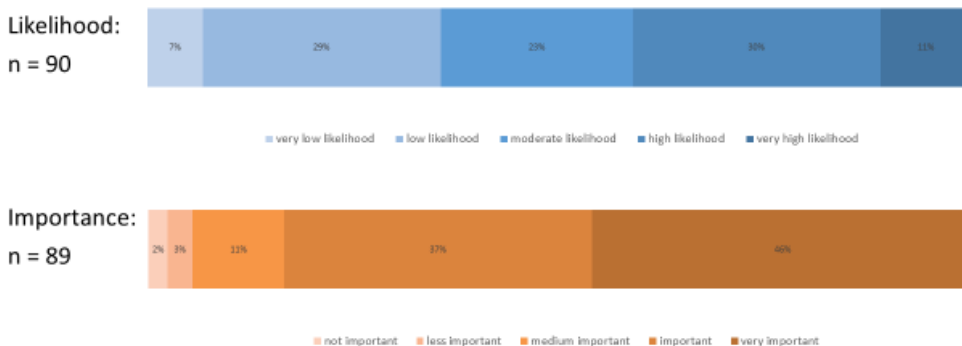


Figure 21 - A13: Delphi Statement 7 (Likelihood and Importance)

Statement 8: Research priorities for green transition

In 2040, the EU has achieved uneven progress between countryside and urban areas in its 'Green Deal' objectives. In the countryside, the green transition has been achieved in agriculture, whereas in urban areas energy, sustainable mobility and housing are still EU R&I priority.

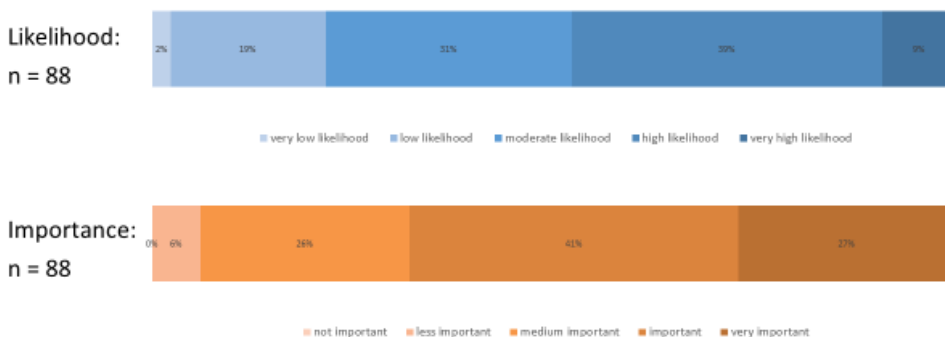


Figure 22 - A14: Delphi Statement 8 (Likelihood and Importance)

Statement 9: R&I funding against climate change

Research and innovation about climate change are still funding priorities in 2040.

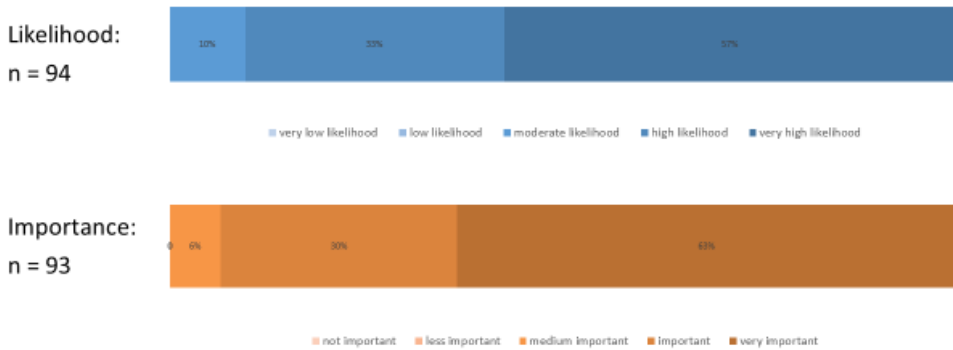


Figure 23 - A15: Delphi Statement 9 (Likelihood and Importance)

Statement 10: Digital transistion

The digital transistion has made societies in the EU more sustainable by 2040.

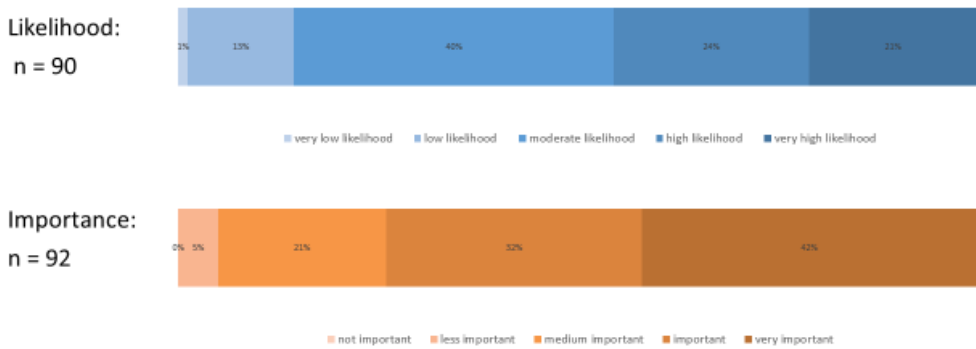


Figure 24 - A16: Delphi Statement 10 (Likelihood and Importance)

Statement 11: Shift in work and consumption

In the EU of 2040, a shift in work and consumption patterns towards local economies has had a strong influence in making the EU green and sustainable.

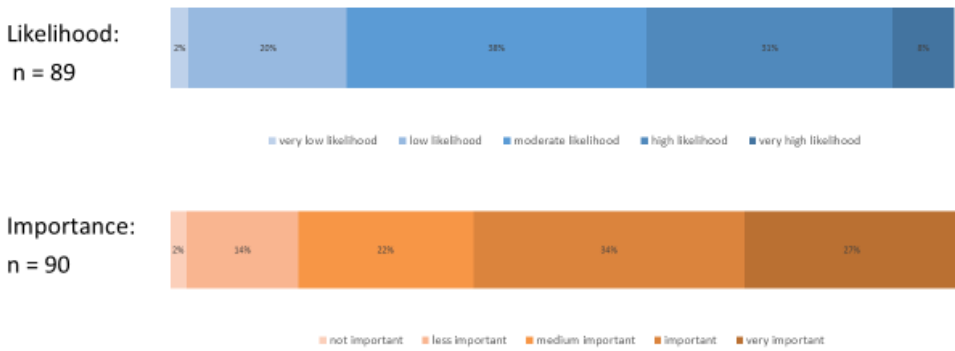


Figure 25 - A17: Delphi Statement 11 (Likelihood and Importance)

Statement 12: Changes in food consumption

In the EU of 2040, policy, incentive schemes, and campaigns have created changes in food consumption patterns towards a sustainable society.

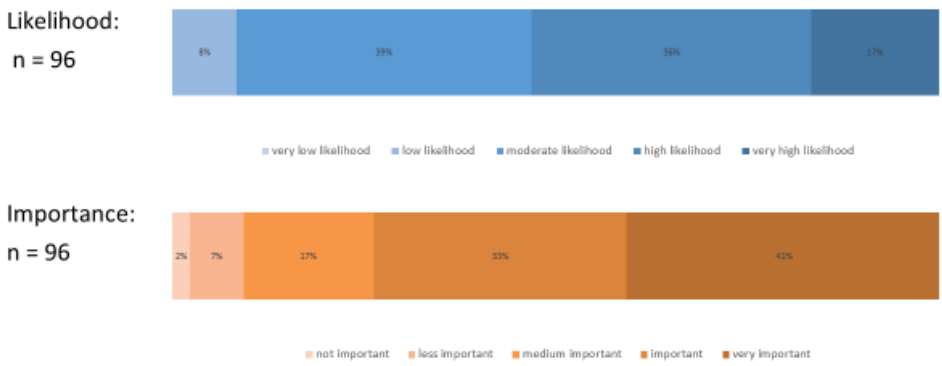


Figure 26 - A18: Delphi Statement 12 (Likelihood and Importance)

Statement 13: EU as world leader in pursuit of SDGs

In 2040, the EU is still a world leader in the pursuit of the Sustainable Development Goals (SDGs) with major contributions from its research and innovation programme in achieving this position.

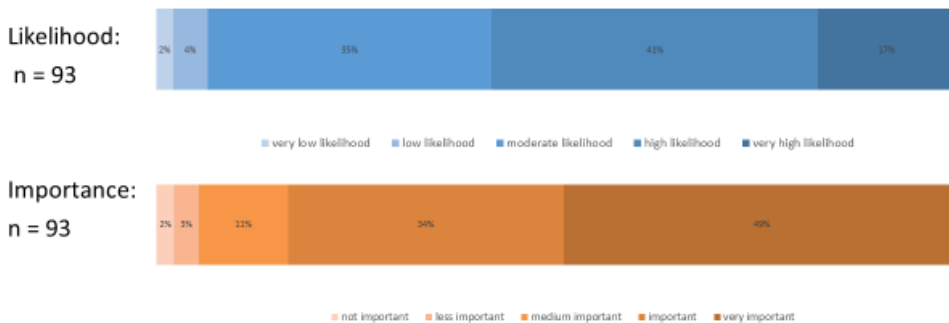


Figure 27 - A19: Delphi Statement 13 (Likelihood and Importance)

Statement 14: Global consensus that STI is key

In 2040, there is a global consensus that science, research and innovation are the key factors for a sustainable world and human wellbeing, and citizens engage in science and participate in research and innovation projects.

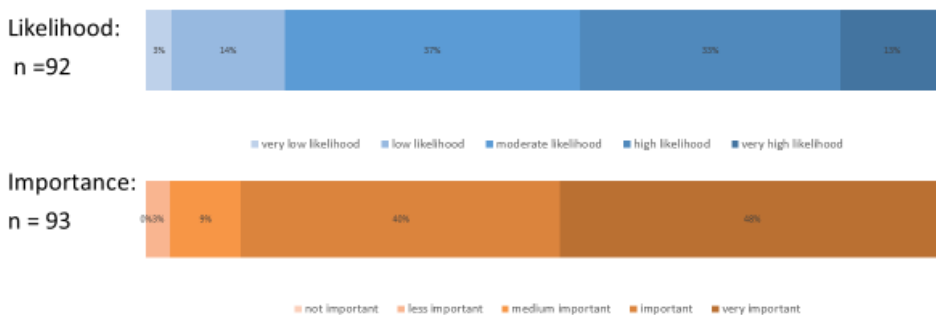


Figure 28 - A20: Delphi Statement 14 (Likelihood and Importance)

Statement 15: Multinationals responsible for funding

In 2040, multinational corporations are responsible for the vast majority (90%) of the funding, implementation, and management of research in the EU.



Figure 29 - A21: Delphi Statement 15 (Likelihood and Importance)

Statement 16: Multinationals captured governments

In 2040, global corporations have captured governments, and channel important parts of public research and innovation budgets towards purposes that serve the interests of multinational companies.

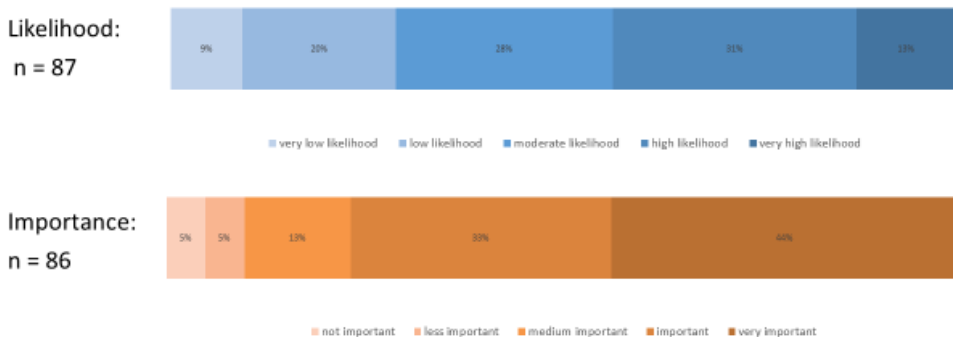


Figure 30 - A22: Delphi Statement 16 (Likelihood and Importance)

Statement 17: Education as a business

In 2040, education is entirely in private hands, training students for the requirements of work in their client industries.

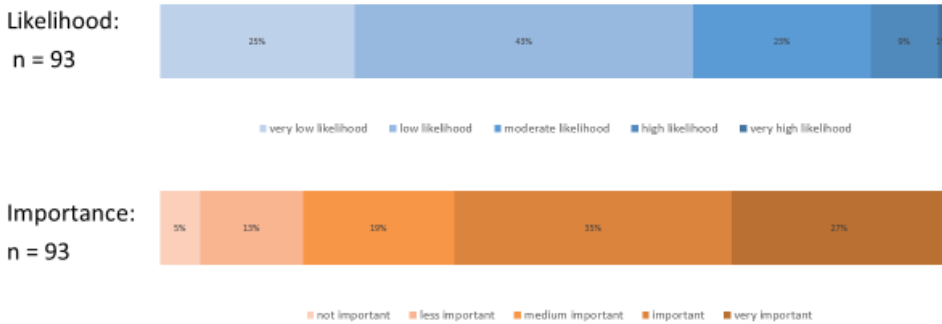


Figure 31 - A23: Delphi Statement 17 (Likelihood and Importance)

Statement 18: EU, China and USA as top 3

In 2040, the EU, China and the USA make up the top 3 most advanced research and innovation entities in the world.

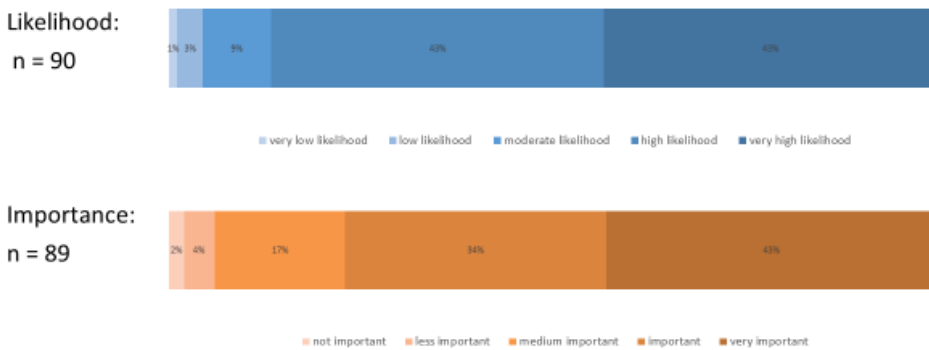


Figure 32 - A24: Delphi Statement 18 (Likelihood and Importance)

Statement 19: Reduced non-renewable resource extraction

By 2040, international agreements have drastically reduced non-renewable resource extraction and let to substantial increase in support for research and innovation towards finding substitutes.

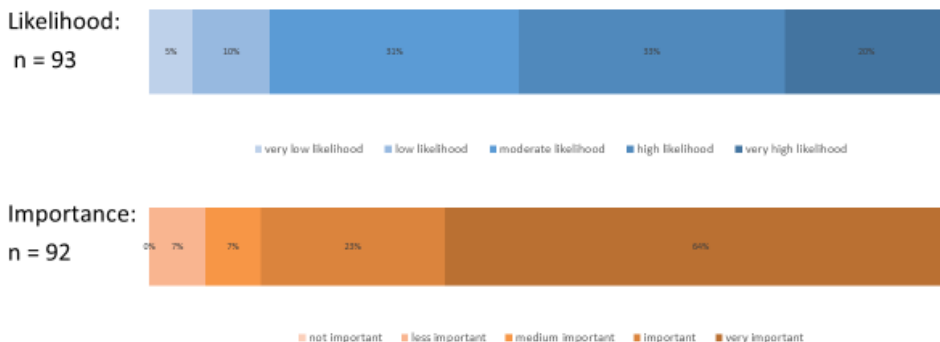


Figure 33 - A25: Delphi Statement 19 (Likelihood and Importance)

Statement 20: Circular economy

In 2040, more than 90% of all materials and waste is physically recycled or re-used energetically in the circular economy.

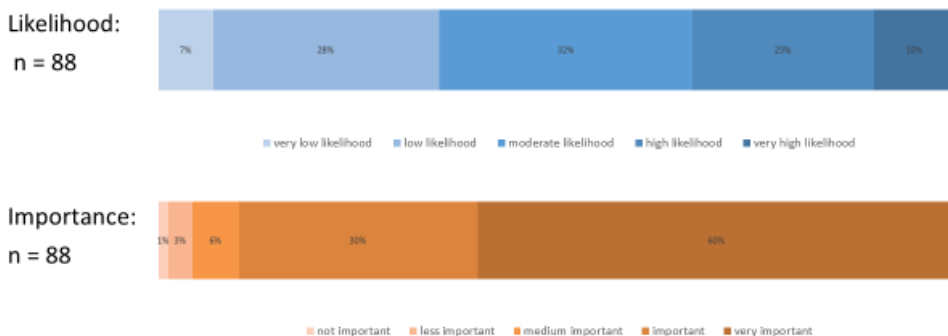


Figure 34 - A26: Delphi Statement 20 (Likelihood and Importance)

Statement 21: Reverse damages in biodiversity with genetic engineering

In 2040, research and innovation in genetic engineering in the EU is used for reversing damages caused by the loss of biodiversity.

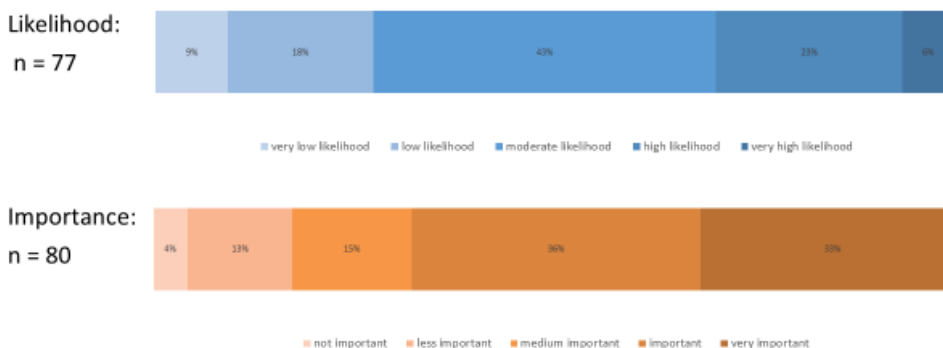


Figure 35 - A27: Delphi Statement 21 (Likelihood and Importance)

5.6 Sources from the Horizon Scanning

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The purpose of the study **AFTER THE NEW NORMAL: SCENARIOS FOR EUROPE IN THE POST COVID-19 WORLD** was to chart the scope of change that the Covid-19 pandemic may bring to the context of the EU itself and EU R&I policy. Five scenarios were designed in a process including the Horizon Europe Network - with horizon scanning, online workshops and scenario writing. The five context scenarios are: The long recession, Back to 'normal'? Big Tech shapes Europe, The Circular Economy and Green Utopia - new hope. They include the numerous disruptions to our daily lives from the Covid-19 lock-downs to 2040 and describe the extent, to which the pandemic might raise new requirements for the EU's future policy frameworks, initiatives and programmes, for example in terms of impact, time horizon of projects or investments.

Studies and reports

