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**Foresight
On Demand**



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Dear reader,

Welcome to the third issue of Horizon Futures Watch. Here, we delve into two interrelated themes that may frequently be paired together (or seen in isolation): the future of green skills and the future of big tech.

Sustainability meets technological progress. A focus on green skills may be amplified with the entrance of innovative, data-driven technologies. Technology may sometimes be viewed as the answer to the need for more sustainable processes, while green skills may provide the essential human touch necessary to ensure these advancements are effectively and ethically applied. But is this always the case? And is there a universally optimal balance between the two? Such questions are explored in the six different projects that follow.

An overview of the latest selection of [news](#) about foresight projects and topics opens the issue. The [Foresight in the Field](#) section presents a report on the EEA's recently published Horizon Scanning – Tips and Tricks.

Turning towards the ['Foresight on Green Skills and Jobs'](#) section, you will find:

[Now Hiring: Low-Carbon Specialists for a Sustainable Europe](#) – Project INNOPATHS explores different forward-looking scenarios leading to a completely decarbonised energy system in Europe by 2050. Each pathway to decarbonising the energy system has been analysed to highlight the economic impact of each choice.

[Shaping the Skills Needed for the Future of Automated Mobility](#) – WE-TRANSFORM leverages existing data and the collective expertise of individuals to understand the skills required in light of automation and its impact on mobility's future development.

[Connected Factories and their pathways for a circular economy](#) – Pathways for a circular economy and the skills required are explored through Connected Factories' overview of technological approaches toward digitalisation of manufacturing.

The ['Foresight of Big Tech'](#) section explores:

[With Big Tech comes Big \(Ethical\) Responsibility](#) – TechEthos, a Horizon 2020 project, wants to facilitate “ethics-by-design” in order to push ethical and societal values into the design and development of new and emerging technologies at the very beginning of the process.

[Curbing the Elusive Force of 'Modern Bigness'](#) – Project MOBI stretches the legal dimension, searching for normative responses to Big Tech's composite power threats to free market competition and European democratic values.

[Connecting... Futures: The Road to 6G and the Right to Connectivity](#) – Hexa-X's 6G flagship research is shaping the design of European wireless technologies to be environmentally, socially, and economically sustainable, while ensuring competitiveness in the global market.

To conclude, a selection of content from the Futures4Europe platform features [Design Futures art-driven Methodology: Shaping the Future of Innovation](#) and [Is Hydrogen that Good For the Climate?](#). And, as always, a selection of upcoming events to not miss out on in the world of foresight!

Sincerely,

The Editorial Team of Foresight on Demand (Hywel Jones, Laura Galante, Emma Coroler, Alexandre Lotito, Giovanna Giuffré, Loredana Marmora, Valentina Malcotti)

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NEWS BULLETIN



Source: European Parliament

loss and collapse.

European Parliament EPRS Roundtable: Future shocks 2023 – Anticipating and weathering more storms to come

7 September 2023

On 7 September 2023, the annual 'Future Shocks' event was held in the library of the European Parliament. This year it explored global risks, highlighting specific risks with the potential for a significant impact on the EU, and analysing the existing capabilities, resilience, and possible responses of the EU system in the face of these multiple challenges. You can find [here](#) a recap of the event's programme, speakers biographical details, as well as 'Future Shocks' policy podcasts on biodiversity



Source: Climate Foresight

Deep into the future planet: Telling climate stories and how they intertwine with our individual and collective lives, across all levels and dimensions

3 August 2023

In this interview with Elisabetta Tola – science and data journalist, and author of the [Foresight – Deep into the Future Planet](#) podcast produced by the CMCC (Centro Euro Mediterraneo Sui Cambiamenti Climatici) – she tells about the process of creating a podcast that delves into climate stories through a forward-looking lens. You can find the interview [here](#).



Source: UNESCO

UNESCO-PMU Symposium: towards evaluation frameworks for futures literacy and foresight

21-22 June 2023

The 'UNESCO-PMU Symposium 2023: Towards Evaluation Frameworks for Futures Literacy and Foresight' took place in Paris on 21 and 22 June 2023. Participants were able to share reflections on futures-oriented work and delve into various facets of review and evaluation processes while also charting the landscape of current evaluation practices. You can find the report of this event [here](#).



Source: <https://op.europa.eu/>

Industry 5.0 and the future of work: Making Europe the centre of gravity for future good-quality jobs

July 2023

The future of work will be shaped by numerous factors, including labour displacement, skill shortages, emerging economic problems, automation and increased competitiveness and strategic autonomy. This policy brief from ESIR looks specifically at the intersection between industrial transformation and the future of work. You can find the report [here](#).



JRC to collaborate on foresight with Japan's National Institute of Science and Technology Policy

13 July 2023

On 13 July 2023, the JRC and Japan's National Institute of Science and Technology Policy (NISTEP) signed a Research Framework Arrangement in the field of Foresight. Both institutions have an interest in collaborating on the shared objective of advancing cooperation in scientific and methodological aspects of strategic foresight, with a specific emphasis on

visioning and technology foresight. You can find the Joint Statement from the EU-Japan Summit [here](#).

Source: JRC

FORESIGHT IN THE FIELD

Addressing underlying assumptions: Tips and Tricks on Horizon Scanning

By Emma Coroler



Photo by Karsten Würth on Unsplash

On 16 August 2023, the European Environment Agency (EEA) [published](#) the practical guide 'Horizon Scanning – Tips and Tricks.' This publication is produced by the European Environment Information and Observation Network (EIONET), which is a partnership network of the EEA involving 38 cooperating countries. Working closely with the EEA, EIONET is responsible for collecting and developing data, knowledge, and advice for policymakers regarding Europe's environment.

The guide offers step-by-step support on how to frame, run, analyse, and communicate the results of a systematic horizon scan for practitioners with different professional backgrounds and levels of experience. It presents a practical methodology structured into four key steps: Signal Spotting, Signal Scanning, Sense Making and Communication. The publication was designed with the aim of enhancing and developing the capabilities of the 38 countries within the EIONET Network to conduct foresight exercises, particularly horizon scanning. According to Richard Filcak, Head of Group Systems, Foresight, and SOER at the European Environment Agency: “After a couple of years of experience with horizon scanning, we had the feeling that we had a lot of things to share. This publication was an attempt to systematically bring together bits and pieces of information, practices and tips and tricks.”

While the guide's primary focus remains directed at environmental stakeholders, its scope goes beyond just the EIONET Network, as it may also be valuable to individuals and organisations outside the network that specialise in foresight practices. This publication assumes greater practical significance amid a rising demand for foresight, fuelled in part by the European Commission's commitment to incorporate foresight methodologies into policy formulation and response strategies.

The guide also highlights the importance of addressing cognitive biases and underlying assumptions in the process of Horizon Scanning. These biases and assumptions wield significant influence over one's capacity to detect weak signals, navigate future possibilities, assess the present, and interpret the past.

Filcak noted that the effectiveness of Horizon Scanning is also closely tied to the diversity and inclusivity of the expert group involved. A more diverse group of experts can broaden perspectives and consider various angles, thus breaking silo thinking. As Filcak highlights, “Sometimes, it takes just one person within the group to introduce provocative questions and alternative viewpoints that can change the entire dynamic”.

When contemplating the future, Filcak questioned the potential limitations of horizon scanning when spotting potential causes of uncertainty in complex interplay between climate change, socio-economic disparities, and technological advancements. As he stated: “My worry would be if these horizon scanning techniques are sufficient to determine key risks and opportunities requiring attention, while we face more and more complicated questions. Foresight methods provide interesting inputs, but I think we are moving in circles with a couple of methodologies which have been in use for 10, 15 or more years. The question is whether you can think out-of-the box in terms of new approaches and methodologies.”

For him, one emerging field in foresight is the “combination of both quantitative and qualitative techniques, with an emphasis on building connections between environmental, social, and economic indicators and finding effective ways to translate them into models.”

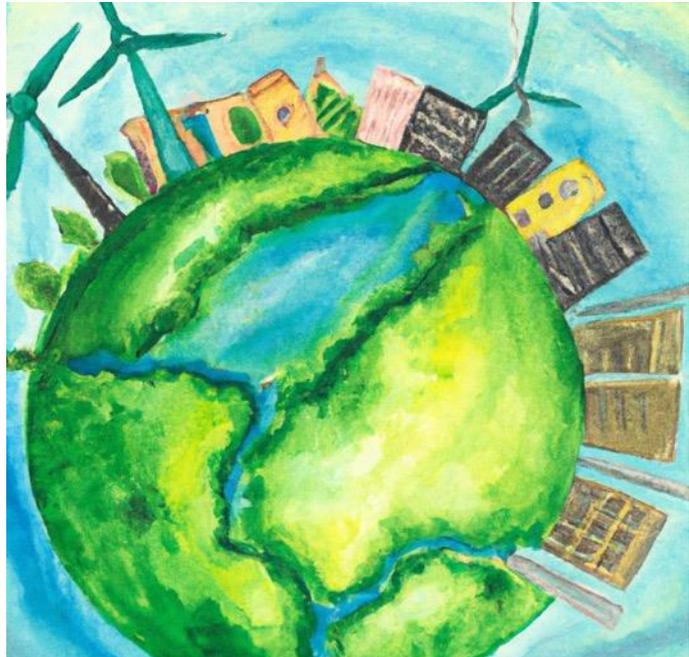
FORESIGHT ON GREEN SKILLS AND JOBS

Now Hiring: Low-Carbon Specialists for a Sustainable Europe

By Hywel Jones and Laura Galante

Project INNOPATHS explores different forward-looking scenarios leading to a completely decarbonised Europe by 2050. How attainable are these pathways and what are the skills in demand?

When designing their innovation pathways for a decarbonised Europe, the team of the [INNOPATHS \(innovation in pathways, strategies and policies\)](#) project took the EU Green Deal's objective to heart. The project explored different forward-looking scenarios leading to a completely decarbonised Europe by 2050. Each pathway to decarbonising the energy system has been analysed to highlight the economic impact of each choice. The project also developed online tools to help policymakers, industry, scientists, and other stakeholders understand the implications for the technological and economic transition (and the skills needed).



This image was generated with the help of GPT-3.

We spoke with the project leader, Paul Ekins, professor of Resources and Environmental Policy at [University College London](#). “We were interested in the various ways that Europe could reach net zero emissions”, he says. The project's web-based [Low Carbon Pathways Platform \(LCPP\)](#)

provides easy access to the technological details of these decarbonisation pathways, from energy carriers to conversion technologies. Anticipating potential future scarcities will help policymakers shape the transformation to a climate-neutral economy.

Working with stakeholders from industry, policymaking and society, the project developed three future narratives:

- In the first, “New Players and Systems”, new companies and entrepreneurs come into the energy system with new technologies, bridging the divide between utilities and customers, changing both supply and demand in a more decentralised system.
- The second, called “Incumbents' Renewal”, assumes fossil fuel companies and big utilities adapt by pivoting towards renewable energy and carbon capture and storage. This supply-side transition would imply less infrastructure and consumer change.
- The third, “Efficiency and Sufficiency”, projects a future where lifestyles change to prioritise energy and resource efficiency, as well as health and non-material well-being.

These narratives were then translated into the quantitative scenarios accessible via the LCPP tool, using a combination of energy system models. “One model was run concerned with the electrification of industry,” says Professor Ekins. “Another model was concerned with the co-benefits of the CO₂-reduction pathway through the reduction of air pollution.”

The project found that across all strategies and models, there are “no-regret” options, such as accelerated renewables deployment, increased electrification across all sectors, and bringing carbon dioxide removal (CDR) technologies and e-fuels to maturity.

“They all came up with more or less the same macroeconomic picture,” says Professor Ekins. “They all suggested there would be only a very small reduction in GDP growth, one so small that it wouldn’t be noticeable, and in most countries, you actually get a positive economic outcome if you put monetary values on the improvements in air quality that go along with reduced use of fossil fuels.”

Each narrative has different implications for the technologies and therefore the skills needed in the workforce: the “New Players and Systems” scenario is centred on renewable technologies, battery-electric vehicles, and heat pumps; “Incumbents’ Renewal” focuses on Carbon Capture and Storage (CCS), nuclear power and synthetic and bio-based fuels; circular economy and lifestyle changes are the main drivers behind “Efficiency and Sufficiency”.

“We had a specific work programme on the issue of green skills,” Professor Ekins says, “Obviously there are some technologies which will be much more used in some pathways than others.”

The project produced a policy brief on decarbonisation’s impact on labour markets and skills. In particular, the team found that increases in energy prices will tend to favour employees with technical skills rather than manual workers, and while this may have large effects on employment in individual firms, it is likely to have less effect for the economy as a whole.

“When you’re talking about getting to net zero, every single economic sector will need to decarbonise,” emphasises Professor Ekins, “and many of the skills that they will use to decarbonise will be the same skills they use at the moment.”

Even the switch from a diesel to a hydrogen bus would demand many of the same skills – from the manufacturing of the vehicle’s body to driving it in service. The biggest differences would be in the engine and infrastructure, although even here, “many of the skills that you would use to redesign the bus are very similar to the skills that you would use to design a diesel one”, he says.

Overall, while the project found that barriers to decarbonisation are not insurmountable, no matter the pathway, portions of the workforce would indeed need new skills. The European Green Deal should therefore make significant provision for retraining, taking account of the nature of workers’ existing skills and the distribution of green industries across EU countries and regions. Based on US experience, the project also concluded that green subsidies are more effective in regions with the appropriate green skills.

By examining different potential scenarios for future decarbonisation, and analysing the associated challenges and benefits, INNOPATHS is helping policymakers make informed steps towards a climate-neutral future.

Shaping the Skills Needed for the Future of Automated Mobility

By Laura Galante

In the fast-moving realm of mobility, one fact stands out: the road to success requires new skills. To meet evolving customer needs, embrace cutting-edge technologies, and fulfil environmental commitments, the transport sector is turning to automation for sustainable, cost-effective, and inclusive mobility solutions. However, the interplay between automation, reskilling, and sustainability is more complex than meets the eye.

WE-TRANSFORM is on a mission. The project leverages existing data and the collective expertise of individuals to craft a cross-national Living Hub. It serves as both a knowledge repository of research actions related to transport automation, as well as a catalyst for smarter decisions paving the way for innovative, evidence-based policymaking in the mobility landscape.

For Cristina Pronello, Professor at the *Politecnico di Torino*, Italy, and Coordinator of the project, automation is changing the way in which we work and live our daily lives. In particular, automation will have a significant impact on mobility's future development, implying big changes for both the organisation of companies and the way that employees work. There are also operational issues and impacts thanks to automation and digitalisation, as well as financial and regulatory aspects.

Pronello makes the example of the automation of the metro in her city in Torino, Italy. Automated transport vehicles have an effect on the workforce, according to her: "You do not need drivers anymore because the metro is driverless, but it implies a shift of tasks, jobs, and competences to be acquired as well as a different way to care about customers and travellers. Another example is the airport, the check-in is less in person and more and more online. This has an effect on the workforce because it means less people work there. So, a lot of the tasks are shifted to the end consumer, but the workers are doing a different job."

WE-TRANSFORM leverages the effective collaboration of stakeholders in the mobility industry for in-depth dialogues to understand and respond to the challenges posed by automation on the transport labour force.

"We exchange with the stakeholders to understand what the problem is: if and how automation has impacted their daily jobs. This means we have a clear vision about what are the effects and impacts of digitalisation and automation in the transport sector." says Pronello.

Using the outcomes of previously done research, such as main trends in the transportation sector, impacts on workers, and legal consequences, WE-TRANSFORM called stakeholders to share their views on the future of the workforce in mobility, with a focus on identification of encountered difficulties and required sources to overcome them. The stakeholders identified several drivers, namely: disaffection and dissatisfaction with their jobs; management skills not being up to date with the evolution of mobility; workers at lower levels often being more up to date with technological trends than their managers.

Another important trend is the relocation of companies and offshoring, which has increased with automation. The last influencing factor is a lack of attention towards worker training, which is linked with the lack of finances that a company can provide for it.

Who is most impacted are the workers and the end users, as automation will change the way that people work, and customer care will see a shift in how services are delivered and experienced. "There is also the risk that automation will leave the end user alone in a desert of machines, so this is the reason why in automation, customer care is so important." Pronello cautions.



This picture was generated with the help of GPT-3.

When asked to consider what the future of mobility is, Pronello has a clear vision: "I expect a mix between hard and soft skills, where technology takes a secondary role to humanistic knowledge rather than being the primary focus of expertise. The ability of human beings to observe, listen and empathise with others will be a must-have. I also want to see a mobility trainer, a person who can teach other people how to travel in a sustainable way and educate people about the values related to sustainable mobility. In this case, the money that is devoted to the advancement of technology should be more used for training and educating people, because this is the only way to change people's behaviour."

In the mobility setting, the driver of a now driverless vehicle could redirect their skills to support and facilitate the customer travel experience. "Those people can shift their focus on exchanging with other human beings, thus balancing the entrance of automated technologies with greater social interactions." Pronello says.

When asked about the implications for sustainability, Pronello adds these last thoughts: "The green transition cannot be achieved only through technology but through behaviours that utilise the full potential of these technologies. To truly drive the green transition, we must articulate why individuals and communities should embrace these technologies in a way that aligns with sustainability goals, rather than simply relying on technological advancements alone."

Connected Factories and their pathways for a circular economy

By Laura Galante

A successful shift to a circular economy requires multidisciplinary skillsets that integrate both business and technology aspects. However, circular economy or sustainability practices are not often seen as competitive advantages for companies. The [ConnectedFactories](#) project focussed on devising potential pathways to digital manufacturing, including circular economy from a broader perspective.

The ConnectedFactories project investigated how manufacturing systems and processes can become digitally integrated and work seamlessly together. It uncovered crucial factors and tools that can make this integration possible. In addition, ConnectedFactories connected different projects and their outcomes, practical examples, and demonstrations to the strategies and important factors identified. The project has been initiated by EFFRA, the European Factories of the Future Research Association.



Source: ArtPhoto_studio

The ConnectedFactories consortium also figured out what factories need now and in the future, as well as the problems they might face across different [pathways](#) and the importance of cross-cutting factors, such as interoperability or legal aspects. It was a project composed of two phases, namely Connected Factories 1 (running from 2016-2019) and Connected Factories 2 (2019-2021). The first project focussed on three pathways, namely smart autonomous factories, hyperconnected factories, and collaborative product-service factories. The second project added pathways on circular economy, cybersecurity, data spaces, and AI.

“In the first level of the smart autonomous pathway, for example, many companies utilise spreadsheets for data management. But to optimise data gathering and processing practices, one needs more advanced solutions and dedicated software platforms,” says Chris Decubber, who coordinated the first effort of the project and supported Connected Factories 2. “As soon as companies can establish more dedicated data processing, they can use that data to improve their manufacturing processes, in some cases even consider automated interaction between the data analytics side and the actual operation of the processes supported by real-time decision making.” These pathways thus describe the structured progression toward achieving advanced levels of digitalisation of manufacturing.

Among the pathways explored, the [Circular Economy pathway](#) was devised to emphasise the importance of circularity for sustainable manufacturing, encouraging companies to embrace this approach. However, often, SMEs find it difficult to invest in new circular approaches and supporting technologies while focussing on growing their business through finding new customers, partners and developing new products. “You clearly have a lot of inspiring approaches and technologies out there, but if nobody knows about them or knows how to use them, then there is no point,” says Decubber. “Additionally, if the management does not have a clear insight in the economic viability and a clear indication that these technologies will make a difference, they won’t be introduced, regardless of whether operators know how to use them or not. And that is also an important aspect to be considered.”

ConnectedFactories developed a [pathway](#) to help companies understand where companies stand in relation to the Circular Economy and where they can improve. It assesses different aspects of their business and compares their position to an ideal one and to other companies on the same journey. Companies don't have to follow a strict, step-by-step process to reach the ideal state, but rather, the path to improvement can be flexible, especially for newcomers.

The CE pathway starts with companies operating in a linear manner, where they meet environmental regulations but do not view CE and sustainability as strategic advantages (level 1). Many companies then move on to piloting initiatives to reduce energy and material inputs, often driven by a desire to enhance their brand image (level 2).

A significant step towards more sustainable manufacturing involves systemic resource management, where data from various sources is used systematically to improve resource efficiency and circularity (level 3). Moving to the next level of CE thinking, companies collaborate with their value chains to explore environmental, social, and economic sustainability aspects. This network-level activity is crucial for fully embracing the Circular Economy (level 4). The most advanced phase is ideal circularity, where companies and their value chains are restructured to create closed or cross-sectoral value loops. In this phase, data flows and data spaces play a crucial role in highlighting the positive sustainability impacts (level 5).

This pathway has clear implications for the kinds of skill sets required to fulfil it, and the cross-cutting factors on human skills demonstrate this. From linearity, which demands simple tasks such as recycling and other environmental obligations, more strategic thinking is found in subsequent levels. Strategies aiming towards resource sufficiency, such as disassembly, require a product lifecycle manager to look at the whole supply chain, rather than just the product. More advanced levels would incorporate servitisation, thereby focusing on the customer service experience to help customers choose resource-efficient options, and industrial symbiosis to maximise exchange of resources and materials across industrial actors.

Walking through an example that illustrates the challenges of circularity in the (re-)manufacturing context, Decubber considers the manufacturing of electric motors. “While there are ongoing advancements in disassembling, reusing, and recycling them, a crucial question arises: how do we handle the disassembly process, and can automation play a role in it? When we're dealing with thousands of engines being repurposed for a second life, it's likely that a combination of manual labour and automation will be necessary. However, this raises another important question: were these engines originally designed with disassembly in mind? In this scenario, the entire maintenance or remanufacturing process must undergo a comprehensive redesign. We need to determine which tasks can be automated and which ones require human intervention, all while ensuring that the engines are designed to facilitate the disassembly process effectively.”

The challenge boils down to the product itself, as often the products that are being put on the market were not originally designed for disassembly. SMEs will therefore have to assess the entire product value chain to understand the critical processes and skill requirements needed to be on the path headed towards a circular economy.

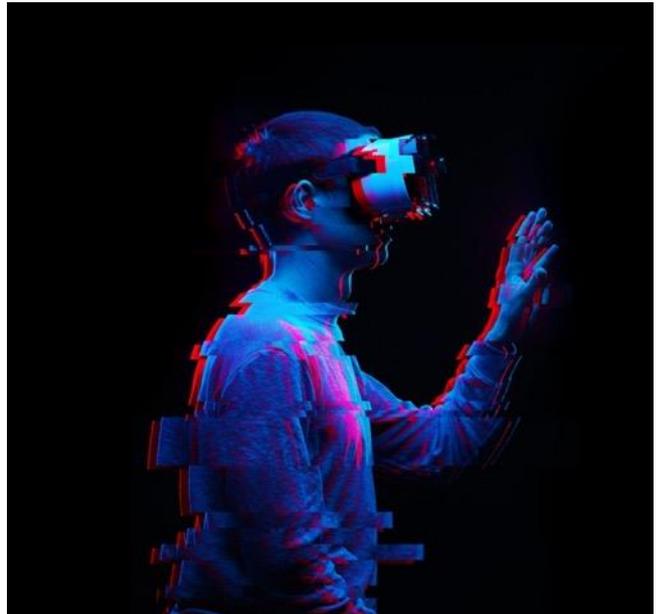
FORESIGHT OF BIG TECH

With Big Tech comes Big (Ethical) Responsibility

By Laura Galante

In a world pervaded by the rapid entrance and development of new technologies, the pace at which ethical concerns are addressed is not always in sync. TechEthos, a Horizon 2020 project, wants to facilitate “ethics-by-design” in order to push forward ethical and societal values into the design and development of new and emerging technologies at the very beginning of the process.

TechEthos aims to produce ethical guidelines that can provide orientation for technology developers in the early stages of development. We spoke with project coordinator and innovation policy expert Eva Buchinger and foresight expert Wenzel Mehnert about their considerations on the outcomes and process of their project. Both are working at the Austrian Institute of Technology.



Source: AdobeStock

How does strategic foresight fit into the work of the TechEthos project?

Wenzel: Strategic foresight is about defining or creating knowledge to orientate actions in the present. If we want to develop innovation of new and emerging technologies responsibly, we need some kind of knowledge or guidelines to orientate our action. I think here TechEthos plays an important role as it creates those guidelines.

Eva: Strategic foresight in the case of TechEthos contributes to ensuring high interest in ethical standards in the EU and beyond. Thus, we want to help reinforce the pivotal role of the European Union as an ethical trailblazer. Reconciling the needs of research and innovation and the concerns of society and reflecting them in ethics guidelines is essential for TechEthos' strategic approach.

Why should these vital concerns be at the forefront of technology design?

Wenzel: New and emerging technologies always create new opportunities, such as generating wealth or general socio-economic benefits. However, they also present potential ethical challenges or unintended social consequences. In the context of disruptive technologies, there are always people who benefit from these technologies but also those who will lose. This is why we need to reflect on how to achieve a positive societal outcome. One way to do this is by constructing scenarios with stakeholders, thinking about positive visions. But often, these visions vary from one stakeholder to another.

Tell us about your guidelines and to whom they are targeted.

Eva: In TechEthos, we analyse existing ethical guidelines and frameworks and provide suggestions for their enhancement. We specifically focussed on guidelines related to TechEthos' technologies - climate engineering, digital extend realities, neurotechnologies – and selected two guidelines per tech, which are in the process of enhancement that we are now finalising. Concerning target groups, TechEthos is a CSA (coordination and support action) and so it was clear from the beginning that we had to deliver orientation for EU policy makers. Another target group are research ethics bodies organised in institutions such as the European Federation of Academies of Sciences and Humanities (ALLEA) and the European Network of Research Ethics Committees (EUREC), both partners in TechEthos. However, our main target group are researchers from industry and academics.

Wenzel: Another interesting target group are citizens. Because these technologies are still relatively new, but will impact society at large, citizens become crucial stakeholders. Therefore, it's important to communicate

these new and emerging technologies to citizen groups and also incorporate their concerns, which we have done in TechEthos.

You have chosen to focus on three technologies: climate engineering, neurotechnologies, and extended reality. Why have you selected these technology families in particular?

Eva: Our task during the first six months of the project was to select three technology families which raise ethical issues and have a high socioeconomic impact. Through a horizon scan we [identified 150 technologies](#) and narrowed them down to 3 with the involvement of 77 experts. Climate engineering, representing a branch of technologies from carbon dioxide removal to solar radiation management; digital extended reality, covering technologies related to the metaverse as well as natural language processing; and neurotechnologies, directly monitoring, assessing, and manipulating the brain's function. During the development of this project, the emerging discussions on ChatGPT and the most recent UN conferences on climate change confirmed the relevance of TechEthos' technology selection.

What was the purpose of your TechEthos game?

Wenzel: When engaging with citizens you need a low threshold activity that does not ask for too much knowledge or preparation. We created the [TechEthos game](#) that puts the players in the position of a fictitious Citizen World Council. The citizens were presented with one technology and had to decide which they want to support or not. The power of this game is that it really stimulates discussion right from the first card. At the end, we engaged with 330 participants, of which one third represented vulnerable groups. The transcripts of the conversations were then coded for "[citizen values](#)", which become important when addressing new emerging technologies, and which have been included in the guideline enhancement.

What were some of the most striking concerns that key stakeholders had in devising these scenarios?

Eva: One striking concern from the expert engagement in scenarios was that "technological fixes" must be balanced with fair social reforms. Citizens especially highlighted the values "equity", "reliability" and "sustainability" against a [media](#) discourse that tends to utilise catchwords such as "cyborgs", "green hydrogen" and "virtual reality". Research ethics committees also emphasised the necessity of guidance documents for an ethics review based on pertinent principles. And it was also interesting to realise in the [policy consultation](#) that in the legal framing, the definitions for a legal treatment are sometimes very weak which makes implementation difficult.

In an ideal world, how would you expect the future of emerging technologies to develop in the next 20 years?

Eva: First of all, we have to take care that technology serves humanity and not vice versa. This has to be done by the interplay of various stakeholders; while we are witnessing how industry is shaping and paving the way, we have to take care that we implement proper regulation. In the next two decades we may expect technology driven disruptions around the world and in an ideal world this will become a win-win-win situation for producers, users, and nature on global scale.

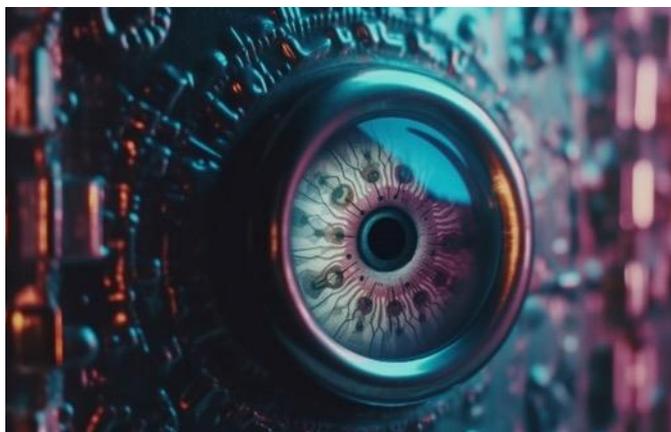
Wenzel: I hope that reflexive innovation becomes the new normal, and that involving relevant stakeholders becomes a paradigm in the development process of technologies. In TechEthos we aim at [policy makers](#), but in an ideal world, there is an open involvement of all types of stakeholders into the technology development process.

Curbing the Elusive Force of ‘Modern Bigness’

by Giovanna Giuffrè & Valentina Malcotti

MOBI stretches the legal dimension, searching for normative responses to Big Tech’s composite power threats to free market competition and European democratic values.

We have seen ‘Big’ before. Big Finance, Big Oil, Big Media, and Big Pharma are all about market dominance in the hands of a few private companies. If it is not a new feature of capitalism, why has Big Tech, today’s XL player, made it onto the *Horizon Futures Watch* list? Digital giants seem to cast a longer (and darker) shadow. Slipping through market regulations, Big Tech has invaded the public sphere and is threatening not only free markets but also the democratic process.



Source: Freepic

Some Big Tech name-dropping will give the density of ‘Modern Bigness’ away: Amazon, Apple, Alphabet (Google), Microsoft and Meta (Facebook). These top 5 tech giants are digital sprawlers: their empires ‘rule’ many aspects of our daily lives.

This supremacy does not stop at market power and political lobbying. Big Tech’s delivery and control of the digital arena has generated a subtle but mighty force: digital power. The effects of this elusive power escape market relationships and are thus harder to trace, assess, and hold accountable.

At Utrecht University’s School of Law, the EU-funded MOBI project (ERC grant) is exploring ‘Modern Bigness’ from a normative point of view. Led by Anna Gerbrandy, MOBI project coordinator and Professor of Competition Law, PhD and postdoc students are researching the composite power that defines ‘Modern Bigness’ and its implications for antitrust regulations.

Gerbrandy puts a finger on the struggle to regulate Big Tech by highlighting how “competition law currently deals with fair market competition, market shares, and consumer rights. However, the non-market effects impacting the public domain, where digital power turns into public power and perhaps threatens democratic relationships, are formally beyond the discipline’s reach”.

A wider perspective is required to overcome the legislative impasse caused by gaps in the legal system and respond with normative instruments. “It’s not good enough to focus on market power” – Gerbrandy explains – “Big Tech can influence the right to reliable information (jeopardised by biased newsfeeds), impact free speech (polluted by social media-induced polarisation of public discourse), fair political representation (threatened by electoral algorithms) and privacy (endangered by exposure of sensitive data)”.

With aggressive business models, gobbling up start-ups and SMEs, platforming services, and aggregating data, Big Tech gurus are now unrivalled ‘gatekeepers’. “Google is our access point to the Internet, Facebook has become a news editor and Amazon has turned into the ‘everything store’”, observes Gerbrandy. Big Tech has penetrated the core of public institutions and governing bodies making them reliant on private digital infrastructure for their operations and blurring the boundaries between consumers and citizens.

As digitalisation and platform-based services are branching out into key sectors such as healthcare (telemedicine and AI diagnostics), agri-food (environmental monitoring and supply chain management), education (virtual learning), and transportation (automation), Big Tech will likely be involved in the delivery of most public services.

MOBI’s research highlights how the legal *modus operandi* must stretch beyond its comfort zone to ‘tame’ Big Tech and keep up to speed with the social challenges posed by rapid technological progress. The values of

the open society are at risk if the concept of 'power' is not extended beyond monitoring mergers and acquisitions. According to Van Dijck, "Institutional innovation should become just as sexy as technological innovation"¹. European competition law is already adapting to counterbalance 'Modern Bigness' by keeping companies accountable for their market effects (i.e., through lawsuits and fines for unfair competition, use of sensitive data, misleading news, etc.). A quicker pace of change is crucial to anticipate power scenarios and include holistic power checks in the regulation of Big Tech sooner rather than later, at greater costs and efforts.

Future-thinking helps us identify worst-case scenarios if we fail to strike the power balance. "Taking it to an extreme, we could face a technocracy" – warns Gerbrandy – "in which public institutions (government agencies, courts, schools, healthcare facilities, etc.) become so dependent on privately owned digital infrastructures to deliver their services that decision-making is outsourced to Big Tech-controlled algorithms.

Gerbrandy points to the billionaires' "space race" to help frame issues of resource ownership and control of services. Space cowboys such as Musk (SpaceX) and Bezos (Blue Origin) are planting satellites and providing rockets to explore the galaxy. Although space colonisation might be a wise Plan B if life on Earth was at risk, Gerbrandy wonders: "Is it desirable to have private companies control access to space and its future colonisation, or should we support government space agencies?"

There is uncertainty as to what the dangers of overregulating or underregulating Big Tech are, but Gerbrandy has no doubt about protecting the public sphere, always. "If strengthening the public domain means delivering heavier regulations on Big Tech or breaking up large companies", she notes, "we have to consider the option".

Europe has moved faster than other governments with the issuing of the [Digital Services Act Package](#) including the Digital Markets Act (DMA), the Digital Services Act (DSA) and the [AI Act](#) which aim to create a human-centric, safe, and fair digital space for users and businesses. "Tech Gurus may need time to adapt to the new regulations, but we are heading in the right direction", comments Gerbrandy.

¹ Van Dijck, J., *Open societies and the technical-digital perspective in The Open Society and its Future – Think Paper Series #1*, Institutions for Open Societies Think Paper Series, Utrecht University, 2020.

Connecting... Futures: The Road to 6G and the Right to Connectivity

by Giovanna Giuffrè & Valentina Malcotti

Hexa-X's 6G flagship research is shaping the design of European wireless technologies to be environmentally, socially, and economically sustainable, while ensuring competitiveness in the global market.



Source: Freepic

Information and communication technology (ICT) has led and spread ground-breaking revolutions ever since Marconi's first wireless telegraph 'call' between the UK and Canada in 1901. When almost one hundred years later global roaming appeared, followed by five generations of wireless technologies, the speed, capacity, and overall performance of mobile communication had already transformed our everyday lives.

Another technological cycle is around the corner (typical duration: 8-10 years) and European research is busy planning the advent of the sixth generation (6G) of wireless technologies, expected to hit the market in 2030. Through the collaborative efforts of the [5G Public-Private Partnership](#) (5G PPP) and the [Smart Networks and Services Joint Undertaking](#) (SNS JU), the European Commission has joined forces with public and private actors, including the ICT industry, academic institutions and research organisations, to enable the evolution of 5G ecosystems and promote 6G research in Europe. Among the EU-funded R&I

flagship projects exploring 6G connectivity is the Hexa-X 'family' with its two 'brother' projects: [Hexa-X](#) (Horizon2020 – 5G PPP) and [Hexa-X-II](#) (Horizon Europe – 6G SNS JU), both led by Nokia and supported by Ericsson's technical management. Over a total period of 4.5 years, the Hexa-Xs will produce a blueprint for a sustainable, inclusive, and trustworthy 6G platform able to meet the future needs of serving and transforming society and business.

Hexa-X I, which ran from January 2021 to June 2023, established the vision for the next generation of wireless technologies by considering potential use cases and key societal values, aiming for a human-centric network design. Building on the architectural insights provided by Hexa-X, Hexa-X II kicked off in January 2023 with a goal to deliver a system blueprint for a European 6G platform by June 2025.

While the USA and Asia may be well-positioned in the global race for future wireless connectivity, Europe's strong foundation in research and innovation, supported by EU funding and enriched by partnerships, enhances its competitiveness, and fosters technological sovereignty.

Mikko Uusitalo, Head of Radio Systems Research at Nokia Bell Labs Finland, is the overall lead of the Hexa-X endeavour (including Hexa-X-II): "our rich consortium, which has grown from 25 to 44 partners over the course of the projects, and our expert advisory group empowered our vision for the design and architecture of the next generation of wireless networks". Hexa-X partners, who represent key European industry stakeholders, along with the full value chain of future connectivity solutions (network vendors, operators, verticals, and technology providers), as well as research institutes and universities, put their foresight cap on. Their deep knowledge supported the project's scanning of societal, economic, regulatory, and technological trends, the identification of connectivity drivers, and the selection of use cases for current and new 6G applications.

At the heart of Hexa-X's vision for the future is an everyday experience enhanced by the seamless integration of human, digital, and physical worlds. 6G aims to connect these worlds through an ecosystem of networks, sub-networks, and device technologies. This ecosystem has the potential to drive global economic growth while transforming industries and societal spheres such as education, skills, and the labour market.

While 4G has enabled and 5G significantly enhanced our ability to consume digital media anywhere, at any time, 6G will deliver a total immersion in virtual worlds, with communication, localisation, sensing, and imaging

coming together in the generation of augmented and mixed realities. We are looking at 6-dimension (6D) experiences, in which the 'traditional' 3 spatial dimensions (latitude, longitude, and altitude) are enriched by 3 orientation dimensions.

With extreme connectivity and ultra-high data rate, 6G has the potential to power disruptive solutions for industries relying on interactions between machines, humans, and the environment, including automotive, transportation, agriculture, education, healthcare, and urban planning.

To ensure that these technologies bring value to society, Hexa-X is adding value-based design to performance-oriented goals for future connectivity networks. The key is to develop 6G around three dimensions of sustainability: environmental, social, and economic.

6G networks can be energy-efficient in terms of choice of materials, circularity practices, and operational modes. They can rely on ecological energy sources and optimise overall energy consumption through cloudification and automation. Part of this effort is also supporting sustainability in other sectors. "With its potential for simulation and real-time monitoring through digital twins, 6G can become a powerful ally for the twin digital and ecological transition," Uusitalo explains.

Connectivity in 2030 will likely be regarded as a basic human right for accessing equal education, business, and health opportunities². Social sustainability is about ensuring inclusive, non-discriminatory network services that provide equal and open access to trustworthy resources and opportunities. Hexa-X aims to 'connect the unconnected' and reach underserved populations, whether due to geographical remoteness or financial constraints. "Technology can become more inclusive also by reducing its costs," Uusitalo explains, "as, in some cases, satellite connectivity is a cheaper way to provide coverage to underserved areas".

Economic sustainability is the ultimate check for a value-based network that achieves innovation, prosperity, and growth without creating burdens for society, the environment, or future generations. Wi-Fi natives will ride the digitalisation wave, with industries becoming 'smarter' and consumers wanting increasingly sophisticated services. "Addressing the growing demand for wireless services is a challenge," notes Uusitalo. "End-users expect fast, safe, and efficient networks everywhere, and meeting these expectations should not be taken for granted!"

² https://hexa-x.eu/wp-content/uploads/2021/02/Hexa-X_D1.1.pdf

FROM THE FUTURES4EUROPE PLATFORM: SELECTED CONTENT

These blog posts were originally published on the Futures4Europe platform. You can find these and other posts [here](#).

Design Futures art-driven Methodology: Shaping the Future of Innovation

By Tatiana Efremenko

As the famous quote by Einstein goes, 'we can't solve problems by using the same kind of thinking we used when we created them'. Today, there is an urgent need to discover and cultivate new ways of thinking and creating to respond to the numerous challenges that have risen in recent decades.

There are different paths to instil new ways of thinking. Art thinking is one that has been employed in various disciplines to stimulate divergent thinking by generating and posing critical and clever questions. Often, it serves as a catalyst for redefining our relationships with existing paradigms, norms, and routines. Art-tech collaborations, as collaboration between artists and scientists or companies, have been initiated to drive technological and digital development while reflecting on societal and environmental impacts of innovative technologies. Bringing different disciplines together can infuse innovative thinking and unconventional approaches, where art thinking is used to pose critical questions about current paradigms of innovation.

Read more [here](#).

Is Hydrogen that Good for the Climate?

By Corina Murafa

The answer is probably, a classic: "it depends". Hydrogen is the smallest and lightest molecule in the world. It is about eight times lighter than methane. There's a lot of methane leakage around the world. And by "a lot", I really mean a lot. Satellite imagery by the European Space Agency collected data that proves there is significantly more leakage in the atmosphere than official estimates. And methane has more than 80 times the warming power of carbon dioxide over the first 20 years after it reaches the atmosphere (Source: Environmental Defense Fund – EDF). Some of this methane leakage is due to sheer industry negligence (oil and gas companies have been proven to do routine gas flaring), but also to bad casings, old pipes, and all sorts of infrastructure mishaps that are bound to happen in any industry. Now imagine how much easier it is for hydrogen – a much lighter molecule than methane – to escape and leak, particularly when we blend it with natural gas in existing pipelines, as is the case in the plans of many countries in Europe – including Romania, my home country.

Read more [here](#).

UPCOMING EVENTS

JOIN OUR HORIZON FUTURES WATCH WORKSHOPS, ONLINE!

Global challenges impact European Research and Innovation, which aims to address current and future societal concerns. To this end, ‘watching futures’ to anticipate future possibilities and shape a forward-looking EU R&I policy continues to gain ground.

The ‘European R&I foresight and public engagement for Horizon Europe’ is launching a second series of **online workshops** on October-November 2023 (information on previous workshops is available [here](#)). The study was launched by the European Commission in the context of the

Horizon Europe Foresight Network.

The two-hour workshops will discuss thematic policy briefs compiled by expert panels, addressing possible future scenarios for critical issues. After thematic policy brief presentations on future scenarios and policy implications, each workshop will host two focus groups: one with panel experts who developed the policy brief and another with representatives from topic-relevant EU-funded R&I projects. All events encourage discussion between panellists and participants, including policymakers.

REGISTER NOW: <https://shorturl.at/nsyJ0>

Futures of Interpenetration of Criminal and Lawful Activities	11.10.2023 11:00-13:00 CET
The intersection of criminal and legal economic activities is shaped especially by technological change and unregulated spaces. Scenarios for 2040 on the dynamics of interpenetration between criminal and legal economic activities will be discussed, with a particular focus on regulatory possibilities, societal desirability, and the intricacies of financial transparency.	
Futures of Green Skills and Jobs	25.10.2023 11:00-13:00 CET
This topic envisions the future of green jobs and skills in the European Union, considering the EU's potential global leadership in green tech. Scenarios leading up to 2050 examine the roles of research and innovation policies, technological advancements like AI, infrastructure needs, and institutional changes.	
Futures of Big Tech	8.11.2023 11:00-13:00 CET
Europe's heavy reliance on foreign Big Tech giants provides the basis for the discussion of scenarios for 2040 on Big Tech in Europe, considering to what extent Big Tech is steering the course of research and innovation and if and how Big Tech may benefit society.	
Futures of Innovation and IPR Regulation	15.11.2023 11:00-13:00 CET
Scenarios for 2040 on innovation and intellectual property rights (IPR) regulation are discussed to explore to what extent IPR policies are favourable and aligned with the EU's core values as well as interests.	
Futures of civic resilience	22.11.2023 11:00-13:00 CET
Alternative scenarios for 2040 relating to resilience and preparedness for handling disruptions and polarisation at individual and community level will be discussed, for instance addressing survival skills, deliberative policies, and sustainable lifestyles.	

Ethics for the Green and Digital Transition



Event date: 14 November 2023, 10:30

Location: [Sparks meeting centre](#),
60 rue Ravenstein – 1000 Brussels, Belgium & online

Event facilitator: Vivienne Parry

About the event: TechEthos will hold an in-person policy event in **Brussels, Belgium, on 14 November 2023**, co-hosted by Barbara Thaler, Member of the European Parliament

& [STOA Panel](#). The event will bring together high-level experts, including **EU policymakers, researchers** from academia, and **industry representatives** to discuss the ethical governance of emerging technologies for the digital and green transitions. The conference will tap into ongoing ethical debates as well as existing and expected EU policy debates such as the proposed [AI Act](#), the implementation of the Digital Services Act and Digital Markets Act, the European Green Deal, and the EC proposal for a Carbon Removal Certification Framework. The event offers a unique opportunity to learn from experts, engage in meaningful discussions, and network with like-minded individuals.

Don't miss out on this exciting event! Mark your calendars and join us for a day of learning, collaboration, and exploration. You may find the programme and upcoming registration [here](#).

Mutual Learning Exercise on R&I Foresight: Dissemination Event



Event date: 13 October 2023, 9:00 – 13:00

Location: Estonian Permanent Representation,
Rue Guimard 11, 1040 Bruxelles, Belgium

About the event:

The Mutual Learning Exercise (MLE) on R&I Foresight was launched in July 2022 at the request of Member States supported by DG Research and Innovation of the European Commission. Nine countries (Austria, Belgium, Czechia, Estonia, Finland, Norway, Portugal, Romania, and Slovenia), the European Commission and a team of foresight experts, have been actively involved.

The aim of the MLE was to facilitate the exchange of information, experiences, and lessons from the practice of R&I foresight across EU and Associated Countries, in order to contribute to the development of an impactful R&I foresight community as an important element of the European Research Area.

For more info, please visit the [project page](#) and the event [AGENDA](#) here.



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

Giefinggasse 4, 1210 Wien, Austria

Matthias Weber

Managing Director

+43 50550-4561

matthias.weber@ait.ac.at

Dana Wasserbacher

FOD Office

+43 50550-4520

dana.wasserbacher@ait.ac.at