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Foresight scenarios of digitalisation processes

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FORESIGHT SCENARIOS OF DIGITALISATION PROCESSES

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FORESIGHT SCENARIOS OF DIGITALISATION PROCESSES

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EXECUTIVE SUMMARY

This report is part of Work Package 1 of the Digi-B-Well project. It is dedicated to the development of foresight scenarios for the digitalisation of Central European (CE) organisations, namely academic institutions, public authorities, and SMEs (referred to as the "triple helix"). It covers future market orientation, organisational and technological changes, as well as the expected future skills of leaders and employees in the short-term (1–2 years), mid-term (3–5 years), and long-term (6–10 years) perspectives.

Structure and Content: The report is organised into four main sections. It begins with an introduction outlining the role of foresight methodology in strategic transformation planning and the successful adaptation of organisations to future uncertainties. The second section details the research methodology and sampling strategy designed to gather insights into the most impactful trends shaping the future of the "triple helix" and to build the four foresight scenarios. The third section presents the research findings and resulting scenarios, while the fourth section discusses the implications of these scenarios for the future of European organisations, considering their market orientation, organisational and technological changes, and the skills of leaders and employees.

Methodology: We employed a foresight methodology, including a five-step process, as one of the widely used methods for exploring possible future challenges and defining strategy.

Results: The foresight analysis revealed seven key trend clusters likely to impact the digital future of Central European organisations. Among the 72 trends assessed, 33 were identified as particularly impactful. These were used to develop four foresight scenarios: *Digital Drift*, *Tech with a Human Touch*, *Beyond the Human Age*, and *Disconnected and Disillusioned*, each reflecting a unique trajectory for digitalisation. Quantitative survey data, gathered from 221 respondents across academia, public authorities, and SMEs, highlighted some intergroup differences. Academic institutions generally rated trends as more impactful, particularly in technology and education, whereas SMEs focused more on market and operational trends. Interviews with 21 representatives confirmed the plausibility of all four scenarios, with the *Digital Drift* and *Tech with a Human Touch* considered the most realistic and desirable. Across all sectors, critical challenges identified include digital infrastructure gaps, uneven digital literacy, cybersecurity concerns, and the urgent need for upskilling.

Recommendations: To ensure a successful digital transformation, Central European organisations must adopt inclusive and future-ready strategies. Digitalisation efforts should prioritise equal access to technology and services, particularly for smaller municipalities, SMEs, and digitally excluded groups. Investment in skills development is essential, with a focus on digital literacy, AI, data ethics, and hybrid leadership. Training should be modular, practical, and tailored to sector-specific needs. Technology must support, not replace, human interaction: organisations should foster innovation that values well-being, trust, and human connection. Cross-sector collaboration between academia, public authorities, and SMEs is key to sharing resources and accelerating transformation.

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ACRONYMS & ABBREVIATIONS

TERM	DESCRIPTION
AG	Augmented Reality
AI	Artificial Intelligence
CE	Central European/Central Europe
DT	Digital Transformation
IT	Information Technology
IoT	Internet of Things
SMEs	Small and Medium Enterprises
“triple helix”	Academic institutions, public authorities, and SMEs
VR	Virtual Reality

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FORESIGHT SCENARIOS OF DIGITALISATION PROCESSES

1. INTRODUCTION

Digital transformation is a multifaceted process involving the integration of digital technologies into all aspects of an organisation's operations, fundamentally changing how businesses create value, interact with customers, and compete in the market (Skare et al., 2023). It combines various organisational layers, including technological infrastructure, strategic management, and workforce skills, and has far-reaching implications for private enterprises (especially SMEs), public sector institutions, and academic organisations (Holmström & Carroll, 2024; Mohamed Hashim et al., 2022). The ongoing digital transformation is driven by rapid advancements in technologies such as artificial intelligence (AI), cloud computing, Internet of Things (IoT), and big data, which are changing market dynamics and creating new opportunities for value creation (Chang & Chen, 2025; Mendoza-Chan & Pee, 2024; Tangwaragorn et al., 2024).

To better understand the future impact of digital transformation, we need to explore it across four critical areas: market orientation, organisational structure, technological innovation, and the skills required for future leaders and employees. Addressing these areas is important for organisations seeking to navigate the complexities of digital transformation, remain competitive, and sustain long-term growth. The introductory section provides a brief examination of these four areas, based on insights from recent studies.

1.1. Future of Market Orientation

Digital transformation fundamentally alters market orientation by shifting organisations from traditional, product-centric models to customer-centric, data-driven approaches. This transformation enables firms to respond quickly to changing customer needs, benefit from real-time data for strategic decision-making, and create personalised customer experiences (Skare et al., 2023). This customer-oriented digital transformation (CODT) approach emphasises agility, innovation, and value creation, helping organisations build sustainable competitive advantages in increasingly digital markets (Tran et al., 2023).

For SMEs, digital transformation can significantly increase market orientation by improving customer insights, enabling efficient digital marketing, and facilitating data-driven decision-making (Skare et al., 2023). Digital tools such as customer relationship management (CRM) systems, e-commerce platforms, and social media analytics allow SMEs to engage more effectively with their customers and expand their market reach (Holmström & Carroll, 2024). However, SMEs often face challenges such as limited financial resources, digital skills shortages, and resistance to change, which can hinder their digital transformation efforts (Chang & Chen, 2025).

In the public sector, digital transformation drives a shift towards more transparent, citizen-centric service delivery. Public authorities increasingly prioritise digital strategies to improve citizen engagement, enhance service efficiency, and increase governmental accountability (Lamprousis & Jonathan, 2025). Digital transformation in this context often involves implementing technologies to streamline public services and improve the user experience. However, public sector organisations must navigate regulatory constraints, complex bureaucratic structures, and legacy systems that can slow digital adoption (Irani et al., 2023).

The academic sector also faces significant market orientation shifts due to digital transformation. Universities are adopting digital tools to improve student experiences, expand their global reach, and increase institutional competitiveness (Mohamed Hashim et al., 2022). This includes offering personalised learning paths, digital-first curricula, and virtual collaboration tools that align with the demands of the modern digital economy. However, academic institutions must overcome challenges related to digital infrastructure, faculty training, and changing educational paradigms to fully support digital transformation (Mendoza-Chan & Pee, 2024).

1.2. Organisational Changes

Digital transformation requires organisations to rethink their structures, processes, and cultures to support digital-first strategies. This often involves flattening hierarchies, promoting cross-functional collaboration, and fostering a culture of continuous learning and innovation (Holmström & Carroll, 2024). Effective digital transformation also demands agile leadership, data-driven decision-making, and an openness to experimenting with new business models (Tangwaragorn et al., 2024).

For SMEs, digital transformation can reduce operational complexity, enhance agility, and enable faster decision-making (Skare et al., 2023). However, SMEs may struggle to implement these changes due to limited resources, fragmented digital strategies, and a lack of digital skills among employees (Chang & Chen, 2025). Successful SMEs often adopt flexible organisational structures that support rapid innovation and customer-centric approaches (Holmström & Carroll, 2024).

In the public sector, organisational change is critical for maintaining effective digital transformation. Public authorities must move away from rigid bureaucratic models and adopt more flexible, data-driven approaches to service delivery (Lamprousis & Jonathan, 2025). This shift requires integrating digital tools into everyday operations, breaking down departmental silos, and promoting a culture of innovation (Irani et al., 2023). However, public institutions often face significant challenges, including resistance to change, complex regulatory environments, and budget constraints.

Academic institutions also need to undergo organisational change to remain competitive in the digital era. This includes adopting agile management practices and creating interdisciplinary research teams that can tackle complex digital challenges (Mohamed Hashim et al., 2022). Universities must also support faculty and staff in developing digital competencies to better serve digitally native students (Mendoza-Chan & Pee, 2024).

1.3. Technology

Technological innovation is the cornerstone of digital transformation, enabling organisations to optimise operations and create new revenue streams (Skare et al., 2023). Key technologies driving this transformation include AI, IoT, cloud computing, and blockchain, each offering unique benefits for different sectors (Tangwaragorn et al., 2024).

For SMEs, digital technologies provide opportunities to automate processes, reduce costs, and scale operations more efficiently (Skare et al., 2023). However, adopting these technologies can be challenging due to financial constraints, digital skills gaps, and cybersecurity concerns (Chang & Chen, 2025).

In the public sector, technology plays a crucial role in improving service delivery, enhancing transparency, and increasing operational efficiency (Lamprousis & Jonathan, 2025). Public institutions can rely on big data analytics and cloud computing to streamline operations and better serve citizens (Irani et al., 2023).

Academic institutions also use digital technologies to facilitate teaching, research, and administrative processes (Mohamed Hashim et al., 2022). For example, universities can use AI for personalised learning, big data for research analytics, and cloud platforms for collaborative education (Mendoza-Chan & Pee, 2024).

1.4. Future Skills of Leaders and Employees

The success of digital transformation depends significantly on the skills of leaders and employees. Leaders must possess digital literacy, strategic vision, and the ability to foster a culture of innovation (Tran et al., 2023). Employees, in turn, must develop technical competencies, data analysis skills, and adaptability to grow, perform and maintain well-being in a digital-first environment (Skare et al., 2023).

For SMEs, digital transformation creates a demand for skills in data analytics, digital marketing, and IT management (Holmström & Carroll, 2024). In the public sector, digital skills are essential for implementing data-driven governance and improving public service delivery (Lamprousis & Jonathan, 2025). Academic institutions must focus on preparing the next generation of digital leaders by integrating digital skills into curricula and supporting faculty development (Mohamed Hashim et al., 2022).

1.5. The Strategic Value of Foresight Methodology in Preparing Organisations for Digital Transformation

As was highlighted in the previous sections, digital transition presents significant challenges for organisations, including SMEs, public authorities, and academia, as they strive to remain competitive and resilient. Foresight methodology might be instrumental in preparing for this challenge. As a structured approach to anticipating and preparing for uncertain futures, it offers a strategic advantage in this context by enabling proactive decision-making and long-term planning.

Foresight is a systematic, participatory, and anticipatory process that helps organisations explore multiple plausible futures, providing a foundation for strategic planning and innovation. Unlike traditional forecasting, which attempts to predict a single probable future, foresight focuses on constructing diverse scenarios that capture a range of possible developments (Nekkers, 2016). It integrates both qualitative and quantitative insights, including weak signals, emerging trends, and expert knowledge, to generate informed narratives about the future (Felknor et al., 2023; Nekkers, 2016).

The foresight process typically involves several iterative stages, each building on the previous one to refine strategic insights (Nekkers, 2016; Peter & Jarratt, 2015). It begins with framing the domain, which involves defining the scope and objectives of the foresight exercise and identifying critical drivers of change and key uncertainties that could shape the future (Felknor et al., 2023; Nekkers, 2016). This foundational step sets the direction for the foresight process, ensuring that it addresses the most relevant and impactful factors. Following this, environmental scanning is conducted to collect data on emerging trends, technologies, and weak signals that may influence the future (Nekkers, 2016). This stage is essential for identifying both the obvious and subtle changes that could disrupt current assumptions about the future (Ködding et al., 2023). Then, identified trends might be assessed in terms of their importance and certainty (Nekkers, 2016). The data gathered at this stage forms the basis for the subsequent development of scenarios.

Scenario development is the creative core of the foresight process, where internally consistent narratives are crafted to describe alternative futures. These scenarios reflect different combinations of critical uncertainties, providing a structured way to explore a wide range of possible futures (Nekkers, 2016). Once scenarios are developed, the next step is the implications analysis, where the potential impacts of each scenario on organisational strategy and operations are assessed. This analysis helps decision-makers understand the strategic implications of each possible future, guiding them in identifying risks and opportunities (Dator et al., 2015). The insights gained from this analysis are then used in strategy and action planning, where organisations formulate strategic responses and develop plans to enhance their agility and resilience in the face of uncertain futures (Felknor et al., 2023). Finally, the foresight process includes ongoing monitoring and continuous review, ensuring that scenarios remain relevant as conditions evolve. This step is crucial for maintaining the effectiveness of foresight as a strategic tool, as it allows organisations to adjust their strategies in response to new data and changing circumstances (Nekkers, 2016).

Foresight provides several strategic advantages, including enhanced agility, better risk management, and improved capacity for long-term planning (Peter & Jarratt, 2015). It helps organisations identify emerging opportunities and avoid potential disruptions, contributing to sustained competitive advantage (Ködding et al., 2023). However, foresight also presents challenges, such as the high level of uncertainty involved, the need for comprehensive data collection, and the risk of cognitive biases influencing scenario development (Nekkers, 2016).

For the Digi-B-Well project, foresight offers a critical framework for understanding the future impacts of digital transformation in sectors facing rapid technological change. By developing foresight scenarios, organisations can align their digital strategies with long-term goals, ensuring that their digital transformation efforts are both effective and sustainable.

1.6. Objective

Given the literature insights into digital transformation changes and the foresight methodology overview provided above, the primary objectives of the following research are to:

1. **Identify the most impactful and uncertain trends affecting the digital future of Central European organisations.**
2. **Develop foresight scenarios for digital transformation within the "triple helix" in Central Europe.**

2. METHODOLOGY

2.1. Procedure

To build the scenarios' structure and elaborate their content, we employed a five-step foresight scenario-building process, combining desk research, stakeholder engagement, and statistical analysis. An overview of the steps is presented in Figure 1.

Figure 1. A five-step foresight scenario-building process

First, we conducted an initial horizon scanning to identify trends across various domains, captured by the STEEP acronym (demographic, economic, socio-cultural, ecological, and politico-institutional factors) (Nekkers, 2016). We drew on over 30 authoritative sources, such as the European Commission, Eurostat, McKinsey, and the World Economic Forum. Initially, we identified 98 trends. We then conducted an expert brainstorming session to review and expand the initial list, increasing it to 144 trends. Afterwards, three experts from the research team reviewed the resulting list once more to remove redundancies and ensure a consistent level of abstraction and specificity, resulting in a **final list of 72 key trends**. The full list of trends is provided in Appendix 1.

Second, to further structure the space of trends, similar trends were independently sorted by three experts from the research team into separate groups based on their meaning, using a card-sorting technique. A network analysis of each expert's grouping revealed seven distinct but interconnected clusters of trends, which we used in the fourth step to define the scenarios' structure. Third, the final list of trends was evaluated through an online survey. The survey consisted of three main parts corresponding to the evaluation of **importance**, **time horizon**, and **certainty** of the trends. First, participants were asked to evaluate the potential impact of each trend on their work and their organisation's future. A five-point Likert scale was used, where 1

corresponded to *minimal*, 2 to *limited*, 3 to *moderate*, 4 to *significant*, and 5 to *transformational impact*. Next, the trends rated 3 or higher were presented again to assess the expected time horizon of the changes they might trigger, using a scale from *short-term (1–2 years)*, through *mid-term (2–5 years)*, to *long-term (6–10 years)*. Finally, participants evaluated the expected certainty of each trend's future development and direction. Once again, a five-point Likert scale was used, where 1 corresponded to *almost certain reversal*, 2 to *probable reversal*, 3 to *uncertain direction*, 4 to *probable continuation*, and 5 to *almost certain continuation*. The survey was translated and distributed in 7 different languages: Croatian, German, Hungarian, Italian, Polish, Slovakian and Slovenian.

To ensure a high participation rate and gather diverse opinions from individuals across different countries and organisation types, we created two versions of the survey. **The full version**, which included all 72 trends, was distributed among project partners. **A shorter version**, in which each participant evaluated 30 randomly selected trends from the full list, was distributed among associate partners and the general public to ensure more diverse and representative input.

In the fourth step, the survey results were analysed, and the **32 most impactful trends** were identified. Based on the earlier network analysis and additional expert input, these trends were grouped into eight thematic clusters. Two experts from the research team then described how each of these trend groups could evolve over a 5–10-year period, following classical foresight archetypes (Dator et al., 2015): **Continuation** (accelerating the present), **Collapse** (struggling with a broken system), **New Equilibrium** (balancing the system), and **Transformation** (imagining a new world). Each thematic group was described according to each archetype, resulting in eight group descriptions per archetype. These were then combined into four draft future scenarios, each corresponding to one of the archetypes. The resulting scenario drafts are explained in more detail in the Results section. These four brief descriptions of possible futures formed the foundation for the final scenario-building step.

Finally, **18 semi-structured interviews** were conducted with managers, HR professionals, and employees from the "triple helix" in the partner countries. The interviews explored perceptions of scenarios' plausibility, skill implications, as well as organisational, technological, and market impacts. Interviews were conducted in the local languages, then transcribed and translated into English.

2.2. Sample

2.2.1. Brainstorming session

The brainstorming session was conducted during the semi-annual project partners' meeting. Twenty representatives from all partner organisations participated in the session. Specific numbers of participants from each country and project partner are presented in Table 1.

Table 1. Participation in the brainstorming session

Country	Project Partner	Number of participants
Croatia	PGKC	3
Germany	TUIL	1
	bwcon	1
Hungary	PBN	2
Italy	UNIBO	3
Poland	ARRSA	2
Slovakia	CLC	3
	EUBA	3
Slovenia	CCIS	2

2.2.2. Survey

A total of 236 participants completed at least one section of the survey, with 230 completing it in full. Among them, 15 participants indicated that they were either not currently employed or were self-employed/freelancers. As our goal was to gather input from individuals currently working within "triple helix" organisations, these participants were not allowed to proceed further. This resulted in 221 valid responses: 34 for the full version of the survey and 187 for the short version. Of the respondents, 55.2% (122) were female, while 3 participants preferred not to disclose their gender. The vast majority of participants (98.6%) were between 25-65 years old. Approximately half (50.2%) identified as professionals or mid-level employees, and nearly equal proportions identified themselves as managers/supervisors (20.8%) or directors/executives (20.4%). The detailed distribution of respondents across countries and "triple helix" organisation types is presented in Figures 2-4.

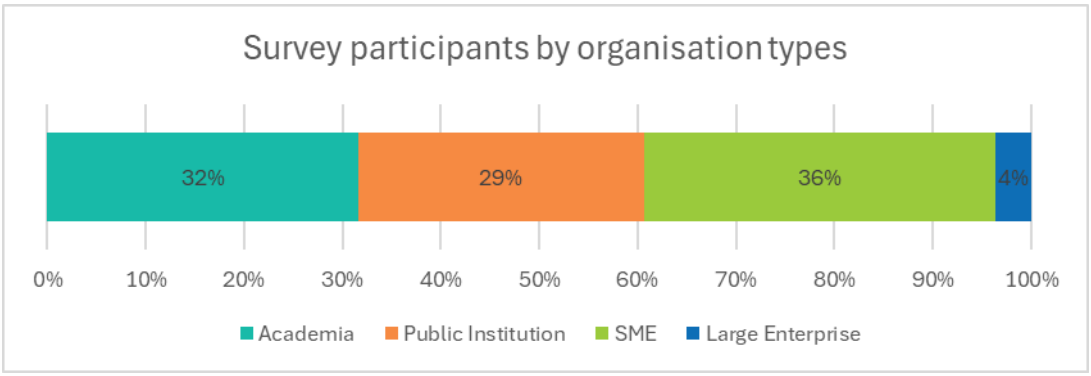

Figure 2. Survey participants' distribution among organisation types

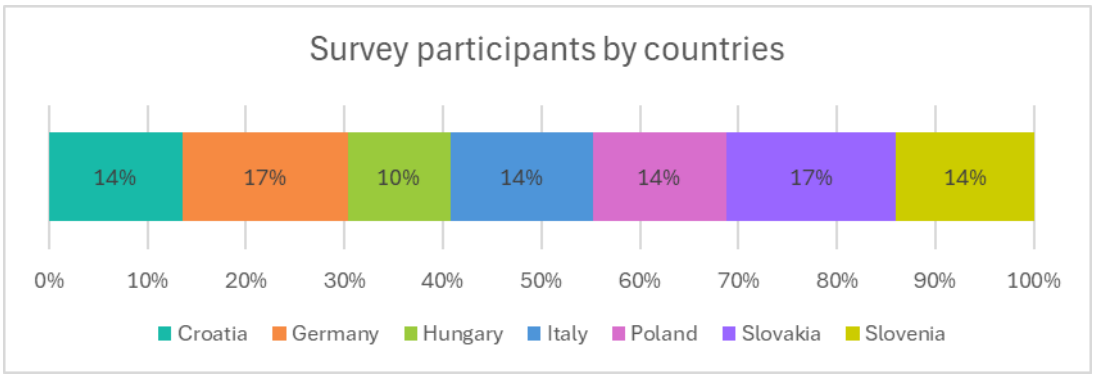

Figure 3. Survey participants' distribution among countries

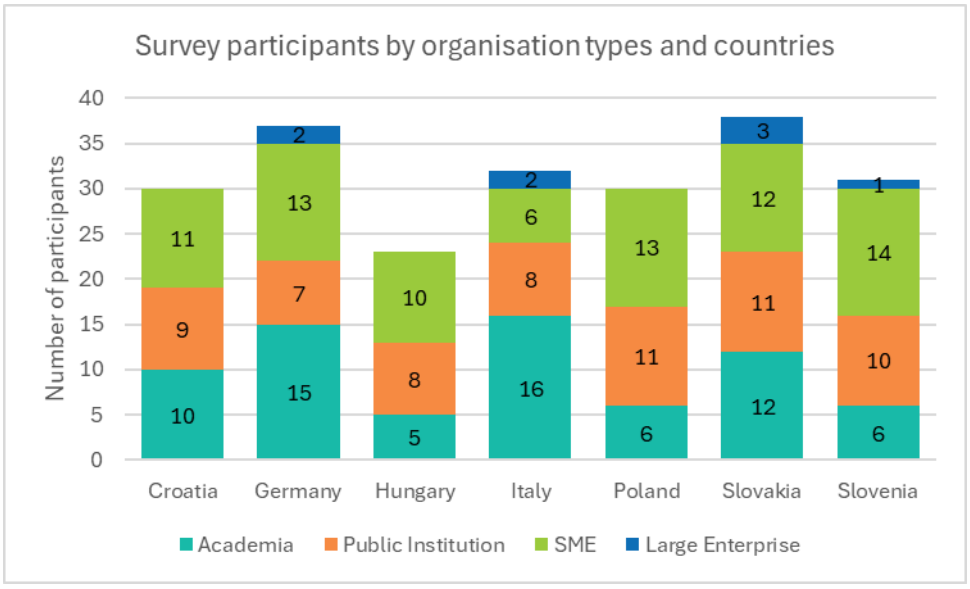

Figure 4. Survey participants' distribution among organisation types and countries

The resulting sample was well-balanced in terms of country and "triple helix" representation, with approximately equal proportions of representatives from academic institutions, public authorities, and SMEs in each partner country.

2.2.3. Semi-structured interviews

We conducted 22 semi-structured interviews with representatives of the "triple helix" from partners' countries. Among the participants were five representatives from Germany, three from Croatia, three from Hungary, six from Slovakia, three from Slovenia, and one from Italy. Seven interviewees represented academic institutions, six represented public authorities, and nine represented SMEs.

2.3. Data Analysis Approach

We applied various qualitative and quantitative data analysis techniques at different stages of the foresight scenario-building process.

2.3.1. Trends sorting analysis

The results of expert sorting of trends into different groups were analysed using an AI-assisted semantic network analysis technique (Newman, 2004), which enabled a structured exploration of themes and patterns within the qualitative data. Trends were organised into clusters based on common themes in the dataset and visualised as networks to illustrate the relationships between them.

2.3.2. Survey

Survey results were analysed using descriptive statistics, one-sample t-tests (comparing means to a neutral midpoint), and ANOVA to assess the significance of the differences between “triple helix” groups. This approach enabled us to surface not only shared priorities but also differences in future expectations across organisational types.

2.3.3. Interview

The interviews were conducted in local languages. Then their full transcripts were translated into English and analysed using qualitative thematic analysis (Braun & Clarke, 2006).

3. FINDINGS

As mentioned in the **Methodology** section, the initial horizon scanning resulted in the identification of 98 trends across all STEEP domains (demographic, economic, socio-cultural, ecological, and politico-institutional factors). The brainstorming session contributed 46 additional ideas, bringing the total to 144 trends. As this number was too large to assess effectively through a survey, we reviewed the long list to eliminate redundancies and ensure a consistent level of abstraction and specificity. This refinement process resulted in a final list of 72 trends.

3.1. Trends clustering

As a result of the card-sorting exercise and subsequent network analysis, the identified trends were grouped into seven general clusters (Figure 5).

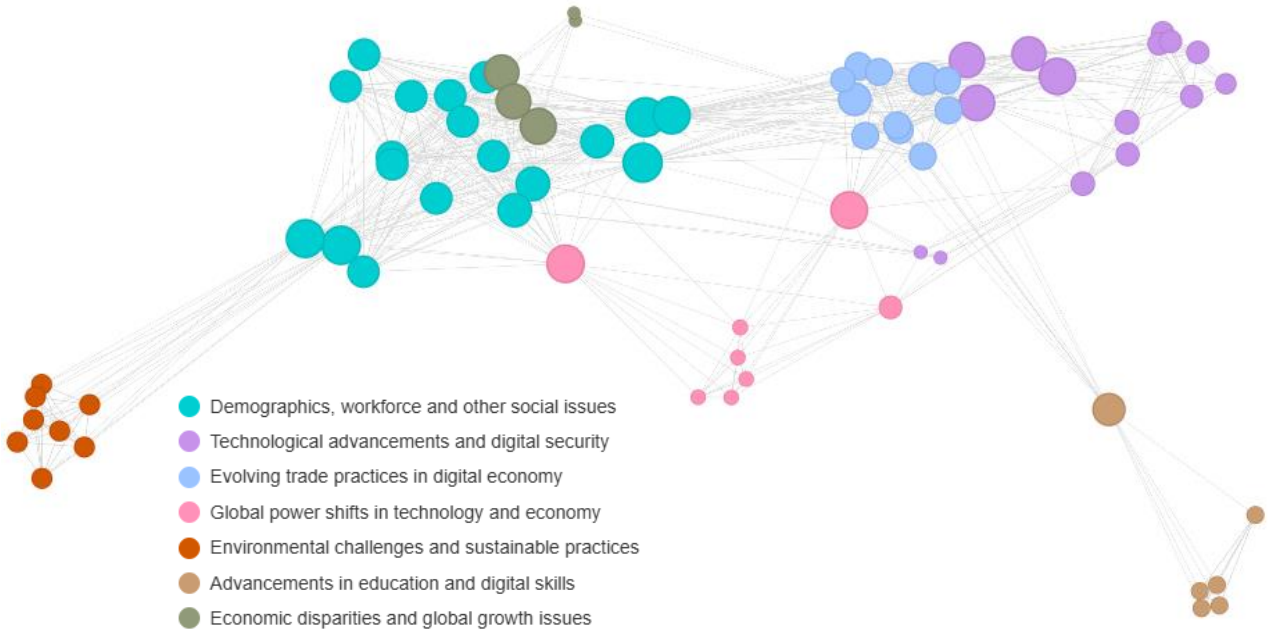

Figure 5. Clusters of trends

Demographics, Workforce Trends, and Other Social Issues

This is the largest and most diverse cluster, comprising 19 trends. It includes developments related to population dynamics, employment structures, and social behaviour. Key highlights include a global decline in self-employment, the rise of precarious work, and growing labour shortages. Additional trends include increased youth migration, digital dissatisfaction, and ethical concerns about automated decision-making. Societies are addressing ageing populations by raising retirement ages and investing in "smart ageing" technologies. There is also a rise in remote and agile work, growing interest in decentralised governance, and efforts to foster diversity and digital well-being in the workplace.

Technological Advancements and Digital Security

This second-largest cluster includes 15 trends focused on emerging technologies and the rising importance of cybersecurity. Notable developments include AI, cloud and edge computing, blockchain, IoT, and immersive technologies such as AR and VR. The cluster also features trends related to automation, digital identity verification, and the use of synthetic data. As cyber threats grow more frequent, organisations are prioritising secure digital infrastructures.

Evolving Trade Practices in the Digital Economy

This group includes 11 trends and highlights how digital technologies are transforming global trade. E-commerce, online platforms, and digital payments are reshaping consumer and business behaviour. Subscription-based models, personalised services, and data-driven decision-making are becoming the norm. While trade in services is outpacing trade in goods, SMEs still lag in adopting technologies like AI and automation.

Global Power Shifts in Technology and Economy

This cluster includes 8 trends and captures the shifting global balance of technological and economic influence. Emerging economies such as China, India, and the UAE are becoming innovation leaders, while Europe faces adoption challenges. National priorities are shifting toward data sovereignty and regionalised supply chains. Geopolitical tensions are intensifying, populism is on the rise, and new global alliances like BRICS+ are reshaping the international landscape.

Environmental Challenges and Sustainable Practices

This cluster includes 8 trends focusing on environmental sustainability and the integration of digital and green technologies. Key themes include the intensifying impacts of climate change, growing e-waste, and pollution. On the positive side, progress is being made in emissions reductions, renewable energy adoption, and sustainable manufacturing. Digital tools are increasingly being used to support green practices, and natural ecosystems are gaining recognition for their ecological, economic, and mental health value.

Advancements in Education and Digital Skills

This group includes 6 trends related to how education systems and workplaces are evolving in response to digital transformation. There is growing emphasis on online and lifelong learning, as well as integrating practical skills into academic programs. Companies are investing more in digital skills development, especially in advanced technologies such as AI and robotics. However, generational gaps in digital literacy remain a significant challenge.

Economic Disparities and Global Growth Issues

The final cluster of 5 trends addresses global inequality and economic instability. Trends in this group include rising income disparities, slowing global growth, inflation, and increasing living costs, all of which are diminishing real incomes and reducing consumer spending. Many regions still lack access to basic digital infrastructure, with a large portion of the global population, particularly in rural and least-developed areas, remaining offline.

In the next section, we present the trends, and trend groups, that were assessed in the survey as having the most potentially transformational impact on the future of CE organisations.

3.2. Results of the survey

Based on the survey results, trends were plotted in a Cartesian space with two axes: **Potential Impact** on the x-axis (ranging from moderate to transformational) and **Certainty of Continuation** on the y-axis (ranging from uncertain to almost certain continuation). The resulting matrix is presented in Figure 6.

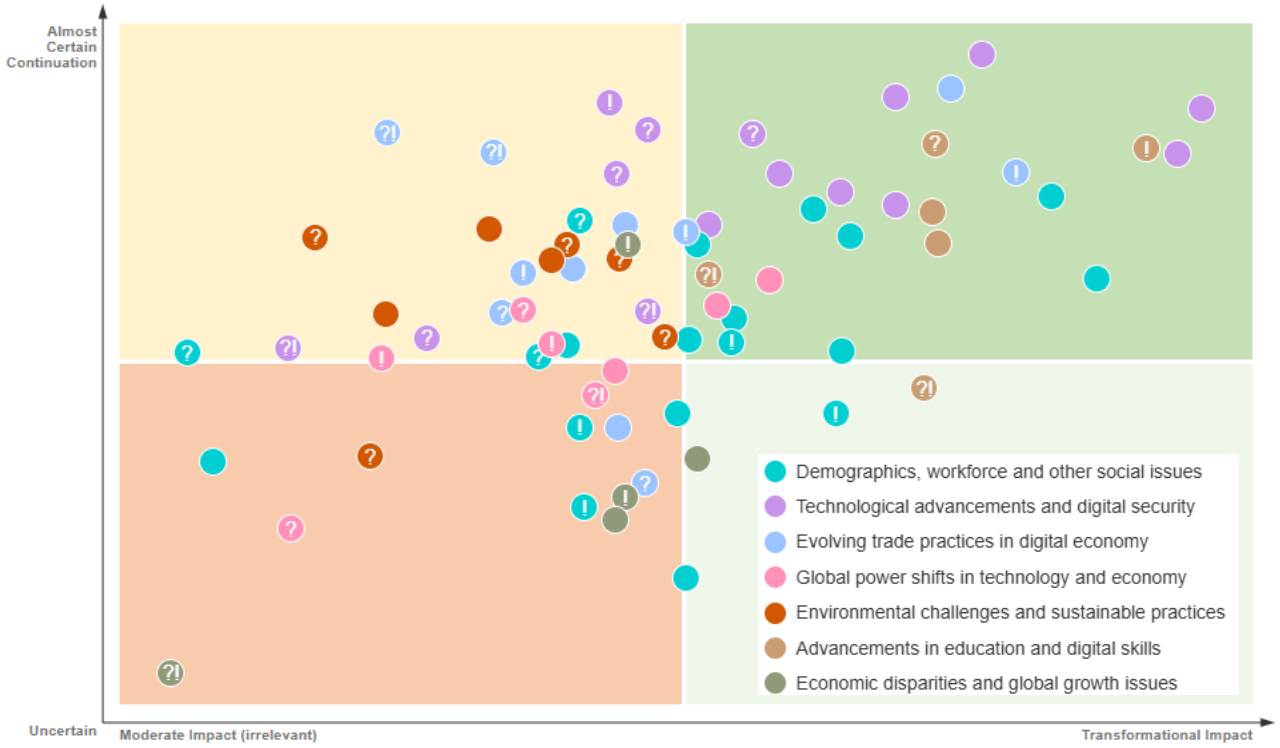

Figure 6. Impact-certainty matrix of trends

3.2.1. General evaluation of trends' importance and certainty

According to the one-sample t-test criteria, **33 trends** were evaluated as significantly more important than the others. These trends are highlighted in blue in Appendix 1. As might be expected, given the size of the trend clusters, the majority of trends scored as impactful belonged to *Demographics, Workforce Trends, and Other Social Issues* (12 trends) and *Technological Advancements and Digital Security* (9 trends). Notably, none of the *Environmental Challenges and Sustainable Practices trends* were assessed as having a transformational impact. At the same time, all trends related to *Advancements in Education and Digital Skills* appeared among the most impactful.

Based solely on the average scores across participants from all "triple helix" groups, the three most impactful trends identified were:

1. There is an increased focus on cybersecurity, aiming to protect data from cyber threats.
2. The growing adoption of AI and cloud solutions. In 2023, 8% of businesses in the EU reported using AI, while 41% reported using cloud computing services.

3. Lifelong learning: the continuous pursuit of knowledge and skills throughout a person's life, beyond formal education like school or university.

The three least impactful trends were:

1. Approximately one-third of the world's population lacks internet access, with a significant portion living in rural areas and least-developed countries.
2. The percentage of the self-employed workforce globally has dropped from 55.5% in 2000 to 48.1% in 2022. This percentage varies significantly between nations: high-income economies typically have lower self-employment percentages.
3. Lifelong learning: the continuous pursuit of knowledge and skills throughout a person's life, beyond formal education like school or university.

Regarding certainty, participants generally believed that all identified trends would continue developing in the same direction. The three most uncertain trends, based on average scores, were:

1. Approximately one-third of the world's population lacks internet access, with a significant portion living in rural areas and least-developed countries.
2. A growing number of individuals intentionally unemployed, especially among young people, are neither working nor looking for a job.
3. The US, as a strong global economic leader, continues to be the most attractive destination for migration from the EU and a key base for start-ups and SMEs.

3.2.2. Participants' agreement on trends' importance and certainty

Regarding the level of agreement among participants, trends with lower agreement – calculated based on the distribution of answers – are marked with an interrogation mark (?) in Figure 6. These indicate trends where participants' evaluations diverged significantly. Trends showing significant differences in evaluation between "triple helix" organisations are marked with an exclamation mark (!).

Among the 33 most impactful trends, there is notable diversity of opinion only on four of them. Despite relatively high average evaluations, a significant proportion of participants expressed doubts about the importance of the following trends for the future of their organisations, resulting in greater variability in responses:

- Growing focus on training specialists in advanced fields such as AI, robotics, biotechnology, and quantum computing (deep tech training).
- Increasing enrolment in online universities and courses, both globally and within the EU.
- Development of robotic technologies, including collaborative robotics, where machines and humans work together.

There is also a noticeable diversity of opinion regarding the certainty of the following trend:

- A growing gap in digital skills between older and younger generations.

While the majority believe that this gap will persist and likely widen in the future, some respondents are more optimistic and believe the gap will be successfully managed.

Other trends with a diversity of opinions on their **impact** are highlighted in **bold** in **Appendix 2**. A general diversity of opinions on importance means that there is disagreement among respondents – some perceive the trend as having a transformational impact on the future of their organisations, while others consider its impact to be low.

Similarly, trends with diversity of opinions regarding their **certainty** are highlighted in *italic* in **Appendix 2**. Diversity of opinion on certainty indicates disagreement among respondents – some believe the trend will certainly continue in its current direction, while others are uncertain about its trajectory or believe it may reverse.

3.2.3. "Triple helix" agreement on trends' importance and certainty

There are interesting differences between "triple helix" in the way their representatives evaluated the trends. In general, there are more differences in scores between academic institutions and SMEs than between academia and public authorities or public authorities and SMEs.

The analysis revealed that **academic institutions** consistently evaluated most trends as more impactful compared to public authorities and SMEs. Particularly, trends related to technological advancements, digital education, and social workforce issues, such as the growing use of data analytics for decision-making, enrolment in online education, and the rise of precarious employment, received significantly higher ratings from academic representatives. This suggests that academic institutions are more sensitive to long-term technological and societal changes and perceive them as critical to the future of their organisations. Moreover, in terms of trend certainty, academics generally showed slightly lower confidence than SMEs about the continuation of some trends, such as lifelong learning and the adoption of cryptocurrency. This might indicate that while academic institutions recognise the importance of many emerging changes, they maintain a slightly more cautious and sceptical outlook on the certainty of their continuation compared to SMEs.

Public authorities, by contrast, generally provided more moderate assessments of trends' importance, rating them lower than academic institutions but often close to SMEs. Significant differences appeared particularly for technology-related trends, such as the utilisation of synthetic data and the adoption of emerging technologies by different global regions, where public authorities provided a lower impact score compared to academics. This could reflect a more sceptical and conservative perspective among public sector organisations regarding disruptive technological changes. In relation to certainty, public authorities tended to express greater confidence than academics regarding the continuation of certain trends, notably income inequality and the growing gap in digital skills. This highlights a more pessimistic perspective among public authorities that global socioeconomic dynamics are likely to persist in their current direction.

Expectedly, **SMEs** demonstrated a distinct pattern by rating trade- and market-related trends, such as dynamic pricing and regional supply chains, as more impactful compared to other groups, while showing lower concern for trends related to education, workforce shifts, and digital inclusion. In some cases, SMEs rated trends such as the development of mobility technologies significantly higher than academics. Regarding certainty evaluations, SMEs were generally more optimistic, rating trends like the increased customisation of experiences as more likely to continue and slow economic growth as more likely to reverse. This highlights SMEs' practical focus on

immediate market dynamics and technological tools that directly affect their operational efficiency and competitiveness, rather than broad societal or educational transformations.

3.2.4. Time horizon

Most survey participants evaluated many trends as having a mid-term impact (Figure 7). Specifically, 13 trends were identified as having an impact in the near future (1-2 years). The top three trends currently affecting organisations include: *"An increasing number of ICT (Information and Communication Technology) security incidents are causing issues such as destruction or corruption of data, identity theft, and other related problems"*, *"There is an increased focus on cybersecurity, aiming to protect data from cyber threats"*, *"A growing gap in digital skills between older and younger generations."* Notably, two of these trends are directly linked to cybersecurity concerns. Additionally, 41 trends were assessed as having a mid-term impact (3-5 years), while 18 trends were identified as having more distant implications (6-10 years). Among the longest-term trends are: *"The population of the European Union is gradually decreasing, driven by declining birth rates"*, *"Many countries are increasing the retirement age to address the challenges posed by ageing populations and strained pension systems"*, *"Cryptocurrency is continuing to develop, with increasing adoption and acceptance across industries and regions"*.

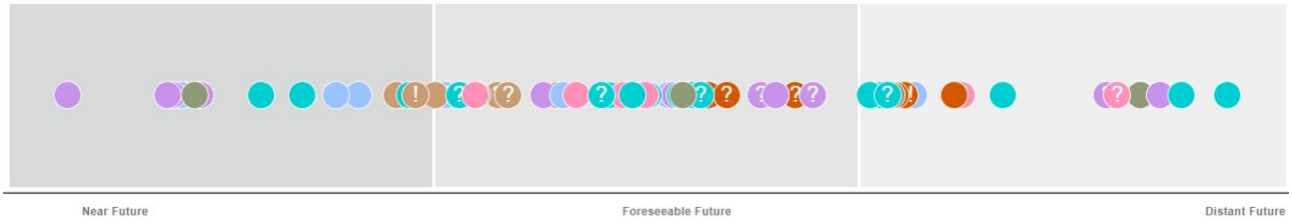

Figure 7. Trends' timeline

3.3. Scenarios drafting

Based on the identified trends, we drafted four future scenarios following the classical foresight archetypes defined by Dator et al. (2015): Continuation (accelerating the present), Collapse (struggling with a broken system), New Equilibrium (balancing the system), and Transformation (imagining a new world). These scenarios reflect potential trajectories for digitalisation and were designed to explore how shifts in technological adoption, organisational adaptation, and skill formation might unfold under different systemic conditions.

To create these four scenarios, two researchers from the UNIBO team first grouped the 33 most impactful trends into smaller, more focused topics, building on earlier clustering work. This process resulted in eight distinct groups of trends, as summarised in Table 2. These groups represent the key themes expected to shape the future of digitalisation.

Table 2. Groups of the most impactful trends for scenarios building

Group	Trend
Skills and education	There is a growing focus on training specialists in advanced fields like AI, robotics, biotechnology, and quantum computing (deep tech training).
	More EU businesses are investing in training their employees in both basic and advanced digital skills. In 2022, 22% of businesses provided ICT (Information and Communication Technology) training to their staff.
	Enrolment in online university and courses has been increasing both globally and within the EU.
	There is an increased focus in education on combining theory with practical skills, with more programmes offering a mix of academic learning and real-world work experience.
	Lifelong learning: the continuous pursuit of knowledge and skills throughout a person's life, beyond formal education like school or university.
	A growing gap in digital skills between older and younger generations.
New technologies	The development of advanced connectivity technologies, such as 5G networks, enabling faster and more reliable connectivity.
	The development of cloud edge computing brings computation, data processing, and storage closer to the location where it is needed.
	The development of robotic technologies, including collaborative robotics, where machines and humans work together.
	The growing adoption of AI and cloud solutions. In 2023, 8% of businesses in the EU reported using AI, while 41% reported using cloud computing services.
	The widespread adoption of IoT (Internet of Things) technology, where devices are interconnected to enable seamless data exchange.
Automatization	Rising interest in decentralised governance: digital platforms now let communities and organisations vote, discuss, and make decisions independently of traditional authorities.
	The growing automation of repetitive tasks and services in various areas.
	Growing public concern over ethical issues such as unfair treatment, discrimination, and lack of transparency in automated decision-making in areas like hiring, loan approvals, healthcare, and law enforcement.
	The growing use of data analytics for automation of decision-making traditionally performed by humans, such as hiring decisions, judicial decisions, and so on.
Global tension	Geopolitical tensions are escalating worldwide.
	The growing focus on local data storage and sovereignty in data access: countries and organisations are prioritising the retention of data within their borders and reducing dependence on foreign providers.

Ageing and migration	The share of people over 65 years old is steadily increasing, while the share of children is decreasing.
	Many countries are increasing the retirement age to address the challenges posed by ageing populations and strained pension systems.
	The increasing migration of young people across regions and countries for economic, educational, or social reasons.
	The population of the European Union is gradually decreasing, driven by declining birth rates.
	Labour shortages are constraining economic growth, with unfilled job vacancies potentially reducing GDP by 0.5% to 1.5% in 2023.
Employee and social wellbeing	The growing adoption of remote, hybrid and flexible working arrangements.
	Digital well-being is emerging as a corporate priority, focusing on balancing technology use with employee mental health and overall wellness.
	A rise in precarious employment, characterised by temporary contracts, job insecurity, and performance-based assessments.
	The increasing reliance on performance assessments for employees and organisations based on subjective ratings from users, such as students, customers, and citizens.
	Rising prices and higher interest rates are reducing people's real incomes, leading to decreased consumption.
	A growing number of individuals intentionally unemployed, especially among young people, are neither working nor looking for a job.
Cybersecurity issues	There is an increased focus on cybersecurity, aiming to protect data from cyber threats.
	The adoption of digital verification systems (including biometric authentication) is increasingly replacing physical processes of identity and document verification.
	An increasing number of ICT (Information and Communication Technology) security incidents are causing issues such as destruction or corruption of data, identity theft, and other related problems.
Market changes	The share of people using online services (such as public, health, banking, and others) has been gradually increasing over the past few years.
	The increased customisation of experiences: businesses tailor their products, services, or interactions to meet individual customer preferences.

Next, the researchers conducted a brainstorming session to envision how each of these thematic groups might evolve over the next 10 years, using Dator's (2015) framework as a guide. This approach resulted in eight distinct projections for each scenario, corresponding to each of the eight thematic groups. An example of these projections for the **Continuation** scenario is provided in **Figure 8**.

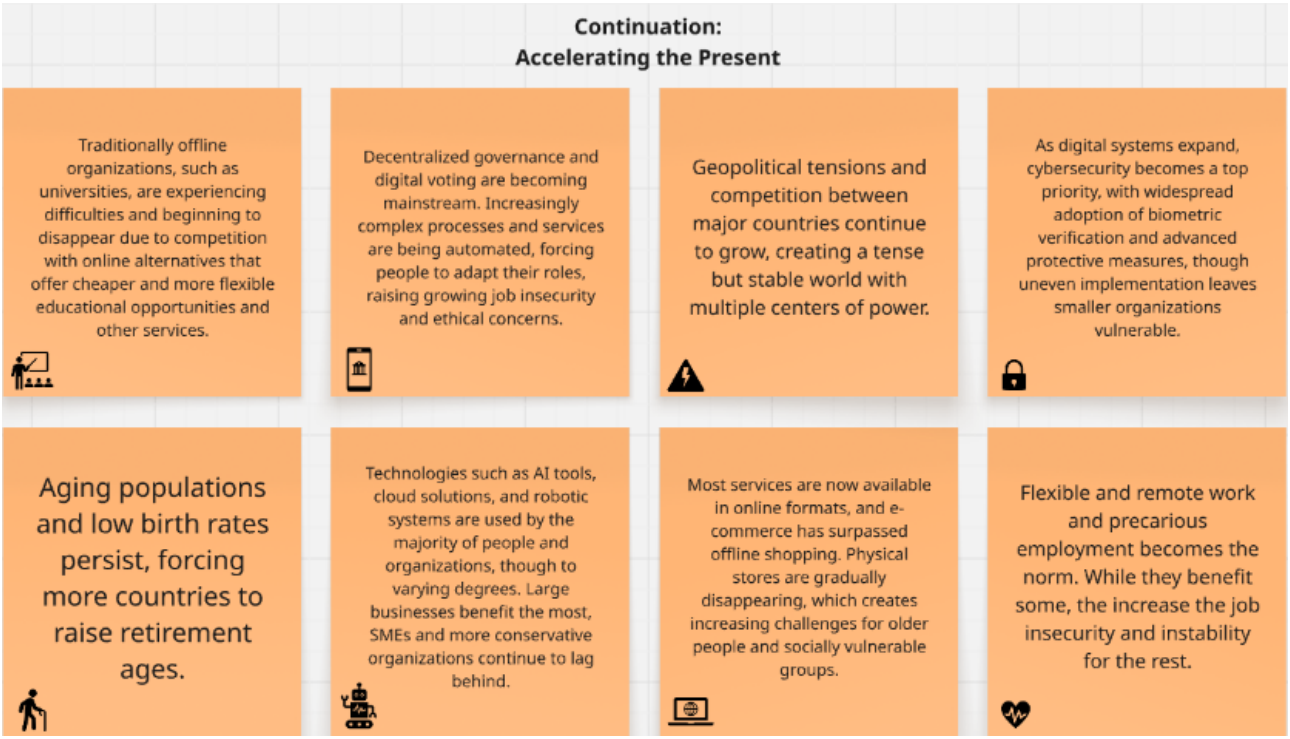

Figure 8. Example of the foresight scenarios drafting

Finally, these projections were synthesised into coherent descriptions of four titled potential future scenarios. The four scenarios present qualitatively different visions of the future. The **"Digital Drift"** extends current trajectories (i.e. continuation), where digitalisation accelerates unevenly, exacerbating fragmentation and reinforcing inequality. **"Tech with a Human Touch"** imagines a balanced evolution (i.e., new equilibrium), integrating participatory innovation and inclusive upskilling with technological development. **"Beyond the Human Age"** envisions a radical new work (i.e. transformation) driven by automation and decentralised governance, with work redesigned around intelligent systems. In contrast, **"Disconnected and Disillusioned"** reflects a loss of trust in digital innovation, leading to retreat and regression (i.e. collapse). The full scenario descriptions are provided in Appendix 3.

4. DISCUSSION AND IMPLICATIONS OF THE FORESIGHT SCENARIOS

The final phase of the research included 21 semi-structured interviews with managers, HR professionals, and employees from the three target sectors in the partner countries. These interviews aimed to capture insights into the plausibility of different scenarios, their potential skill requirements, structural impacts, and implications for market positioning. Below, the possible consequences of each scenario for public authorities, academic institutions, and SMEs, as expressed by the interviewees, are discussed.

4.1. Scenario 1: Digital Drift

4.1.1. Public authorities

Public authorities generally perceive the "Digital Drift" scenario as highly realistic and already partially true. Many respondents noted that their organisations are experiencing rapid digitalisation, yet often lack the necessary resources, infrastructure, and skills to manage this transformation effectively. Smaller municipalities feel particularly vulnerable, citing budget constraints, outdated systems, and limited technical expertise. One interviewee reflected: *"Honestly, this scenario is very close to what we're already experiencing. Larger cities and state institutions are moving fast with digital tools, but small municipalities like ours are being left behind. We are not well prepared – our budget is tight, we lack IT staff, and many citizens still prefer to come to the office in person."*

To remain functional in this evolving context, public organisations anticipate structural and operational changes. Several highlighted the need to create specialised units for digital services, cybersecurity, and data management. For example: *"We will need to set up a new department for digital services and IT security."* Others expect a broader shift to hybrid working models and new digital roles: *"Our organisational structure would shift toward a hybrid model, where part of the team would work remotely and digital profiles would become more important than local offices. We would develop roles such as data analysts, AI system operators and digital advisors, while traditional administrative tasks would be fully automated."*

Digital transformation will also reshape public engagement. Authorities stress that services must become more personalised and data-driven while retaining inclusive, human-centred support structures. There is a consensus that the digital divide must not widen further – especially for the elderly, rural populations, or those with low digital literacy. As one municipality described: *"We'd need to combine old and new – online forms for the youth, personal visits for seniors. We'd set up open days with volunteers to help people access digital services."* Another added: *"We will rely more on AI-driven chatbots, digital platforms, and self-service portals. However, we must retain physical access points for digitally excluded citizens. The Municipality will act more as a digital service coordinator than a traditional office."*

Adapting to this scenario also places demand on the skills of public sector staff. Both leadership and frontline workers must develop new capabilities. Leadership, in particular, must integrate digital strategy with ethical governance and change management. *"Management would have to strengthen its focus on change management, risk management and ethical governance of digital*

systems, especially to ensure fair access to services for vulnerable groups such as older job seekers or those with low digital literacy," one respondent explained. At the same time, employees across all roles need to build their digital literacy and understand the basics of cybersecurity, privacy, and data use: *"We need digital literacy across all age groups, basic understanding of cybersecurity and data protection."*

But the full benefits of digitalisation remain out of reach without a robust technological infrastructure. While some larger cities may begin to invest in advanced tools like blockchain, AI and CRM systems, many smaller municipalities are still struggling with basic digital connectivity and the need to digitise legacy systems. *"Many technologies are not yet available or known to us, so in the first phase we must first get to know them, ensure the selection of suitable ones and then finance them,"* one interviewee noted. However, new technologies must also be introduced: *"It will be necessary to run blockchain for secure voting, AI for document processing, and CRM for case management."* At the same time, the majority of the interviewees acknowledged that the current environment is not yet ready to support this vision.

4.1.2. Academic institutions

Academic representatives generally found the "Digital Drift" scenario plausible and, in many cases, already reflective of ongoing developments. Several interviewees noted that universities are actively transitioning towards more digital education models, especially after experiences during the COVID-19 pandemic. One participant remarked, *"This scenario feels highly realistic, as many elements are already part of our current reality. I would describe it as a natural continuation of today's digital transformation. Personally, I would feel quite comfortable in this scenario, but adaptation will depend on age and openness to change."* Views on the long-term sustainability of a predominantly digital model were mixed. While some respondents saw the potential for increased access and flexibility, others raised concerns about the loss of interpersonal contact and the suitability of online formats for all disciplines. In particular, manual fields and the development of soft skills like communication were frequently mentioned as challenges. As one participant observed, *"So, it's more about building communities, building friendships, building learning friendly environments."*

Organisational structures would likely need to evolve. Universities are expected to introduce roles dedicated to digital strategy, data management, and AI integration. Hybrid work models would become standard, leading to new operational dynamics. However, there were also concerns that increased reliance on digital delivery could reduce the demand for traditional academic staff, especially if student numbers decline due to global competition from online providers. One respondent explained, *"Yes, we would likely introduce roles focused on digital strategy and data management. Hybrid work would become the default, with decentralised teams and digital platforms replacing many traditional functions."*

Teaching and learning methods would also need to be rethought. Lecture-based delivery is seen as outdated, with growing emphasis on personalised, data-driven, and practice-oriented models. Asynchronous communication and digital tools like Moodle, AI tutors, and virtual reality environments are expected to dominate. *"Most tasks would be conducted through digital tools. Face-to-face meetings would be rare, and asynchronous communication would become standard,"* noted one interviewee. Another added, *"Professors will have to modernize their teaching*

methods. It'll be necessary to give students many more examples from practice, and not teach exclusively ex cathedra."

Both academic and administrative staff would require continuous upskilling. Faculty must learn to use digital teaching tools effectively and incorporate practical, real-world examples into online content. Leadership will also need new competencies in managing remote teams, overseeing digital infrastructure, and responding to fast-changing technological environments. As one participant stressed, *"They would need further training in digital leadership, data-informed decision-making, and managing hybrid teams."*

While many institutions have already begun integrating digital platforms, the full adoption of technologies such as AI, cloud-based systems, and immersive environments still presents challenges. Several respondents admitted to a limited understanding of the tools already in use: *"A deeper understanding of online teaching platforms would be important. Even in the case of Moodle, many functions remain unknown to us."* Another pointed out, *"Currently, as far as AI is concerned, we only use VR glasses in teaching two subjects – sports management and tourism destination management."*

4.1.3. SMEs

SMEs generally perceive the "Digital Drift" scenario as both a realistic progression and a complex challenge. Many already view digitalisation as a necessity to remain competitive in a landscape increasingly dominated by tech-savvy multinationals. As one respondent put it, *"Compared to other scenarios, I think this one is the most likely to come true. It is certainly not ideal, but the world is simply pushing you in that direction."* Another noted, *"It doesn't feel like science fiction, it's simply the next step in what we're already doing."* However, while some SMEs are enthusiastic about the transition, others expressed concern over the cost, speed, and sustainability of these changes, especially the risk of losing meaningful personal interaction with clients.

Organisational structures are expected to evolve toward greater flexibility and decentralisation, particularly in administrative and support functions. Hybrid work models would become the norm, especially for roles not directly tied to production. Respondents anticipate creating new digital departments and roles, such as specialists in data management and process automation. One interviewee explained, *"We would likely need to create specialised departments for data management and digital process oversight, beyond the traditional production and development teams."* However, some SMEs expressed hesitation about full digitalisation, citing the lack of digital readiness among partners and clients as a barrier: *"We still have the problem that many of our partners are not yet so digitalised – first and foremost, the offices. They have a great deal of bureaucracy."*

From a market perspective, SMEs acknowledge growing customer expectations for faster, more personalised and transparent digital services. Marketing, sales and support are expected to move toward full automation and real-time responsiveness. Nevertheless, many SMEs stressed that human relationships will remain a critical competitive advantage. As one respondent remarked, *"Our customers would expect faster responses, personalised solutions and transparent communication. Marketing and sales would need a full digital upgrade."* Yet, another cautioned, *"Maintaining personal relationships is a key element, and this requires a skilled professional – something that cannot be digitalised."*

The scenario also underscores the need for upskilling across all organisational levels. Employees will need to become proficient in digital tools, data analysis, AI systems, and remote collaboration platforms. Leadership must adapt to managing hybrid teams and making decisions based on real-time data. One SME representative noted, *"Digital skills at all levels would become essential – from technical know-how to strategic thinking, data analysis and critical evaluation."* Others added that change management and soft skills will be essential, particularly to navigate resistance among older staff or less tech-savvy workers.

Technological investments will be a priority for SMEs navigating Digital Drift. This includes AI tools, cloud platforms, cybersecurity solutions, and software for digital collaboration. One participant observed, *"We would have to invest more in automation tools, cloud services for material development, and cybersecurity solutions."* However, SMEs often lack the in-house capacity to implement these tools effectively and would benefit from external support, particularly in navigating regulatory and data security challenges.

4.1.4. Commonalities and differences

Public authorities, academic institutions, and SMEs all consider the *Digital Drift* scenario plausible and closely aligned with current trends. While they share a general awareness of the urgency to adapt, their specific concerns and priorities differ depending on their roles, resources, and institutional cultures.

Public authorities are focused on modernising service delivery while ensuring inclusivity. Their main concern is balancing the adoption of digital tools with the need to maintain access for digitally excluded populations. Limited budgets, ageing infrastructure, and uneven digital literacy levels create structural barriers, particularly in smaller municipalities. There is a strong emphasis on maintaining physical access points and integrating digital services without alienating vulnerable groups.

Academic institutions recognise the potential of digital education but remain cautious about fully abandoning traditional, in-person teaching. While many have already implemented hybrid learning models, concerns exist about the long-term impact on student engagement, practical skills acquisition, and institutional credibility. The shift to digital learning requires not only technological adaptation but also significant pedagogical and organisational change.

SMEs tend to view digitalisation as both an opportunity and a threat. Many are already operating in highly digital environments and see the scenario as a natural extension of ongoing transformations. However, the cost of digital tools, the risk of losing personal client relationships, and the pressure to keep pace with large, tech-savvy competitors pose challenges. SMEs are concerned with upskilling their workforce, adapting leadership styles, and maintaining customer trust in an increasingly automated market.

Despite these sector-specific differences, all three organisation types highlight the critical importance of **digital skills development**, **data management**, and **strategic leadership**. The scenario demands a rethinking of organisational structures, the creation of new roles and competencies, and increased inter-sectoral cooperation.

4.2. Scenario 2: Tech with a Human Touch

4.2.1. Public authorities

Public authorities generally perceive the "Tech with a Human Touch" scenario as a realistic and desirable pathway that balances digital progress with social responsibility and human connection. Compared to more disruptive futures, this scenario is viewed as achievable and aligned with ongoing initiatives at the local level. It resonates particularly well with smaller municipalities that often feel left behind in the digital transformation. Respondents repeatedly described it as a future that is *"balanced and people-friendly,"* one that takes into account the needs of digitally excluded groups and prioritises well-being and inclusion. One interviewee described it as *"a more humane and achievable future for us,"* while another commented, *"This scenario seems to me the most balanced and the most socially responsible."*

Organisational implications in this scenario are seen as significant but manageable. Public institutions anticipate a gradual adaptation involving the introduction of hybrid service models and supportive roles. AI and digital tools would increasingly be used to handle repetitive administrative tasks, allowing staff to focus on complex cases and human interaction. *"We would use AI to automate routine tasks such as certificates or registrations. But the personal support must be maintained – we know most of our citizens by name."* While some job functions may change or disappear, new roles in digital facilitation, community engagement, and ethical oversight are expected to emerge. Smaller municipalities in particular envision shared services models, regional hubs, and external consultants as cost-effective ways to build digital capacity. According to one interviewee, *"There is definitely a need for financial support, shared services within municipalities and access to IT consultants or mentors."*

In terms of market and service delivery, the scenario suggests a mixed model in which both digital and physical channels coexist to ensure accessibility. This shift would reinforce citizen trust and improve the overall quality of service. Public authorities foresee the increased use of online tools – such as livestreaming meetings, feedback apps, and digital participatory platforms – alongside in-person engagement strategies. As one respondent noted, *"Citizen participation would improve through a combination of digital platforms and in-person meetings."* Personal contact remains central in this scenario, especially for vulnerable populations. Support centres, municipal helpdesks, and live assistance were highlighted as essential for bridging the digital divide. *"Maintaining physical contact points, introducing digital guides in community centres, and investing in user-friendly platform design"* were identified as practical measures to improve accessibility.

Skills development is seen as an important condition for success in this future. Authorities stress the importance of lifelong learning and targeted training for both leadership and staff. Priorities include digital literacy, hybrid leadership, cybersecurity, and ethical use of AI. *"Tailored micro-trainings on hybrid leadership, cybersecurity, AI in administration, and community engagement strategies"* were among the most frequently cited needs. Many also underlined the necessity of training for frontline staff to support digitally excluded citizens and promote trust in public services. One respondent noted, *"We need specific education around business segments, especially in the digital part where I don't think any of us are particularly fluent."* Another proposed training in communication skills for civil servants working with vulnerable or digitally inexperienced users.

On the technological side, authorities emphasised that technology should be designed to assist – not replace – public servants. AI would be deployed primarily for backend automation, freeing up human resources for empathetic and context-sensitive service. *"AI can assist with repetitive tasks like sorting submissions or drafting standard responses. But human involvement is irreplaceable."* Several interviewees called for the creation of accessible, user-friendly platforms tailored to local government needs. Shared systems between municipalities and national-level guidance were suggested as ways to lower costs and reduce fragmentation. Additionally, cybersecurity emerged as a priority, with one interviewee pointing out, *"Investments would be needed to modernize the municipal office, provide digital tools for staff, and ensure cybersecurity. State support in this area would be an advantage."*

4.2.2. Academic institutions

Academic institutions regard the "Tech with a Human Touch" scenario as both realistic and desirable, especially when compared to more extreme digital futures. While some respondents see it as somewhat idealistic given the current pace of change and political uncertainty, many expressed that its focus on balance, collaboration, and the ethical use of technology aligns well with their vision for education. The scenario was described as *"extremely interesting"* and *"not so unrealistic,"* especially in how it preserves the human side of teaching and research. Others welcomed its potential for promoting well-being, flexibility, and long-term institutional resilience.

Organisationally, interviewees anticipate maintaining core educational practices while integrating digital tools in a way that supports – not replaces – academic staff. There is a shared understanding that AI could automate administrative and repetitive academic tasks, enabling educators to concentrate more on mentorship, creativity, and knowledge transfer. As one respondent explained, *"We would use AI to automate administrative tasks and provide learning analytics, freeing time for educators to focus on mentoring and creativity."* Hybrid work arrangements and partnerships with other institutions and industry would become the norm, with structures increasingly designed to prioritise inclusion and employee upskilling. Institutions would integrate well-being and professional development into their operational core, recognising that sustainable growth depends as much on people as on platforms.

In terms of market positioning and teaching models, the scenario envisions a hybrid, student-centred approach. Rather than rely solely on massive online courses, universities would offer blended learning pathways that combine digital resources with practical training. Respondents noted that *"practice-oriented training opportunities and practical knowledge that cannot be found on the internet could offer a significant advantage."* This shift would reframe students as active partners in the learning process, not just recipients of information. Digital tools would enable deeper engagement, but practical skills learning, personalised mentoring, and real-world application would remain vital. For academic institutions, this implies new forms of collaboration with employers and local communities, as well as a stronger role in shaping digital ethics and inclusive access.

The scenario places strong emphasis on staff development, not just in technical areas but also in interpersonal and pedagogical skills. Flexible, modular training programmes – especially in AI, data analytics, and digital strategy – are seen as essential. However, these must be paired with training in communication, inclusion, and mentoring. One participant summarised the dual need well: *"All*

trainings which, on the one hand, help people to make use of all these technologies... and on the other hand, make clear that these tools are not ruling over the humans, but are... tools which support and help us in our daily job." Institutions are expected to encourage a mindset that embraces technological change while maintaining control over its use and implications.

From a technological perspective, academic institutions anticipate using AI and other tools as assistants. AI would support core functions such as test creation, data processing, content curation, and student assessment, but always under human supervision. Respondents stressed the importance of maintaining user-friendly systems that reduce cognitive load rather than add to it. *"The use of artificial intelligence as a support tool for teaching and non-teaching staff... is related to the fact that a large number of processes are already digitised."* However, universities are also mindful of infrastructural and financial limitations. Effective digital transformation would require investment in updated hardware, access to AI platforms, and stronger partnerships with industry. While most respondents expect their students and staff to be digitally literate, hybrid service models and live support would be necessary to ensure no one is left behind.

4.2.3. SMEs

SMEs generally perceive the "Tech with a Human Touch" scenario as an appealing but difficult-to-implement vision. Many respondents acknowledged that it represents a desirable direction for future development, one that supports both human well-being and technological progress. However, several expressed doubts about the scenario's feasibility without strong state intervention, significant financial investment, and better-regulated digital frameworks – especially in Central and Eastern Europe. One participant noted, *"That sounds very good. I hope that it will be realistic, but with a good degree of intervention by the state,"* while another added, *"To make it happen, it would require a lot of regulation and a lot of additional money, especially in Central Europe."* While they appreciated the scenario's emphasis on human values and balanced innovation, they cautioned that real-world constraints such as fragmented support systems, underinvestment, and bureaucratic inefficiencies could make its full realisation unlikely in the short term.

Organisationally, this scenario implies a transformation in how SMEs operate, communicate, and structure their teams. Some anticipate the emergence of new roles like *"technology scouts"* or *"AI trainers"* to bridge gaps between emerging tools and everyday operations: *"There would certainly be new roles, the first thing that comes to mind is something like technology scouts and technology trainers."* Hybrid work and flexible schedules are already widely adopted, and this future is seen as building upon these practices by enhancing autonomy and trust. One interviewee explained, *"Our employees have a lot of flexibility, like coming and going to work... we are a small company and our employees all more or less enjoy these benefits."* However, effective leadership will be essential, particularly in managing decentralised teams, overseeing digital adaptation, and ensuring consistent knowledge transfer. *"We need a management system of knowledge transfer… time resources for creating content, motivating and integrating in new processes."*

On the market level, SMEs see the opportunity to differentiate themselves by retaining their human touch. While automation and AI are embraced for improving operational efficiency, many respondents stressed that personal relationships, tailored services, and empathetic customer

engagement would remain key competitive advantages – especially for clients with limited digital literacy. As one participant said, *"We combine digital communication... with personal support options, such as phone calls or individual help."*

Skills development is seen as one of the challenges in this scenario as well. Respondents agreed that generic digital training often fails to meet the specific needs of their businesses. Instead, they advocate for tailored, practical, and modular programmes that reflect real tasks and tools used on the job. *"I don't see that there is anything offered on the market in general that is adapted for the type of organization that we are. It should perhaps design a "tailor made" training with some experts."* Others pointed out the importance of short, targeted formats: *"Short, hands-on, workplace-based training would be the most useful – especially courses focused on using AI tools for project preparation, legal research, or generating outputs for grant applications."* Several highlighted that training must accommodate a diversity of digital proficiency levels within the same organisation: *"Digital transformation progresses more like a leopard's spots... people don't all have the same predisposition or starting level."*

Technologically, SMEs plan to use AI and automation as supportive tools, particularly for streamlining repetitive tasks like content creation, data processing, or administrative workflows. *"We could digitise recurring topics and automate them with AI, so our employees would have more time for other things."* Rather than aiming for wholesale replacement of human labour, they see technology as a way to free employees from routine burdens, allowing them to focus on higher-value tasks such as client interaction, strategy, or creative work. One participant said, *"AI could help us reduce repetitive tasks and improve production quality, but ethical and controlled implementation will be crucial."* However, they also emphasised that employees need guidance and training to effectively use such tools.

4.2.4. Commonalities and differences

In the "Tech with a Human Touch" scenario, public authorities, academic institutions, and SMEs share a generally positive outlook, appreciating the balanced approach that integrates technology without fully replacing human roles.

Public authorities see this scenario as more achievable and humane than the "Digital Drift" scenario, aligning well with their mission to provide inclusive services to diverse populations. They emphasise the need for new roles focused on digital service delivery, citizen engagement, and IT security, while highlighting the importance of maintaining a human touch in public services. This perspective is echoed by academic institutions, which also see potential in this scenario, particularly through partnerships and lifelong learning. However, they stress the need for substantial investment in digital infrastructure, modular training, and support for faculty adapting to new teaching methods. SMEs also generally support this vision, recognising the potential for technology to enhance productivity without fully replacing human workers. They anticipate the need for agile organisational structures, including roles like technology scouts and digital mentors, and emphasise the importance of maintaining personal relationships in customer interactions.

Despite these commonalities, each sector faces unique challenges. Public authorities must balance digital efficiency with the need for physical services, academic institutions face ongoing pressures to modernise without losing personal connections in education, and SMEs have the practical challenges of funding, training, and adapting to rapidly changing digital markets. All three sectors

agree on the critical importance of **ongoing digital skills development**, **ethical technology use**, and **maintaining human-centred approaches** as they navigate this digital future.

4.3. Scenario 3: Beyond the Human Age

4.3.1. Public authorities

Most public authorities view this scenario as largely speculative and far removed from current realities. For example, one respondent noted, *"That's still a long way off... That's exactly what science fiction is."* Others similarly expressed scepticism, pointing out that the technological foundations for such a future, like quantum computing and advanced robotics, are not yet in place. Another participant stated, *"It is too much, because we don't have any quantum computers... and I don't know if we have it in 10 years."* This suggests a significant gap between the ambitious vision of this scenario and the current technological capabilities of many public institutions.

If such a scenario were to materialise, the role of human professionals in public organisations would shift dramatically. Instead of traditional administrative roles, employees would become ethical supervisors of AI systems, case managers for complex issues, and trainers of AI algorithms. One respondent described this transition as moving towards *"ethical supervision of AI decision-making"* and managing exceptional cases that require human judgment. Additionally, new roles like AI teachers and data sovereignty experts would emerge to manage these systems and ensure they align with public values and legal frameworks.

While direct market implications were not deeply discussed, there is a recognition that public services would need to adapt to a more data-driven, automated environment. This would require collaboration across organisations and with private sector partners to build robust, interconnected digital infrastructures. One respondent mentioned the need for *"strong collaboration with international networks to develop shared digital infrastructures,"* indicating that even public authorities would need to operate in a more interconnected, globally oriented market.

The scenario would demand new skill sets from public sector employees. Employees would need to move beyond traditional administrative skills and become *"trainers of AI systems"* and *"ethical supervisors,"* capable of guiding automated systems in a human-centric direction. There would also be a strong emphasis on cybersecurity, data protection, and ethical governance to maintain public trust in these systems.

The shift to a fully digital, AI-driven environment would require massive upgrades in technological infrastructure which is old now and not ready for such a future. This includes the deployment of fibre-optic networks for faster data transmission, robust data security frameworks, and advanced AI management systems. One respondent highlighted the importance of *"better internet connection"* and *"fiber optic infrastructure"* as foundational elements for this transformation. Additionally, there would be a need for significant investment in training and digital education to ensure that staff can effectively use and oversee these technologies.

4.3.2. Academic institutions

Academic institutions generally view this scenario as both unsettling and potentially transformative. Some respondents expressed deep scepticism, describing it as a future where

"there is no place for human beings anymore" and questioning whether such a system would align with human values. Others acknowledged that while this scenario might seem distant and speculative, rapid technological change could make it a reality within a decade. One respondent noted, *"What seems unimaginable today will likely be completely normal in 10 years."* However, many also highlighted the risk of losing human connection, with one respondent emphasising the need to preserve the social aspects of education, as *"student life is still an important period in life when people need to connect and socialise."*

If this scenario were to become reality, academic institutions would undergo fundamental structural changes. Traditional universities might cease to exist in their current form, as teaching roles evolve into training AI systems and supervising automated educational processes. One respondent even suggested that *"the current university structure would cease to exist and would be rebuilt entirely according to a new order."* This transformation would require universities to develop new departments focused on AI ethics, digital pedagogy, and data governance, reflecting a shift from purely educational institutions to hybrid, technology-driven knowledge networks.

The academic market would shift significantly. Universities would need to adapt to a world where physical student interactions are replaced by AI-driven learning paths, potentially eroding the personal connections that have historically defined the educational experience. This shift could make the acquisition of real knowledge harder to verify, as one respondent noted, *"Strict regulation is necessary to ensure that students don't participate solely to obtain a certificate, as the acquisition of real knowledge could become increasingly difficult to verify."* This could lead to significant challenges in maintaining academic standards and credibility.

The skills required in this scenario would shift towards advanced digital literacy, including the ability to train and supervise AI systems. Educators would need to focus on creativity, critical thinking, and systems-level understanding to remain relevant. One respondent described the future role of educators as *"knowledge holders, providing systems-thinking foundations and contributing with creative minds."* This reflects a broader need for flexible, interdisciplinary skills that blend technical competence with human-centric judgment.

To remain relevant in this future, academic institutions would need to invest heavily in cutting-edge digital platforms, AI software, and quantum computing technologies. This includes building robust digital infrastructures that can support personalised, continuous learning at scale. One respondent highlighted the need for *"professional knowledge of digital platforms and the routine, day-to-day use of AI software,"* while others pointed to the importance of international collaboration to develop shared technological solutions and standards. Additionally, institutions would need to balance automation with human oversight, ensuring that AI-driven education remains ethically sound and inclusive.

4.3.3. SMEs

Most SMEs see this scenario as a highly speculative and distant future. Many respondents expressed scepticism about the feasibility of such a rapid transformation within the next decade, largely due to the slow pace of legislative change and the need for human oversight in decision-making. As one respondent noted, *"This scenario sounds futuristic, but elements like personalised learning and AI-assisted decision-making are already emerging."* However, several respondents also recognised the potential benefits, such as reduced routine work and a shift towards more

meaningful, purpose-driven roles, even though they remained cautious about the loss of human connections and the risk of excessive automation. One particularly critical voice described the scenario as *"too idealistic,"* warning that it could lead to the loss of diversity and creative autonomy in the business world.

The organisational structures of SMEs would need to undergo profound changes to survive in this scenario. Many respondents anticipated a shift towards flatter, more networked organisations, where human roles focus on strategy, oversight, and creative problem-solving rather than routine operations. For example, one participant highlighted the need for *"AI-output curators, inclusion auditors, and ethical supervisors,"* while others foresaw the emergence of roles like data engineers and digital transformation leaders. Some SMEs also recognised the potential for new business models, potentially evolving into service-sharing hubs or integrated networks, where companies would collaborate closely to remain competitive.

The market dynamics for SMEs in this scenario would change, with many small businesses either disappearing or becoming tightly integrated into larger industrial networks. Some respondents expressed concern that this shift could lead to a loss of diversity and innovation, as smaller firms might struggle to compete with larger, AI-powered corporations. One respondent noted that in such a scenario, their company would need to *"reposition itself completely,"* potentially even changing its core business model. There were also concerns about the impact on employee autonomy and creativity, with several participants emphasising the need to maintain human connections to keep work meaningful.

The skills required for SMEs may not be significantly different from the skills required by other scenarios. Employees would need to focus on creative thinking, strategic oversight, and the ability to interpret AI outputs. One respondent described the need for *"employees who handle data rooms, integrate data into new systems, and manage AI tools,"* reflecting a broader shift towards technical and digital expertise. Another highlighted the importance of maintaining a *"human touch"* in decision-making, ensuring that employees remain responsible for the ethical and social implications of their work, even in a highly automated environment.

SMEs would need to invest heavily in advanced digital infrastructures, including AI systems, quantum computing, and secure communication networks, to remain competitive. Many respondents noted the importance of building robust digital systems that support real-time collaboration and data sharing. However, some also expressed concerns about the risks of excessive automation and the potential loss of human judgement in decision-making. One participant emphasised the need for *"transparent access protocols and ethical standards,"* suggesting that collaboration between companies would require not just technical upgrades, but also strong regulatory frameworks to protect smaller players.

4.3.4. Commonalities and differences

The **"Beyond the Human Age"** scenario presents both shared challenges and distinct perspectives across public authorities, academic institutions, and SMEs. All three sectors recognise that the shift to a fully digital society, driven by AI, robotics, and quantum computing, will reshape their organisational structures, work processes, and human roles. They agree that this transformation demands significant investments in digital infrastructure, including advanced computing networks and ethical frameworks to guide AI decision-making. Each sector also acknowledges the

importance of redefining human work, moving away from routine tasks towards more strategic, creative, and supervisory roles, such as overseeing AI systems, ensuring ethical standards, and maintaining human connections.

However, there are specific concerns and priorities. Public authorities tend to approach this future with caution, viewing it as potentially unrealistic without substantial regulatory and infrastructure support. They emphasise the need for human oversight of automated systems to maintain public trust and prevent ethical risks. Academic institutions express a deeper philosophical concern, fearing that fully AI-driven education could undermine the human connections central to learning and personal development. They highlight the need to preserve the authenticity of human teaching and mentorship, even as they prepare for a world where AI systems design learning paths. SMEs, in contrast, focus more pragmatically on business survival, expressing concern about being absorbed into larger industrial networks and losing their creative independence. They see the potential for new roles, like AI-output curators and ethical supervisors, but worry that smaller firms might struggle to maintain their autonomy in a highly automated economy. Despite these differences, all three sectors agree on the need for continuous upskilling, adaptive leadership, and strong ethical frameworks to navigate this uncertain digital future.

4.4. Scenario 4: Disconnected and Disillusioned

4.4.1. Public authorities

The overall reaction from public authorities to this scenario is one of deep concern, with many describing it as troubling and negative. Several respondents noted that it mirrors some aspects of the COVID-19 era, highlighting a decline in digital trust, rising social isolation, and an over-reliance on failing technologies. One respondent stated, *"It is a horrific scenario and I believe that this is not what awaits us or humanity."* Others echoed this concern, fearing a loss of trust in public institutions and technology, with some describing the scenario as a possible warning of what might happen if emotional and social needs are ignored in the pursuit of technological efficiency.

In this scenario, public authorities would need to significantly adapt their operations. Many respondents indicated a shift away from digital services towards more personalised, human-centred approaches. This includes reopening physical contact centres, reintroducing field work, and prioritising face-to-face interactions. One respondent highlighted the need to *"go back to a personal approach - more physical contact points, more field workers,"* emphasising the importance of personal relationships in small communities. This shift would likely involve increased staffing, reintroduction of manual processes, and a focus on local, community-based initiatives to restore public trust.

Public institutions anticipate a challenging market environment, with less reliance on digital platforms and a return to traditional, hands-on service models. This might include supporting traditional crafts, community volunteering, and small local businesses. Some respondents mentioned a potential return to earlier forms of communication, like community announcements and public radio, as digital systems become less trusted. One respondent observed, *"Citizens would lose trust in digital participatory tools. The municipality would focus on direct engagement through public gatherings and community activities that build relationships and trust."*

Respondents emphasised the need for practical skills over digital certifications in this scenario. Many suggested a return to mentorship, shadowing, and hands-on training to ensure employees can perform essential tasks without relying on potentially unreliable technology. *"Digital certificates alone are not enough – we need a system to verify practical skills and real competences,"* one respondent stated, reflecting a broader concern about the limitations of purely digital education. Some also noted the need for staff to develop emotional intelligence and relationship-building skills, essential for maintaining community trust.

Technological investments would shift in this scenario, with many respondents suggesting a move away from cutting-edge digital systems in favour of more resilient, community-focused solutions. This includes physical 'safety points' where citizens can verify their information and receive support without relying on potentially compromised digital platforms. One respondent proposed, *"Establish physical 'safety points' – places where citizens can check information and get help."* Additionally, there would be a focus on reducing dependence on technologies prone to failure and data breaches, with investments redirected towards human resources and mental health support.

4.4.2. Academic institutions

Academic institutions generally view this scenario as deeply concerning and largely unrealistic, though some aspects, such as digital burnout and loss of trust in technology, are recognised as existing challenges. One respondent described it as *"a really dark scenario,"* while another noted that it would be akin to a technological regression, comparable to a *"new Middle Age"* following a catastrophic event. Despite this pessimism, some institutions acknowledge the potential for this scenario if digital tools fail to deliver meaningful outcomes and erode public trust.

If this scenario were to become reality, universities would need to rapidly adapt by abandoning digital-first approaches and returning to traditional, in-person education. One respondent suggested, *"We would abolish everything that was online and return to the traditional way of studying,"* emphasising the need for face-to-face teaching to maintain educational credibility. This shift would also involve a renewed focus on human-centric skills like critical thinking, interpersonal communication, and practical experience, as these would become more valued in the absence of reliable digital tools.

Academic institutions would face challenges in aligning their curricula with market demands, especially if trust in certifications collapses. As one respondent observed, *"Online certification of studies is about trust, and if it disappears, the whole point of education is lost."* In this scenario, universities would likely need to reintroduce professional practice and hands-on learning to meet the expectations of employers who prioritise practical skills over digital credentials.

Practical skills would become increasingly important, with a strong emphasis on hands-on training, internships, and real-world problem-solving. Respondents highlighted the need for students to gain practical experience to be employable, noting that purely digital education often fails to prepare graduates for the communication and interpersonal challenges of the modern workplace. One institution stated, *"Professional practice is a mandatory course for us, through which students must complete 420 working hours in a company."*

Universities would likely reduce their reliance on digital technologies, instead investing in offline infrastructure and interpersonal teaching methods. One respondent argued that universities could quickly adapt by *"returning to a fully classroom-based teaching model"* if digital trust erodes.

However, this would also require changes to curricula and teaching methodologies to ensure students acquire the skills needed in a less digital world.

4.4.3. SMEs

SMEs generally view this scenario as deeply pessimistic, with some considering it unlikely unless driven by broader geopolitical crises. One respondent noted that it only seems plausible if global conflicts escalate, reflecting the interconnectedness of technology, economy, and politics: *"This scenario is only realistic if there is a situation where the story about Ukraine does not calm down, but escalates."* Many SME representatives express hope that their organisations can avoid such a bleak future, but acknowledge that some elements, like burnout and digital mistrust, are already present.

In this scenario, SMEs would need to shift their focus back to human-centric approaches, prioritising personal relationships over digital efficiency. This would likely require significant internal restructuring, as many businesses have built their models around digital communication and automation. For instance, one SME noted that *"Mentoring and hands-on training would be vital, especially for new employees, as formal – mostly online – education would no longer meet industry needs."* Some companies also anticipate a return to manual, face-to-face interactions, viewing this as a potential advantage in building stronger, more resilient customer relationships.

Many SMEs fear that a widespread loss of trust in digital tools would undermine their core business models, especially those that rely on digital platforms or automated processes. One respondent described this as *"a very negative scenario,"* potentially leading to a market where physical presence and personal trust become the primary competitive advantages. However, this could also open opportunities for businesses that have maintained strong offline connections, as digital fatigue pushes customers back towards traditional services.

Practical skills and interpersonal abilities would become critical as businesses move away from purely digital interactions. Several SMEs highlighted the need for hands-on training and "on-the-job" learning to close the gaps left by online certifications. One respondent remarked, *"We would have to teach the practical skills to the graduates and employees ourselves, or join forces with other companies,"* emphasising the need for collective efforts to rebuild skills. Psychological resilience and stress management would also become essential, as employees struggle to adapt to a less automated, more labour-intensive work environment.

While some SMEs indicated that they would reduce their technology investments, most would seek a balanced approach, maintaining essential digital tools while investing more in human skills and physical infrastructure. One respondent captured this sentiment well: *"I would perhaps shift something, but not take it away completely."* However, others expressed deep scepticism about fully retreating from digital tools, arguing that such a move would be both impractical and regressive.

4.4.4. Commonalities and differences

In the "Disconnected and Disillusioned" scenario, different organisation types share some common challenges but also exhibit differences in how they perceive and would respond to this potential future. All organisation types express deep concern about the potential erosion of trust in digital

tools and the need to return to more traditional, human-centric approaches. They recognise that without public confidence in technology, a critical component of modern work, education, and governance would be lost. For example, both public authorities and SMEs anticipate the need to rebuild personal relationships, emphasising face-to-face contact and direct engagement to restore trust. Academic institutions similarly acknowledge the need to return to in-person teaching and practical training if digital education loses credibility. Mental health and employee well-being are also shared concerns. Public authorities, academic institutions, and SMEs alike highlight the importance of psychological support, team building, and stress management as essential responses to the pressures of this scenario. They see the need to strengthen interpersonal skills, emotional intelligence, and practical competencies, recognising that purely digital skills would no longer be sufficient.

However, the responses diverge when it comes to organisational structure and adaptation strategies. Public authorities tend to focus on community engagement and transparency as core recovery strategies, often prioritising physical contact points and rebuilding trust through direct communication. They emphasise the need for stable, predictable public services, even in times of digital distrust. Academic institutions, in contrast, highlight their inherent flexibility to switch between online and offline modes of operation. They see themselves as uniquely positioned to bridge the gap between digital skills and real-world competencies, often emphasising their historical role as centres of hands-on learning and critical thinking. SMEs, on the other hand, face perhaps the greatest disruption. Their responses reveal a blend of anxiety and pragmatism, as many are deeply embedded in digital business models that would struggle to adapt if digital tools lost credibility. They express concern about the practical skills gap and the need for direct customer relationships. In summary, while all organisation types share a desire to rebuild human connections and restore trust, their approaches reflect their distinct missions and operational contexts, highlighting the diverse strategies required to navigate this challenging future.

5. CONCLUSION

As a result of our work, we developed four plausible scenarios for the digital transformation of Central European organisations, grounded in both survey responses and qualitative insights from stakeholder interviews. These scenarios, *Digital Drift*, *Tech with a Human Touch*, *Beyond the Human Age*, and *Disconnected and Disillusioned*, represent distinct yet interconnected visions of the future, shaped by varying technological, organisational, and societal dynamics. An infographic overview of these four scenarios is presented in Figure 9.

Despite their differences, all scenarios converge on certain skill imperatives. Future roles will demand not only technical proficiency but also the ability to collaborate with AI systems, make ethically grounded decisions, and engage in lifelong, adaptive learning (Mendoza-Chan & Pee, 2024). The ability to work across all systems, technological, social, and organisational, emerges as a critical capability, along with competencies related to digital well-being, such as managing technostress and maintaining purpose and engagement in hybrid contexts (World Economic Forum, 2025).

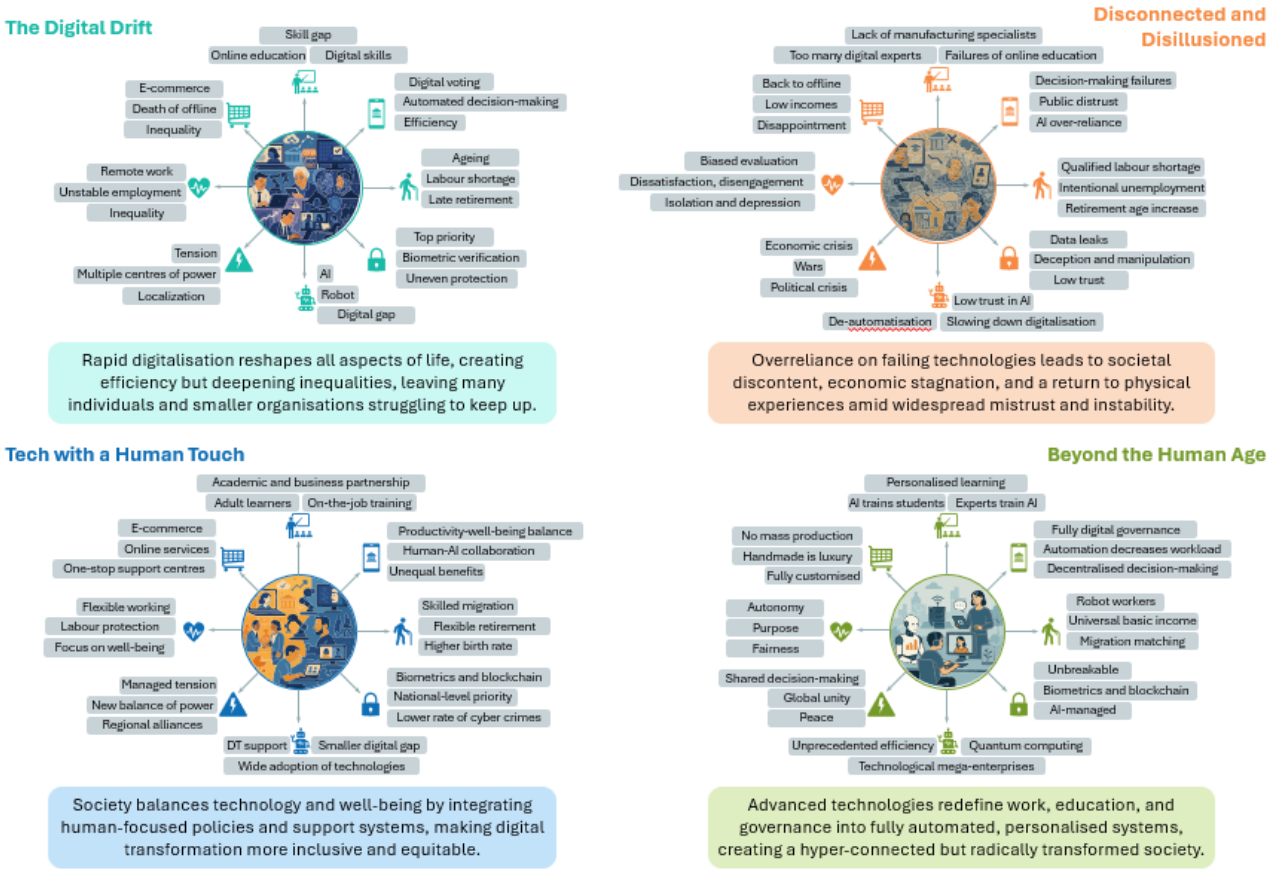

Figure 9. Infographic overview of the foresight scenarios

Overall, interviewees across academia, public authorities, and SMEs considered all four scenarios to be plausible to varying degrees. Rather than dismissing any one scenario outright, stakeholders acknowledged elements of each as either already visible or likely to emerge depending on contextual developments.

To illustrate the practical implications of each scenario, **Tables X-Z** summarise their expected impact on organisational structures, market orientation, technological adoption, and skill requirements across the three organisational types within the "triple helix". These tables serve as a comparative guide to how different sectors may need to adapt in response to divergent digital futures.

Table 3. Implications of the Digital Drift scenario

Organisation type	Organisational changes	Market orientation	Technology	Skills
Public Authorities	Creation of digital service departments; hybrid work structures; investment in cloud-based collaboration tools	Focus on digital service delivery and citizen engagement	Basic digital infrastructure, AI, cloud-based tools, digital identity systems	Digital literacy, data analysis, cybersecurity, strategic leadership
Academic Institutions	Shift to online education; reduction in physical campus roles; increased reliance on digital teaching platforms	Competitive pressure from global online education platforms	AI, online learning platforms, cloud-based collaboration tools	Digital pedagogy, data analysis, digital communication, lifelong learning
SMEs	Decentralisation, fewer administrative roles, creation of new digital roles	Automated, personalised customer service; key role of communication	Automation, AI, digital customer management tools, CRM systems	Technical know-how, strategic thinking, data analysis, prompt engineering

Table 4. Implications of the Tech with a Human Touch scenario

Organisation type	Organisational changes	Market orientation	Technology	Skills
Public Authorities	New roles for digital service delivery, hybrid work models, support centres	Focus on maintaining inclusive, accessible services for all citizens,	AI for automating routine tasks, digital platforms for public services,	Digital literacy, hybrid leadership, data management, cybersecurity

	for citizens with low digital skills	balancing digital efficiency with human support	centralised IT systems	
Academic Institutions	Flexible organisational structures, increased collaboration with businesses, partnerships for lifelong learning	Emphasis on practical, modular, skills-based education to stay competitive	AI for administrative tasks, digital collaboration platforms, virtual learning environments	Advanced digital literacy, data analysis, AI integration, flexible pedagogy
SMEs	Agile, decentralised structures, potentially new roles like technology scouts and digital mentors	Strong focus on customer relationships, combining digital tools with personal support, niche market strategies	AI for automating repetitive tasks, digital dashboards, cloud-based collaboration tools	Digital skills, self-organisation, data literacy, AI prompt engineering

Table 5. Implications of the Beyond the Human Age scenario

Organisation type	Organisational changes	Market orientation	Technology	Skills
Public Authorities	Shift from traditional roles to AI supervision, ethical oversight, and data management; emphasis on maintaining public trust in automated systems	Focus on fairness, inclusion, and transparency; balancing automation with human oversight	Advanced digital infrastructure, including quantum computing and AI systems	Ethical decision-making, digital literacy, data analysis, and AI oversight
Academic Institutions	Potentially radical restructuring; emphasis on training AI systems and managing digital knowledge networks	Loss of traditional human connections in education; focus on personalisation and data-driven learning	High reliance on AI for personalised learning and administrative automation	Digital pedagogy, critical thinking, creativity, and systems thinking
SMEs	Possible integration into larger networks, new roles like AI-output curators	Concern over loss of autonomy and creative independence; need for agile	Advanced AI systems for automation, data integration, and	Strategic oversight, adaptability, digital fluency,

	and ethical supervisors	adaptation to networked production	digital collaboration	and ethical leadership

Table 6. Implications of the Disconnected and Disillusioned scenario

Organisation type	Organisational changes	Market orientation	Technology	Skills
Public Authorities	Generally, see the scenario as troubling but plausible, recognising the risk of losing public trust if technology fails	Likely to revert to traditional, face-to-face services, focusing on rebuilding community ties and restoring human contact	Reduced digital engagement could require a shift back to local, physical services	Emphasis on interpersonal skills, practical training, and hands-on work
Academic Institutions	View the scenario as partially realistic, acknowledging past experiences like the COVID-19 pandemic	Potential return to fully in-person education, focusing on hands-on training and practical skills	Potential return to fully in-person education, focusing on hands-on training and practical skills	Emphasis on practical skills, interpersonal communication, and critical thinking over purely digital competencies
SMEs	Generally, see this scenario as undesirable and highly disruptive, with significant challenges to current business models	Would need to rebuild direct customer relationships, potentially shifting to in-person services	Could face severe disruptions if digital tools lose credibility, with some questioning their survival in this context	Emphasis on soft skills, practical experience, and psychological resilience

This work offers valuable foresight into the range of possible trajectories Central European organisations may face as they navigate digital transformation. By identifying key uncertainties and surfacing sector-specific perspectives, the scenarios provide a strategic tool for organisations and policymakers to stress-test current plans, anticipate emerging challenges, and design more resilient, inclusive, and future-oriented strategies.

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Appendix 1. Final list of trends

#	Trends
1	**Trade in services grows faster than merchandise (physical products) trade.**
2	**Over the past decade, e-commerce (selling and buying goods and services through apps and websites) has experienced significant growth both in the EU and globally.**
3	**Approximately one-third of the world's population lacks internet access, with a significant portion living in rural areas and least-developed countries.**
4	The percentage of the self-employed workforce globally has dropped from 55.5% in 2000 to 48.1% in 2022. This percentage varies significantly between nations: high-income economies typically have lower self-employment percentages.
5	Platformisation: the rise of online platforms (such as Amazon, Airbnb, and Upwork) as central hubs for goods and services providers.
6	The shift towards subscription-based payment models for software and digital content.
7	The share of people using online services (such as public, health, banking, and others) has been gradually increasing over the past few years.
8	**Enrolment in online university and courses has been increasing both globally and within the EU.**
9	The increased customisation of experiences: businesses tailor their products, services, or interactions to meet individual customer preferences.
10	Rising interest in decentralised governance: digital platforms now let communities and organisations vote, discuss, and make decisions independently of traditional authorities.
11	The growing automation of repetitive tasks and services in various areas.
12	The adoption of digital verification systems (including biometric authentication) is increasingly replacing physical processes of identity and document verification.
13	**The development of quantum computers, which perform calculations far faster than traditional computers.**
14	Companies that offer human-made products and human interaction stand out among those providing fully digital and automated solutions and attract more customers.
15	People are becoming increasingly disappointed and frustrated with digital services and tools when they malfunction, fail to meet expectations or replace human interaction effectively.
16	**There is a continuing disparity between large businesses and SMEs when it comes to adopting new technology. For example, in the EU, 30% of large businesses use AI, whereas only 8% of SMEs do so.**
17	Dynamic pricing: adjusting prices in real time based on demand and customer behaviour.
18	Growing public concern over ethical issues such as unfair treatment, discrimination, and lack of transparency in automated decision-making in areas like hiring, loan approvals, healthcare, and law enforcement.
19	The growing adoption of AI and cloud solutions. In 2023, 8% of businesses in the EU reported using AI, while 41% reported using cloud computing services.
20	**A growing discrepancy in the adoption of new technologies between countries, with China, India, and the UAE leading, while Western countries, particularly in Europe, lag behind.**
21	The growing focus on local data storage and sovereignty in data access: countries and organisations are prioritising the retention of data within their borders and reducing dependence on foreign providers.
22	The growing use of data analytics for automation of decision-making traditionally performed by humans, such as hiring decisions, judicial decisions, and so on.

23	More EU businesses are investing in training their employees in both basic and advanced digital skills. In 2022, 22% of businesses provided ICT (Information and Communication Technology) training to their staff.
24	Lifelong learning: the continuous pursuit of knowledge and skills throughout a person's life, beyond formal education like school or university.
25	**The leading positions of China and the US in the number of patents and scientific publications.**
26	There is an increased focus in education on combining theory with practical skills, with more programmes offering a mix of academic learning and real-world work experience.
27	**There is a growing focus on training specialists in advanced fields like AI, robotics, biotechnology, and quantum computing (deep tech training).**
28	A rise in precarious employment, characterised by temporary contracts, job insecurity, and performance-based assessments.
29	The increasing reliance on performance assessments for employees and organisations based on subjective ratings from users, such as students, customers, and citizens.
30	Environmental degradation is intensifying globally, with rising plastic pollution in oceans and worsening air quality in many regions, particularly in developing countries.
31	The contribution of renewable energy sources in the EU is gradually increasing, rising from 23% in 2022 to 24.1% in 2023.
32	**Nature is becoming increasingly valued and recognised for its role in mental well-being, recreation, and economic stability.**
33	Europe is experiencing the fastest rate of warming globally, characterised by an increasing frequency of extreme heat events and shifting precipitation patterns (droughts and floods).
34	**EU greenhouse gas emissions have significantly decreased, reaching a reduction of 37% below 1990 levels by 2023.**
35	**The convergence of digital and environmental goals in green IT practices, such as developing energy-efficient IT systems and reusing and recycling hardware.**
36	**The volume of e-waste generated from old devices, including laptops, tablets, smartphones, and desktop computers, is increasing, particularly in developing regions.**
37	The widespread adoption of IoT (Internet of Things) technology, where devices are interconnected to enable seamless data exchange.
38	**Growing focus on sustainable practices, including zero-waste manufacturing, ecolabelling for sustainability, and life cycle assessments to reduce environmental impact.**
39	The development of cloud edge computing brings computation, data processing, and storage closer to the location where it is needed.
40	**The development of robotic technologies, including collaborative robotics, where machines and humans work together.**
41	**The use of cash is gradually declining as digital money and electronic payment methods become increasingly prevalent.**
42	The growing adoption of remote, hybrid and flexible working arrangements.
43	The development of mobility technologies, including autonomous and electric vehicles.
44	**The development and increased application of immersive-reality technologies, such as the use of AR (Artificial Reality) and VR (Virtual Reality) in training and service delivery.**
45	**Cryptocurrency is continuing to develop, with increasing adoption and acceptance across industries and regions.**
46	The development of advanced connectivity technologies, such as 5G networks, enabling faster and more reliable connectivity.

47	Digital well-being is emerging as a corporate priority, focusing on balancing technology use with employee mental health and overall wellness.
48	The shift towards agile practices is driving the emergence of new organisational forms with flatter structures, project-based collaboration, and informal dynamics.
49	Populist political parties are gaining influence across various regions.
50	Income inequality is increasing globally, with widening disparities in wealth distribution across regions and demographics.
51	The growing influence of BRICS+, Asia and Africa is reshaping global economic and political dynamics.
52	Labour shortages are constraining economic growth, with unfilled job vacancies potentially reducing GDP by 0.5% to 1.5% in 2023.
53	Inflation is slowing down globally, easing pressure on economies and consumers after a period of significant price increases.
54	Businesses are increasingly favouring regional supply chains and nearshore outsourcing to reduce reliance on global networks, ensuring faster, more reliable access to critical components and services.
55	Rising prices and higher interest rates are reducing people's real incomes, leading to decreased consumption.
56	Global economic growth remains slow in both developed and developing countries due to factors such as inflation, geopolitical tensions, high public debt, and tighter monetary policies.
57	Geopolitical tensions are escalating worldwide.
58	The increasing migration of young people across regions and countries for economic, educational, or social reasons.
59	A growing number of individuals intentionally unemployed, especially among young people, are neither working nor looking for a job.
60	The US, as a strong global economic leader, continues to be the most attractive destination for migration from the EU and a key base for start-ups and SMEs.
61	*A growing gap in digital skills between older and younger generations.*
62	The share of people over 65 years old is steadily increasing, while the share of children is decreasing.
63	The population of the European Union is gradually decreasing, driven by declining birth rates.
64	Many countries are increasing the retirement age to address the challenges posed by ageing populations and strained pension systems.
65	**The development of technologies and tailored services for "smart ageing", focusing on enhancing the quality of life for older adults, including digital health tools and age-friendly environments.**
66	There is an increased focus on cybersecurity, aiming to protect data from cyber threats.
67	**The utilisation of synthetic data, replicating the characteristics of real-world data without containing actual sensitive or identifiable information.**
68	**The adoption of blockchain technology for secure and transparent transactions.**
69	An increasing number of ICT (Information and Communication Technology) security incidents are causing issues such as destruction or corruption of data, identity theft, and other related problems.
70	**The share of children born to mothers who were not born in their country of residence is rising.**
71	**The majority of immigrants in EU Member States are not EU nationals.**
72	Organisations and societies are increasingly prioritising diversity, focusing on inclusive hiring, representation, and equitable opportunities for people from various backgrounds.

Appendix 2. Full scenarious descriptions

The Digital Drift

The world continues on its current path, with fast digitalisation changing almost every area of work, services, and everyday life. Online platforms take over many functions, replacing traditional institutions like physical universities, public offices, and offline shops. Organisations that are not active online begin to disappear.

Academic institutions struggle to compete with global online education providers that offer cheaper and more flexible learning. Only the most adaptable universities stay relevant, often by focusing on digital skills or working with technology companies.

Public authorities automate many services and introduce new tools such as digital voting and online decision-making platforms, known as decentralised governance. These systems allow people to take part in decisions without needing central control, but they can be hard to use for older people or those without digital skills.

SMEs feel increasing pressure from larger businesses that are better at using technologies like artificial intelligence, cloud computing, and robotics. Some smaller companies keep up, but many cannot, which increases the gap between them.

Remote and hybrid work become normal, but so do jobs that are not secure, often based on short-term contracts or performance reviews. Cybersecurity becomes a major concern. Biometric identity checks, such as facial recognition, are common. However, many smaller organisations cannot fully protect themselves from digital risks. Concerns grow about fairness, transparency, and who controls the data behind automated decisions.

At the same time, ageing populations, global tensions, and workforce shortages continue. While systems become faster and more efficient, they are also less fair and more difficult for many people and organisations to navigate.

Tech with a Human Touch

After years of disruption, society finds a new balance between technology, the economy, and people's well-being. Academic institutions and businesses form new partnerships, offering short, flexible courses and on-the-job training. More adults return to education to gain new skills and stay competitive in the job market.

Artificial intelligence (AI) works alongside people in many jobs. This cooperation helps increase efficiency and improve job quality, but differences in pay, job security, and access to opportunities still remain.

Public authorities introduce policies to support higher birth rates, longer working lives, and attract skilled workers through smart immigration. These steps help solve labour shortages and support economic stability.

Technologies like AI tools, cloud services, robotics, and smart devices are widely used by people and organisations of all sizes. SMEs and more traditional institutions receive

support through digital transformation programs to catch up with larger, tech-savvy players.

Most services and shopping are online, but support centres are set up to help people who find digital tools difficult to use. These centres help make digital systems more inclusive.

Cybersecurity becomes a national responsibility, reducing pressure on individual companies. New identity systems using biometrics (like facial recognition) and blockchain make it harder to commit digital crimes, though risks still exist.

Remote and flexible work continue to grow. Governments introduce stronger labour protections and mental health support. People who cannot work remotely are given other benefits, helping create a fairer and more balanced system.

Beyond the Human Age

Society has entered a new era, shaped by powerful technologies like artificial intelligence, robotics, and quantum computing. Traditional systems such as education, work, and government have been completely transformed.

In education, teachers and professionals now train AI systems, which in turn create personalised learning paths for students. Learning is flexible, continuous, and tailored to individual needs.

Public authorities introduce fully digital and decentralised governance, where decisions are made through online platforms and autonomous systems. In some regions, automation reduces working hours while increasing salaries and work-life balance. Universal basic income – a guaranteed income for everyone – replaces traditional pensions.

SMEs that survive this transformation often join networks led by mega-companies, gaining access to shared AI and computing power. Advanced technologies give big players a major advantage, but cooperation helps narrow the gap.

Borders become less important. AI-driven migration-matching systems help connect people with jobs across the world. At the same time, countries shift from competition to collaboration to solve global problems.

Products are mostly custom-made with robotics and AI, while handmade or offline services become expensive luxuries. Cybersecurity is managed by AI with biometric and blockchain identity systems that create safe and trusted digital environments. Work is redefined around purpose, fairness, and well-being, supported by – intelligent systems that reduce bias and promote inclusion.

Disconnected and Disillusioned

Technology has failed to meet expectations. There are too many digital specialists, but not enough skilled workers in hands-on jobs like manufacturing, repair, or technical

maintenance. Many online courses do not provide the practical knowledge needed by employers, especially in smaller businesses and public services.

Academic institutions lose credibility as students struggle to find real jobs after online education. Public authorities face protests after serious failures in automated decision-making and digital services. Overuse of artificial intelligence and automation causes public mistakes, leading to a deep loss of trust in both technology and government.

SMEs and other organisations stop investing in new technologies, using them only for basic tasks. Economic growth slows as older people retire and many younger people are not interested in entering unstable job markets. Efforts to raise the retirement age and taxes spark public anger.

Online services feel empty and disappointing. Many people suffer from isolation and mental health problems. In response, physical shops and in-person experiences become popular again. Cybersecurity breaks down: personal data is often stolen or misused, and people struggle to know what information is real or fake.

Jobs are insecure, and workers are judged by user ratings from customers or citizens. This system creates constant pressure, unfair evaluations, and mental stress. Without strong support systems, people feel disconnected, tired, and disillusioned. Global conflicts and wars make the situation even worse, adding fear and instability to daily life.