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D3.1 Digital Policy Report - a

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Abstract	This document presents the methodological framework to be followed in the Project for the monitoring and analysis of the European regulatory landscape and policy initiatives related to the Cognitive Computing Continuum. It is an ongoing deliverable with an initial version in M9, covering the description of the Project approach and the initial EU policy and regulatory landscape analysis, and subsequent, updated versions to be produced in M18 and M30.

Keywords	Regulatory framework, policy, open source, standardisation, skills, digital sovereignty.

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V0.7	18/10/2024	Internal review by RISE	Thomas Ohlson (RISE)
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Nature of the deliverable:	R	
Dissemination Level		
PU	*Public, fully open, e.g. web*	**x**
SEN	*Sensitive, limited under the conditions of the Grant Agreement*	
Classified R-UE/ EU-R	*EU RESTRICTED under the Commission Decision No2015/ 444*	
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Executive summary

Deliverable D3.1 “Digital Policy Report – a” is the first one of a series of three (scheduled for M9, M18, and M30), describing the approach and the activities performed in the Project to support the European computing constituency by monitoring the European regulatory landscape and policy initiatives related to the Cognitive Computing Continuum. It provides an up-to-date, factual overview of the implications for both scientific and industrial ecosystems. Additionally, it suggests ways to align research and technology priorities in key strategic areas with relevant policy aspects, promotes the participation of EU organizations in these processes, and analyses the impact of the Regulatory Framework on achieving Digital European Sovereignty within the Cognitive Computing Continuum.

During the first period, the Project has advanced in the following activities towards the analysis of the regulatory and policy landscape:

- Definition of the overall strategy and methodology for enhancing EU Digital Sovereignty, particularly within the Cognitive Computing Continuum. Our approach is structured around three key pillars:1) EU policy & regulatory analysis, 2) Public Consultation and Participatory actions, and 3) Comparative analysis with the international situation, especially in Japan and the Republic of Korea (ROK). This methodological framework was shared with a broader community during the NexusForum.EU summit in 2024. The feedback received, which is included in this report, will be integrated into the next iteration of the deliverable. Alignment to the most recent publications at EU policy level (i.e., “The future of European Competitiveness” report and the “Mission Letter for Tech, Sovereignty, Security and democracy” has been also introduced and will be furher discussed in upcoming versions of this deliverable, as the main policy framework in Europe for the next years.
- Selection and analysis of the relevant policy initiatives and regulations which can have an impact to the European Computing Continuum including; Gaia-X, EUCS, HE, DEP, EU Digital Decade Policy Programme, IPCEI-CIS, Digital Markets Act, Digital Services Act, Cyber Resilience Act, Data Act, and Artificial Intelligences Act. The initial analysis incorporates a mapping of the main policies selected and the main research and innovation topics identified by the Project in the Cognitive Computing Continuum Roadmap [D2.1 in NexusForum.EU].
- Initial study and preliminary research on the concept of a “sovereign” approach for the European computing ecosystem through open source, open standards, and collaborative skillsets as enablers for interoperability, vendor neutrality, and technological autonomy. In this case, initiatives such as RISC-V, SIMPL, NGI and others have been considered for the analysis.
- Preliminary analysis on the international landscape with the Japan case, discussing the Continuum infrastructure, usage, and policy initiatives (Society 5.0 and the Data-Driven Society) overseas.

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Abbreviations

AI	Artificial Intelligence
CEI	Cloud Edge and IoT
DFFT	Data Free Flow with Trust
ENISA	European Union Agency for Cybersecurity
EU	European Union
FOSS	Free and Open Source Software
GDPR	General Data Protection Regulation
HE	Horizon Europe
IoT	Internet of Things
IPCEI-CIS	Important Project of Common European Interest on Next Generation Cloud Infrastructure and Services
NGI	Next Generation Internet
NZ	New Zealand
OEM	Original Equipment Manufacturer
OSH	Open Source Hardware
OSPO	Open Source Program Office
OSS	Open Source Software
SDV	Software Defined Vehicle
SWOT	Strengths, Weaknesses, Opportunities, Threats
US	United States
WP	Work Package

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1 Introduction

Deliverable D3.1 “Digital Policy Report – a” is the first one of a series of three (M9, M18, M30), describing the approach and the activities performed in the Project to support the European computing constituency. These activities include monitoring the European regulatory landscape and policy initiatives related to the Cognitive Computing Continuum, offering an up-to-date and factual overview of the implications for the scientific and industrial ecosystems, and suggesting ways to align research and technology priorities in key strategic areas with relevant policy aspects. promoting the participation of EU organisations in the process and providing analysis on the impact of the Regulatory Framework towards Digital European Sovereignty in the Cognitive Computing Continuum.

The remaining content of the current report is structured in the following sections:

- Section 2 presents the overall approach of the Project to strengthen the European digital sovereignty through the analysis, consultation and participation boosting on the EU policy and regulatory initiatives.
- Section 3 provides a discussion about the EU policy and regulatory situation concerning the Cognitive Continuum from different perspectives, including: the European landscape on public policy initiatives and regulations, the role of the open-source initiatives, and a view towards the international landscape with the Japanese case. It also incorporates initial feedback from relevant stakeholder representatives who participated in the Policy workshop held during the NexusForum.EU2024 Summit (19-20 September 2024, Brussels).
- Section 4 proposes an initial mapping of the most relevant and impactful policies and regulations with the main research and innovation topics defined in the Future Cognitive Continuum roadmap (Deliverable D2.1), including a discussion about their impact.
- The Conclusions section wraps up the report and foresees the future activities to be implemented in the context of policy and regulatory analysis.

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2 Digital sovereignty policy approach and methodology

A few weeks before the submission of the current report, two EU policy relevant documents were published, namely “The future of European Competitiveness” by Mario Draghi and the Mission Letter by Ursula von der Leyen to the appointed Commissioner for Tech, Sovereignty, Security and Democracy. Both reports will strongly impact the policy actions and research and innovation initiatives in the next years in Europe, as they shape the values and pillars for the inclusive Economic growth of Europe. The principles outlined underscore the critical role of NexusForum.EU in advancing Europe’s competitiveness in areas Draghi identifies as vital to the continent’s economic resilience and global standing. To this end the insights of both relevant documents will be one of the main focuses in NexusForum.EU from October 2024 onwards. While the current deliverable includes a preliminary analysis of their key points affecting the Cognitive Computing Continuum, future iterations of this report will incorporate deeper insights and align closely with these documents as they are further explored.

The future of European Competitiveness[1]

In relation to the most recent work from the Commission to define the new plan for Europe’s sustainable prosperity and competitiveness, “The future of European Competitiveness” report by Mario Draghi published in September 2024 the main three objectives for the next decade in Europe are:

1. **Unlock innovation** potential to the next level and reduce the constraints for companies to jump from innovation to commercialisation, especially on **advanced technologies like AI**, while ensuring opportunities for education towards skilled professionals.
2. **Advance on a joint plan for decarbonisation** and competitiveness spanning industries that produce energy and the ones that enable decarbonisation such as **clean techs**.
3. **Reduce dependency** on external suppliers **of digital technology** to increase security and reduce geopolitical threats.

To work further on these objectives and as part of Europe’s competitiveness strategy for the next decade, policies and initiatives in digitalization and advanced technologies, supported by significant public and private funding, must be prioritized in three areas:

- High-speed and high-capacity broadband networks and related hardware and software (i.e., fixed, wireless, and satellite/hybrid networks) to enable connectivity and deliver secure, ubiquitous, and sustainable digital services essential for EU citizens and businesses.
- Computing and AI, i.e., the infrastructure, platforms, and advanced technologies necessary to autonomously develop and scale digital services, enabling businesses to innovate, increase productivity, and expand, particularly regarding cloud, high-performance computing, and quantum computing, as well as AI and its industrial applications.
- Semiconductors, a key driver and enabler of the electronics value chain, and a strategic element of Europe’s industrial strength and security across all sectors.

[1] *https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20_%20A%20competitiveness%20strategy%20for%20Europe.pdf*

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For each of these three main prioritized areas, key actions have been defined which will drive the political and regulatory framework in the next decades. Here we summarize the most relevant ones impacting the Cognitive Continuum and therefore the NexusForum.eu thematic areas:

- Reform the EU's regulation and competition stance to complete the **DSM for telecommunications**, harmonizing rules and promoting mergers and cross-border operations.
- Harmonize spectrum licensing rules and processes across the EU, including satellite applications, and orchestrate the design features of spectrum auctions to create scale benefits and incentivize the consolidation of continental digital networks.
- Simplify and harmonize cybersecurity architecture and Legal Interception across the EU, and enhance cooperation with or among EU cybersecurity agencies, including technologically neutral rules on critical infrastructures
- Encourage the deployment of new infrastructures by setting deadlines for old technologies to improve the profitability profile of investments in new technologies
- Support European providers of telecommunications equipment and software to strengthen strategic autonomy in EU technology sources
- To sustain innovation and cooperation among EU actors, coordinate technical standards at the EU level for the deployment of network APIs, edge computing, and IoT.
- Develop and fund a strategy to rapidly enhance the EU's computing infrastructure and AI capabilities, connect public and private computing nodes, and reinvest the returns from this public "computing capital" into new capabilities. This requires an upgrade program for Euro-HPC.
- Establish systematic cooperation between the EU and the USA on access to cloud and data markets
- The EU Chips Act should be reviewed and expanded to increase funding, coordination, and the speed of public-private cooperation at the continental level, as well as to maximize joint efforts to strengthen innovation in semiconductors and presence in the most advanced chip segments.
- Launch a new EU Semiconductor Strategy based on five pillars: funded innovation labs, incentives for fabless companies active in chips design, funding fabrics on strategic segments (automotive industry, IA chips, chiplets, network equipment, etc.), support innovation on conventional chips and chiplets, funding for back-end 3D materials.
- Launch a long-term EU quantum chips plan, coordinating funding and architecture options and avoiding duplication of investments to concentrate funding efficiently.

The derived recommendations by the main outcomes of this WP in NexusForum.EU will be driven to achieve the aforementioned objectives which will be further analysed, discussed and incorporated into the activities in the future months.

Mission letter for Tech, Sovereignty, Security and democracy[2]

Another relevant political guideline document recently published by the EC is the Mission Letter by Ursula von der Leyen to the appointed Commissioner for Tech, Sovereignty, Security and

[2] *https://commission.europa.eu/document/download/3b537594-9264-4249-a912-5b102b7b49a3_en?filename=Mission%20letter%20-%20VIRKKUNEN.pdf*

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democracy. To this end, the mission letter reinforces the message of the Draghi, towards the defence of EUs industrial competitiveness through the digital transformation with the main objective of shaping a competitive, resilient and inclusive digital future and establishing essential assets for technological sovereignty, with special focus on:

- **Reaching Europe's 2030 Digital decade** targets.
- **Boost AI innovation** through the AI factories initiative, setting up the European research council, the development of EU Cloud and AI development Act, and the creation of a single EU-wide cloud policy.
- Promote EU digital norms and standards, following up on the ongoing policy level and regulatory initiatives such as the **Chips Act, the Digital Services Act, the Digital Markets Act and the EU Digital Rulebook,** and develop new ones such as a long-term **EU Quantum Chips plan**, and a new **Digital Networks Act.**

2.1 Overall approach

One of the main objectives of the work with respect to policy and regulatory framework in NexusForum.EU is to provide a series of policy recommendations to contribute to the convergence of cloud, edge and IoT technologies, through the integration and consolidation of the technologies prioritized in the NexusForum.EU Research and Innovation Roadmaps and promoting closer collaboration with the industry.

NexusForum.EU will identify key technology priorities and needs for strengthening European competitiveness in cloud, edge and IoT technologies, and in particular in supporting the development of AI technologies in Europe. Additionally, the project will provide up-to-date analyses of the relevant policy landscape, and identify gaps and opportunities concerning the identified technology priorities and needs. All these inputs will be necessary to define the Analysis framework that we will use to develop the recommendations.

The following figure shows the proposed methodological approach:

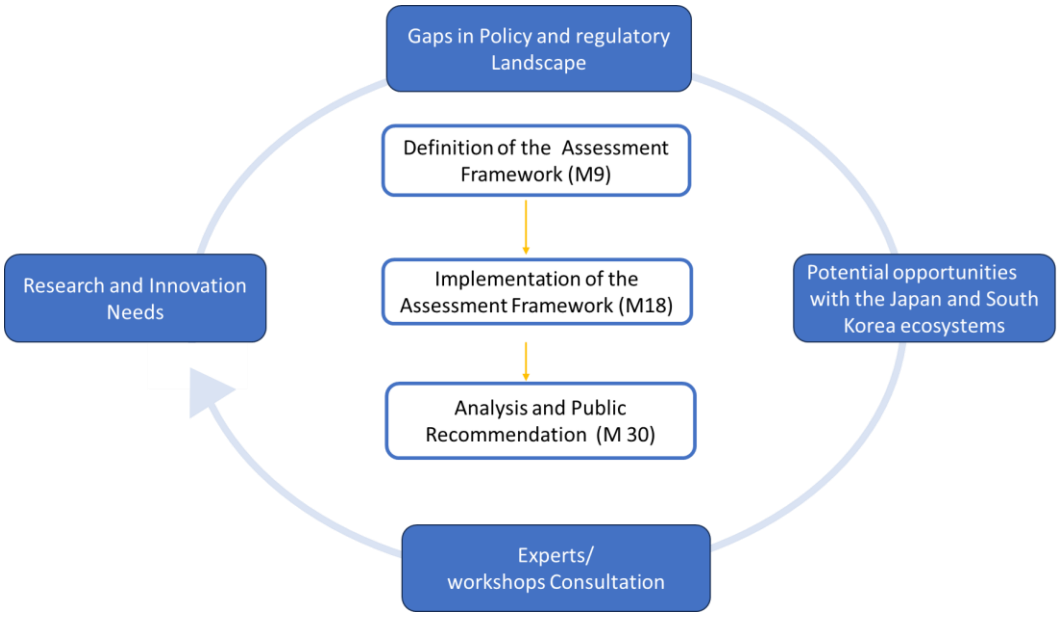

Figure 1: Process proposed to derive the Policy related recommendations in NexusForum.EU

As shown in Figure 1, the approach encompasses three phases:

1. Definition of the Analysis framework for policy recommendations, where the main factors involved in the convergence of cloud, edge and IoT technologies are discussed and refined (M9, September).
2. Implementation of the Analysis Framework compiles the information and findings gathered in the different tasks of the activities performed in the different work streams of the project (WP2, WP3, WP4 and WP5), and intends to produce a SWOT analysis and to identify needs and gaps according to the different factors (M18, June).
3. Analysis and recommendations. Policy recommendations will be developed with the stakeholders involved in the Working Groups described in Deliverable D4.1 (M30, December).

The main outcomes of the three phases will be reported in different iterations of the current report as shown in Table 1 below:

D3.1 Digital Policy report. a (M9)	D3.2 Digital Policy report. b (M18)	D3.3 Digital Policy report. c (M30)
• Methodology • Initial Mapping of policy assets at EU level • Analysis framework (tool, template)	• Preliminary information collected • Analysis framework (updated)	•Analysis of collected information •Regulation & Policies recommendations

Table 1. Main outcomes from WP3 activities.

2.2 Methodology

When assessing the European policy and regulatory framework related to edge, cloud and IoT technologies, it is crucial to consider several key factors that will influence the technological sovereignty and competitiveness of the EU in edge, cloud and IoT technologies.

These factors must be analysed in detail to develop policy recommendations that promote the convergence of edge, cloud and IoT technologies and strengthen the EU's digital sovereignty and competitiveness in digital technologies.

The process planned for this purpose is a dynamic process, by means of stakeholder engagement and discussion. The information gathered from the different tasks of the project will be considered in combination with the feedback from different stakeholders, such as industry, professionals, and the academic world, which will be given special relevance. The methodology is aligned with the project implementation logic and thus leads to the following planning in three main phases. Figure 2 presents the methodology suggested to reach the project scope:

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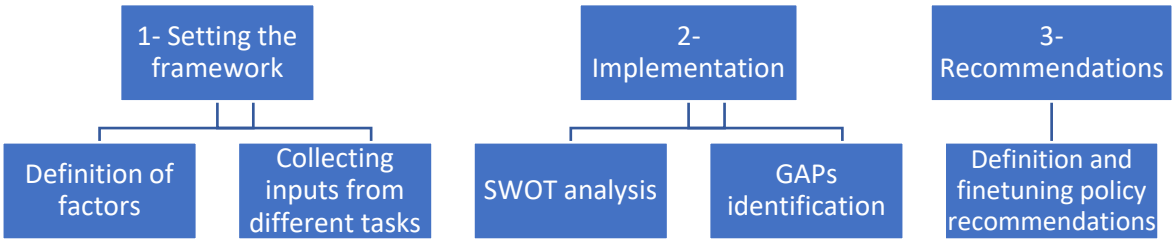

Figure 2. Methodology phases and activities

1. Setting the framework. This first phase consists in defining the factors that will guide the logic of the policy recommendation process. The factors are aligned to the project objectives and expected inputs. The preliminary status/assessment of these factors is coming from the work developed in the different tasks and WPs of the project as explained in Figure 2 above.

This phase is being carried out from month 1 to 9 of the project and reported in the current version of the deliverable. The main factors have been discussed and validated and will be refined after month 9.

2. Implementation. This is the immediate next step to be carried out from month 9 to month 18 of the project. This phase starts from the findings gathered in the different tasks of WP2, WP3, WP4 and WP5 and intends to produce a SWOT analysis where Strengths, Weaknesses, Opportunities and Threats are suggested. The principle is to reinforce the Strengths and overcome the Weaknesses found by means of recommendations. The same applies to the Opportunities and Threats.

An identification of gaps will be carried out through a SWOT analysis with the information collected from the different tasks in the project, and in online workshops held with the leaders of the tasks/relevant partners. The outcomes of the SWOT analysis will be the main gaps in the respective factor, which will later be contrasted and validated in the Working Groups. It is from these gaps that we will be able to draw up recommendations.

This analysis allows us to identify the gaps in each of the factors defined and focuses on overcoming these gaps. This covers all the identified factors, not just the policies but also infrastructures, standards, research, collaboration platforms, etc. This will be done in collaboration with the tasks' leaders by analysing the different outputs obtained in their tasks and identifying gaps that would bring opportunities for policy recommendations.

Strengths (internal perspective)	Weaknesses (internal perspective)
Opportunities (external perspective)	Threats (external perspective)

Figure 3. SWOT analysis perspectives

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3. Analysis and policy recommendations. This phase is planned to be carried out from M18 until the end of the project (M30). Policy recommendations will be defined taking in consideration the findings of the previous phases and will be validated with the stakeholders involved in the Working Groups, as defined in Deliverable D4.1.

The following subsections will describe the Analysis framework in more detail, that will be used to derive the recommendations, the approach to public consultation and feedback collection, and the comparative methodological approach to analyse the external policy initiatives.

2.2.1 Analysis Framework: Defining factors for policy recommendations.

The main factors that will be used in the process of defining policy recommendations are presented below. Besides a description of each factor, the presentation includes the key parameters that would be analysed, discussed and considered in the SWOT analysis to identify the gaps in each factor. It also identifies the tasks/WPs and lead partners that need to provide input and the main findings in the SWOT analysis and Gap identification phase.

F1. TECHNOLOGY, INNOVATION AND RESEARCH CAPABILITIES	
FACTOR DESCRIPTION: *European technological capabilities that are relevant to the development of Europe's Cognitive Computing Continuum and that are needed to meet research & innovation challenges.* *Scientific knowledge and European technological sovereignty and competitiveness in technologies relevant to the Cognitive Computing Continuum will be increased by the identification of current gaps between research challenges and technological capabilities in the Cognitive Computing Continuum.* ***Objective**: Identifying current gaps between research challenges and technological capabilities in the Cognitive Computing Continuum.*	
RELATED TASKS	**INPUTS USED FOR POLICY RECOMMENDATIONS**
WP2	**Parameters to be analysed (within the factor):** - Prioritized Research lines T2.1 (TECNALIA). - Technological capacities T2.5 (RISE/MARTEL). - Future research lines T2.3 (RISE). - Synergies with industry actors (in R&D&I) T2.4 (RISE/ONS). - Complementarity with strategic agendas of Japan and ROK. T2.2 (Yonsei/Meiji).

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F2. FRAMEWORK CONDITIONS (POLICIES, STRATEGY, PLAN, REGULATION, ETC.)

FACTOR DESCRIPTION:

These are the boundary conditions in the context of a country's policies, strategies, plans and regulations, and refer to the general circumstances or conditions in which a technology or industry develops.

***Objective**: Identification of gaps that must be covered to establish the context of the continuum from regulatory and policy aspects.*

RELATED TASKS	INPUTS USED FOR POLICY RECOMMENDATIONS
T3.1 **(ONS)** **T3.3** **(RISE)**	**Parameters to be analysed (within the factor):** - The main adopted legal instruments and regulation in terms of cybersecurity, standardization, strategic autonomy, etc. mainly the AI Act, the Data Act, the CRA, DMA SRIP, DSA, SWIPO (Switching cloud providers and data porting). - Certification schemes as other means for regulation: EUCS+ and the Cloud Rulebook as they might play a crucial role for European sovereignty and data protection. - Government policies: This may include policies to support certain technologies, subsidies, tax incentives, etc. - National or regional strategies for infrastructure, for investment in research and development, the formation of strategic alliances, etc.

F3. ENABLING CONDITIONS (OPEN SOURCE, OPEN STANDARDS, SKILLS)

FACTOR DESCRIPTION:

Enabling conditions in the context of technology development refer to the factors that facilitate the successful development, implementation and adoption of a technology.

***Objective**: Identifying all crucial topics that play a significant role in the development of Europe´s Cognitive Computing Continuum.*

RELATED TASKS	INPUTS USED FOR POLICY RECOMMENDATIONS
T3.3 **(RISE)**	**Parameters to be analysed (within the factor):** - Skills and Knowledge: Training of the workforce (businesses and public procurement), new generation of workers to prepare them for the jobs of the future related to these technologies. - Training needs for new generation and older generation - Open source.

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	- Standards and Compatibility: Promote open and interoperable. standards to facilitate the integration of different technologies and services. - Ethical and social aspects: Social impact of the technology, equity, etc.

F4. INFRASTRUCTURES AND CONNECTIVITY (INCLUDING SPACE INFRASTRUCTURE AND DATA)

FACTOR DESCRIPTION:

Identifying infrastructure need to enable the European single market for data with the corresponding data spaces and a trustworthy artificial intelligence ecosystem.

***Objective**: Improved open strategic autonomy in critical data infrastructures along the Continuum.*

RELATED TASKS	INPUTS USED FOR POLICY RECOMMENDATIONS
T2.3 **(F6S)**	**Parameters to be analysed (within the factor):** - Digital Infrastructure: Develop a robust infrastructure to support edge computing and the vast amount of data generated by IoT devices. - 3C Networks initiative Connected Collaborative Computing Networks. - Data ownership / data sovereignty, data spaces and governance. - ICT services (Roadmap T2.3).

F5. COLLABORATION & ENGAGEMENT

FACTOR DESCRIPTION:

***Objective**: Identify the opportunities to ensure the alignment and active participation of those EU companies directly involved in the IPCEI-CIS and the European Alliance for Industrial Data, Edge and Cloud.*

Additionally, identify the opportunities to increase the engagement at international level with research, industry, and users from different domain/sectors interested in the Cognitive Computing Continuum, especially those based in Japan and South Korea (ROK), identifying and evaluating opportunities for strategic alignment with relevant international initiatives.

RELATED TASKS	INPUTS USED FOR POLICY RECOMMENDATIONS

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Task 3.5 **(Meiji)**	**Parameters to be analysed (within the factor):** - International Collaboration: Cooperating with other countries and economic blocs to strengthen Europe's autonomy strategy. - Digital Autonomy: Strategies to strengthen Europe's technological independence, reducing dependence on non-European suppliers. - Promote awareness of digital sovereignty in the EU. - Engagement with international partners.
Task 4.4 **(TECNALIA)** **Task 4.2** **(Martel)**	**Parameters to be analysed (within the factor):** - Strategic alignment with relevant initiatives. - Engagement of European research and innovation ecosystem. - Need for partnerships and international cooperation to seek win-win strategies.

F6. INDUSTRY

FACTOR DESCRIPTION:

Identify needs and barriers faced by industry in accessing the necessary infrastructures and technologies in cloud and edge computing.

Objective: *Identify effectively bridge between key technologies and industry needs, with an emphasis on ensuring that policies and innovations are tailored not only to large companies, but also to SMEs, which are vital for European digital sovereignty.*

RELATED TASKS	INPUTS USED FOR POLICY RECOMMENDATIONS
T4.3 **(ONS)** **T.5.1** **(ONS)**	**Parameters to be analysed (within the factor):** - European market and industry engagement: connection with industry actors. - The European Data Market (EDM) Monitoring Tool (EU Publication Aug. 2024)[3]. - Solid links with European Alliance for Industrial Data, Edge and Cloud and IPCEI-CIS. - Community building/engagement, in order to build up on internal strengths and seek for new external opportunities.

[3] https://digital-strategy.ec.europa.eu/en/library/european-data-market-study-2024-2026

2.2.2 Public Consultations and Participatory Actions

This section presents the initial strategy for actively engaging stakeholders in policy consultations and participatory actions within the scope of the NexusForum.EU project. Leveraging insights from Task T3.1, this section outlines methods to establish a stable dissemination channel for European organisations and extends the reach to non-EU stakeholders potentially impacted by new EU policies.

This channel aims to increase the awareness and participation of stakeholders in shaping EU policies relevant to cloud, edge, and IoT technologies, and to facilitate the integration of diverse perspectives into the policy-making process, enhancing the relevance and effectiveness of regulatory outcomes.

Public Consultations are formal processes where stakeholders such as industry professionals, academics, and other interested parties are invited to provide feedback on specific policy proposals. The main goal is to gather input that can influence policy making, ensuring that the recommendations are well-informed and reflective of the needs and perspectives of those affected by the policies. This approach is set to be structured, with specific questions posed to the participants and formal submissions required.

Participatory Actions, on the other hand, involve a broader scope of engagement activities where stakeholders are actively involved in the development of the policy itself, not just providing feedback. This includes workshops, collaborative drafting sessions, and ongoing working groups. The aim is to co-create policy recommendations, allowing for a deeper integration of stakeholder expertise and insights into the policy framework. on the differences between consultation and participatory actions.

Stakeholder Segmentation and Engagement Activities

This table (Table 2) outlines the diverse stakeholder groups that need to be engaged in the policy-making process, highlighting how their specific characteristics and needs can be addressed through tailored engagement strategies.

Stakeholder Group	Segmentation	Relevance	Engagement Strategy
Industry Leaders and Corporations	- Large technology corporations - Mid-sized companies - Start-ups and innovators	Crucial for practical insights on challenges and opportunities within the industry.	Roundtable discussions, innovation showcases
Academic and Research Institutions	- Universities and other academic institutions - Independent research institutions	Provide theoretical expertise and innovative solutions through research.	Collaborative research initiatives, academic conferences
Government and Regulatory Bodies	- Local and national government agencies - International regulatory entities	Ensure policies align with regulatory requirements and societal norms.	Regulatory workshops, policy briefing sessions
NGOs and Advocacy Groups	- Consumer protection organizations - Privacy and digital rights groups - Economic development organizations	Represent societal and ethical dimensions of technology deployment.	Public forums, stakeholder hearings

Technology End-Users and Consumer Advocates	- Business end-users (healthcare, finance, manufacturing) - Consumer advocates	Offer insights into usability and effectiveness from a user's perspective.	User experience surveys, feedback panels
International Partners and Non-EU Stakeholders	- Companies with global operations - International academic collaborations	Bring international perspectives to the consultations, highlighting global implications.	Virtual conferences, collaborative policy workshops

Table 2. Public Consultations and Participatory Actions Stakeholder Segmentation

The strategy incorporates **a dual approach** of public consultations and participatory actions, each tailored to foster both broad and deep involvement.

Public consultations are designed to collect a wide range of inputs through structured mechanisms. NexusForum.EU will utilise **online surveys and dedicated feedback forms** that are both concise and targeted, focusing on specific areas of policy. These tools are implemented through a central platform, **Whaller**,[4] making them accessible to a diverse group of stakeholders and promoting participation via emails and social media campaigns. Additionally, we establish a dedicated public consultation section within Whaller, providing stakeholders with direct access to policy documents where they can submit detailed comments, engage in discussions, and provide feedback directly on the text, enhancing the clarity and specificity of their contributions.

Simultaneously, project partners will **engage in participatory actions to involve stakeholders** more directly in the policymaking process. Collaborative workshops will be organised both virtually and in-person, structured to facilitate in-depth discussions on thematic areas critical to the roadmap. These workshops are set to allow stakeholders to contribute their expertise, but also to promote collaborative problem-solving through facilitated discussions and breakout sessions. Additionally, roundtable discussions with industry leaders, policymakers, and academic experts will be hosted and strategically planned to coincide with major industry events to leverage the presence of influential stakeholders. The format will encourage high-level dialogue on policy direction and strategic decisions, ensuring that insights from these discussions are integrated into the policy development process.

The integration of feedback from both public consultations and participatory actions will be managed through **a system of feedback loops**.

Newsfeed Mechanism Development

To enhance stakeholder engagement and ensure timely dissemination of crucial information related to EU regulations and project developments, partners will be introducing **a refined newsfeed mechanism** integrated into the existing Whaller platform. This centralised approach will provide stakeholders with direct access to updates, enabling them to stay informed on the latest regulatory changes and project progress.

The newsfeed will be designed for ease of use and accessibility, allowing stakeholders to receive tailored content specific to their interests. Notifications will be delivered via email and direct platform alerts. Interactive features will also enable stakeholders to provide feedback directly on the newsfeed, creating a dynamic communication channel that encourages dialogue and community engagement. A dedicated editorial team will manage the newsfeed, ensuring content is both accurate and aligned with the project's objectives, while also incorporating stakeholder feedback to continuously improve the utility of the platform.

[4] https://whaller.com/en

Content will be updated regularly based on a predefined schedule, with immediate alerts for urgent updates. All information will be archived and made easily searchable, allowing stakeholders to track developments over time and access historical data as needed.

To monitor the effectiveness of the newsfeed and the broader consultation process, we will implement specific KPIs. These include tracking the **number of organisations participating** in public consultations, aiming for **at least 10 organisations** linked to the project engaging for the first time. We will also monitor the diversity and relevance of these contributions to evaluate the impact of the consultation process. This will help us ensure that the newsfeed not only serves as a tool for information dissemination but also fosters an active and diverse community of stakeholders effectively engaged in shaping digital policy.

The newsfeed is slated for a phased rollout, beginning with development and integration in the first two months (after the submission of this deliverable), followed by a beta testing phase with selected stakeholders. After refining the system based on initial feedback, the full launch will occur in the fourth month (from the submission of this deliverable), accompanied by comprehensive support materials and training sessions to maximise stakeholder engagement.

2.2.3 Comparative methodology development

Comparative approaches to policy analysis are quite diverse due to the range of purposes such analyses serve as well as methodological differences of opinion among scholars and practitioners in policy arenas.[5] This diversity is reflected in related fields such as comparative law where, again, methodological discussions appear in the literature almost as much as actual comparative work.[6] There are, however, broadly agreed aspects to comparative methods that will be used in this project.

The first aspect is that policy does not exist in a vacuum. In comparing policy in different jurisdictions, it is not only formally stated policy documents that require consideration. The broader context must also be included in the in the consideration of what policies exist and how their meaning should be interpreted. The contexts that should be taken into account vary depending on the policy area and jurisdictions under consideration. For the NexusForum.EU project's policy roadmap development and comparative policy analysis, the primary contextual areas that will be considered are the general economic situations (e.g., economic development status of the state, as well as the relative size of the economy), the political situations (level of democracy, importance and influence of the Continuum in political processes) and the existing infrastructural state of the Continuum in the relevant jurisdictions.

The second aspect is that intentions and outcomes must be considered alongside stated intentions when considering policy comparisons. It need not be a stated government policy to achieve digital sovereignty, for example, if companies based in one's own country are the predominant providers of cloud services already. Thus, the United States currently stresses what it refers to as "digital solidarity"[7] rather than "digital sovereignty". In Japan, meanwhile, the focus of the government on catching up in e-government and other digitization of the

[5] *Comparative Public Policy: Using the Comparative Method to Advance Our Understanding of the Policy Proces. Gupta, K. The Policy Studies Journal, 40(S1) 11-26, 2012.*

[6] *An Introduction to Comparative Law. Zweigert, K. and Kötz, H. Translated by Weir, T. 1998. 3rd Edition. Oxford: OUP.*

[7] *US Department of State Foreign Policy Briefing UNGA79: Foreign Policy Update on U.S. Cyberspace and Digital Technologies Priorities. https://www.state.gov/briefings-foreign-press-centers/unga79/cyberspace-and-digital-technologies-priorities*

economy means that capability of providers was far more important than nationality of providers in awarding government cloud services contracts in 2021.[8]

Given the broad context that is required to perform such analyses, and taking into account the practical limitations of analysis that can be undertaken in the project, the primary targets for comparative policy analysis in the project will be South Korea and Japan (keys targets and the location of project partners), New Zealand and Canada (chosen due to their recent association to the Horizon Europe program) and South Africa (to include a representative country with a developing economy which nevertheless has significant involvement in EU research and development projects without association under availability of funding for developing economies). Most of the policy documents and other relevant contextual information from these countries is either available in English (NZ, Canada, South Africa) or in the language of consortium partners (Korea and Japan). Some attention will also be paid to current development in the US and India, due to their availability in English and importance in the field (India is currently seeking to develop digital sovereignty and capability in the field, while the US is the home of the hyperscalers who capture much of the current EU, Japanese and Korean cloud markets).

The primary method of research will be documentary analysis. This will include concrete policy statements made by government ministers or appointed representatives (e.g., regulators, heads of relevant agencies). Contextual information will be sourced from a variety of places, such as news reports or press releases (e.g., the Japanese government's adoption of providers for its public sector cloud[9,10]) or business analysis (e.g., IDC's analysis of Japanese businesses cloud adoption[11]).

In addition to qualitative analysis of documentary material, some interviews may be carried out with relevant experts in Japan and Korea to provide deeper understanding of these two key countries.

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[8] *Amazon, Google win Japn Government Cloud Contract. Suzuki, W. NIkkeia Asia, 26th Octoer 2021. https://asia.nikkei.com/Business/Technology/Amazon-Google-win-Japan-government-cloud-contract*

[9] *Amazon, Google win Japn Government Cloud Contract. Suzuki, W. NIkkeia Asia, 26th Octoer 2021. https://asia.nikkei.com/Business/Technology/Amazon-Google-win-Japan-government-cloud-contract*

[10] *Fujitsu and Oracle collaborate to deliver sovereign cloud and AI capabilities in Japan. Fujitsu Ltd Press Release, 18th April 2024. https://www.fujitsu.com/global/about/resources/news/press-releases/2024/0418-01.html*

[11] *Japan Cloud Adoption Trends and Strategies. IDC, 2024. https://www.idc.com/getdoc.jsp?containerId=IDC_P15423*

3 EU policy & regulatory Landscape analysis

In the European Union, there are several policies, initiatives and laws that are particularly relevant to the European Computing Continuum. To depict the current landscape, it is useful to first define what the Computing Continuum entails (Figure 4): a core data center, or else a private cloud, alimenting the cloud-edge continuum, which is comprised of the public cloud, the public edge, 5G-Near Edge, on-premises edge and IoT-Far Edge. Both the provider of the continuum elements and the end user side are considered in the current EU landscape analysis.

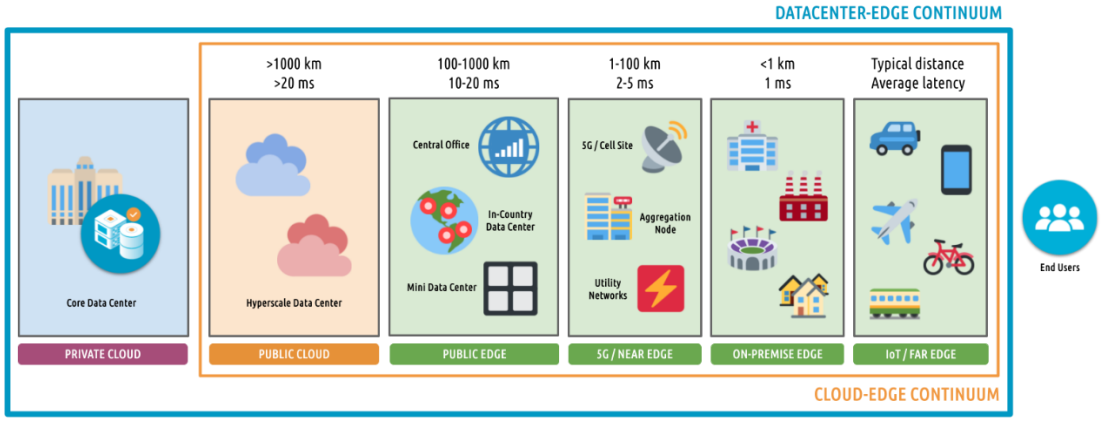

Figure 4. The Computing Continuum

The policy analysis is based on this definition of the computing continuum, and is meant to, in this first policy analysis phase, showcase the current policy and regulatory landscape at European level impacting this continuum.

3.1 Relevant policy initiatives and regulations to the European Computing Continuum

In recent years, several key EU initiatives have aimed to strengthen Europe's position in the Computing Continuum. Among the most prominent is **Gaia-X**,[12] an initiative launched in 2020 by the French and German governments in collaboration with industry leaders. The aim of Gaia-X is to establish a federated and secure data infrastructure that is backed up by core European values, allowing more interoperability between elements across the continuum. It equips these elements with a common data-exchange mechanism. Such interoperability equips cloud providers and other digital elements with an alternative to proprietary, non-interoperable technologies. In return, this system fosters innovation and collaboration between businesses and organizations within the EU, making the ecosystem of data providers and data users more transparent and trusted. The more trust on the providers' and on the users´ side, the greater the functioning of these elements across the continuum. This federated system of interoperable cloud nodes allows for smoother and more efficient data distribution. From the users` perspective, the impact envisions making the data that they generate more accessible and more exchangeable. Gaia-X also created a common framework that empowers the users

[12] *Vision & Mission - Gaia-X: A Federated Secure Data Infrastructure*

to have agency over when the data they generate is exchanged, while respecting European values. From an economic standpoint, the initiative pushes forward incentives to foster a European digital marketplace, where businesses can offer and consume, for example, cloud services, that are in line with EU regulatory standards.

In parallel, the European Union´s Agency for Cybersecurity (ENISA), published a draft of the **European Cybersecurity Certification Scheme for Cloud Services** (EUCS) in late 2020.[13] This certification framework, if put into place, would aim at providing a unified approach to cybersecurity across the EU, in a field in which the cloud providers are diverse and in continuous evolution. The framework details the criteria for the establishment of security standards across cloud services, based on three levels – basic, substantial and high – depending on the robustness that a service presents in terms of security measures. Cloud providers would not be forced to join the EUCS, they would be able to join voluntarily. If opting to join, they would contribute to the creation of a harmonized rulebook where factors such as data sovereignty, localization, compliance, transparency and incident management are monitored. Thanks to continuous collaboration between industry experts and ENISA and consecutive re-evaluations of the scheme, there would be a guarantee of staying up to date with the latest threats to security. With regards to supply-chain security across the cloud, the EUCS criteria advocate for transparency. Therefore, elements across the supply-chain would have to adopt strict measures to ensure that third-party vendors respect and comply with EU security standards. Ultimately, this scheme could have the potential of harmonizing cybersecurity criteria at supranational level, while emphasizing the criteria that make sensitive data of EU citizens and businesses remain within the European Union. This would have positive spillover effects on the interoperability and portability of services in the cloud sector and beyond.

Horizon Europe, launched in 2021 as the successor to[14]Horizon2020, put forward a strategy operating until 2027, with the aim of boosting research and innovation in Europe and beyond. It supports the development of innovation in the Computing Continuum by providing funding for projects such as the NexusForum.EU to become a tangible reality. So far, the impact of Horizon Europe can be observed in the myriad technological projects pursued by academic, industrial and public sector entities involved in the projects across the computing continuum. This has encouraged collaboration between parties, and it has led them to complement each other´s skills, knowledge and capabilities. It has promoted breakthroughs in performance, security and scalability of the technological components of the continuum. Ultimately Horizon Europe contributes to enhancing the industrial competitiveness of the EU's digital market, while ensuring that EU Digital Decade and Green Deal objectives are a step closer from their accomplishment.

Building on these foundations, the **EU Digital Decade Policy Programme**[15] launched in 2022, providing a vision for Europe's digital transformation until 2030. This program lays the grounds to shape the future of the computing continuum until 2030, having as its main objective to foster a human-centred, net-zero and prosperous digital future through the empowerment of European businesses and its citizens. It favours the development of an innovative infrastructure by promoting investment in target digital areas, some of which are elements of the Computing Continuum, includingthe development and maintenance of 10,000 edge nodes within the EU. This is meant to reduce latency and enhance real-time data processing

[13] *https://www.enisa.europa.eu/publications/eucs-cloud-service-scheme*
[14] *Horizon Europe the EU's funding programme for research and innovation (europa.eu)*
[15] *Decision - 2022/2481 - EN - EUR-Lex (europa.eu)*

capabilities. The program is also set to amplify high-speed broadband and secure cloud services, which ultimately also impacts EU end users; it tackles gaps in digital skills and literacy of the workforce and the European citizens, to ensure that end users can take an active and confident role in the digital transition.

At the end of 2023 the Directorate Generate for Competition of the European Commission approved the **Important Project of Common European Interest on Cloud Infrastructure and Services**[16] (IPCEI-CIS), marking a significant step toward European digital sovereignty. It is an unprecedented initiative, bringing together 19 leading European tech industry players, and providing the funding to develop the first interoperable and openly accessible European data processing ecosystem. It promotes the development of advanced cloud services and edge computing solutions, aiming to foster a cohesive ecosystem that encourages seamless data processing and storage. This IPCEI emphasizes cybersecurity measures to protect data and infrastructure across the continuum by aiming at developing advanced security frameworks and technologies. This will lead to more resilient systems, mitigating the risk of cyber threats. The initiative also promotes energy-efficient computing continuum technologies, for example by aiming at making data centers more energy efficient, resulting in a reduced carbon footprint of the continuum.

On the one hand, service providers can develop cutting-edge technologies that advance innovation and empower competitiveness of the Internal Market. They are also encouraged to share their resources and knowledge, which in return can lead to obtaining better services and lower development costs. On the other hand, users have more choice of services, and a higher level of trust because of European standards. Overall, the IPCEI-CIS contributes to Europe´s digital sovereignty, by funding local, European alternatives to Big Tech industry players.

Complementing these projects, several legislative measures have been introduced to reinforce Europe's position in the digital economy. 2022 saw the **Digital Markets Act**[17] come into force. This legal instrument calls for a reduced digital services user's lock-in in non-EU Big Tech players, or else the "gatekeepers", by imposing strict rules. It actively contributes to the survival of smaller innovative actors across the Continuum because it prevents gatekeepers from monopolizing market power. From the provider's side, this implies that smaller-scale businesses have a greater chance of competing with bigger players, and from the user side this means more choice of services. Cloud services qualify as core platform services (CPSs) under the Digital Markets Act, meaning that they could be classified as Gatekeepers if criteria such as size of market share are met. So far, the European Commission has identified 6 Gatekeepers so far, namely Alphabet, Amazon, Apple, ByteDance, Meta, Microsoft. If they do not comply with the rules laid out in the Act, they can either face fines of up to 10 percent of their total annual turnover or be imposed periodic penalty payments of up to 5 percent of the average daily turnover. If repeated infringements take place, remedies may be imposed, following a market investigation. These legally binding measures influencing the economic power of gatekeepers can ultimately help smaller actors such as SMEs survive within the EU digital market, and they can also contribute to overall fairer behaviour when these smaller players do businesses with tech-giants.

The **Digital Services Act**[18] also enacted in 2022, introduces harmonised conditions for innovative digital services to emerge and scale up in the digital market, while fostering interoperability between them and limiting regulatory fragmentation between Member States legislation. Similarly, to the Digital Markets Act, this piece of legislation primarily targets large

[16] *SA_102517_707E5C8E-0000-C216-8C1C-3081176554C2_287_1.pdf (europa.eu)*
[17] *Regulation - 2022/1925 - EN - EUR-Lex (europa.eu)*
[18] *Regulation - 2022/2065 - EN - DSA - EUR-Lex (europa.eu)*

market players (“very large online platforms”) but it also has implications for smaller players, such as online platforms, hosting services and intermediary services. The categorization of digital services depends on the number of users that a specific service can reach within the EU´s territories. Any business offering its service within the European Internal Market must adhere to these rules; the greater the size of the business within the Internal Market, the stricter the rules. In the event of non-compliance with the laws laid out by this act, the Commission can charge digital service providers (for example, cloud providers) with fines of up to 6% of their annual turnover.

In 2024, the **Artificial Intelligence Act**[19] came into force, providing a risk-based regulatory approach to AI systems within the EU. The Act categorizes AI systems based on their risk levels, imposing different regulatory requirements. High-risk AI applications, such as critical infrastructure, healthcare, and law enforcement, are subject to strict requirements, including rigorous testing, documentation, and oversight. In cloud computing, AI is used for predictive analytics and cybersecurity fostering greater trust in AI-powered cloud services. In edge computing, as well as in IoT, AI is designed and operated taking safety and ethics into account, ensuring immediate and tangible impacts on safety and security. The Act is set to promote innovation within a regulated framework by providing clear guidelines for companies to navigate the complex landscape of AI development. This helps developers design AI solutions compliant with European regulations, reducing the risk of costly regulatory sandboxes for testing innovative AI solutions in controlled environments. The Acts also reinforces Europe´s commitments to data protection, ensuring AI systems comply with the GDPR when processing personal data. This aligns with broader European Initiatives like GAIA-X, positioning Europe as a leader in trustworthy AI. Overall, it ensures that the AI used in the continuum is secure and transparent; it pushes for regulated innovation, conferring trust to developers incorporating AI systems in the continuum, while applying transparency and governance to the data generated by AI.

The **Data Act**[20], which is expected to come into force in 2025, enforces an open data ecosystem where data access and sharing are encouraged only if they occur under regulatory oversight. This complements previous legislative instruments such as GDPR, reinforcing data security measures. The data generated by industry players across the continuum, as well as the one generated by users, must be shared more transparently and freely, while remaining fully accessible to the user who generated it. The Act facilitates interoperability by mandating standard formats and protocols for data sharing. Consequently, this advances seamless integration between elements of the Continuum. As a matter of fact, the Data Act advocated for the portability and interoperability of the data, while limiting vendor lock-in mechanisms, so that businesses can switch providers without having to lose access to their own data. It also sets measures that aim at the prevention of unlawful data transfers outside the European Union, with a specific focus on countries with lower data protection and data privacy standards. Indeed, the data generated and stored by providers must adhere to the Data Act when it comes to data sharing practices; only under unusual circumstances such as emergency situations and crisis management, the providers hosting vital data may be asked to share this data with public authorities. Data portability must also be respected: cloud vendors will have to allow customers to displace their data to other service providers, therefore encouraging simple transfers between diverse computing environments, with minimal disruption and at fair costs.

[19] *Regulation - EU - 2024/1689 - EN - EUR-Lex (europa.eu)*
[20] *Regulation - EU - 2023/2854 - EN - EUR-Lex (europa.eu)*

Lastly, the **Cyber Resilience Act**,[21] adopted in October 2024, is expected to play a significant role in shaping the future of cybersecurity across the European Union by creating a comprehensive cybersecurity framework. One of the central elements of the act is to establish standardized certification schemes for products, services, and processes that are critical to Europe´s digital infrastructure. Elements across the Continuum must adhere to these standards to demonstrate that their solutions are secure and reliable. The Act also strengthens ENISA's (European Union Agency for Cybersecurity) role with a permanent mandate and additional resources to support EU member states in cybersecurity matters; this enhanced role includes coordinating responses to large-scale cyber incidents and developing the certification schemes that will be critical under the new framework. The application of a harmonized certification framework will also ensure that cloud services, edge computing, IoT devices and other elements of the continuum meet consistent security standards across the EU. Apart from protecting the integrity of these technologies, trust among users could grow, which in return should encourage wider technological adoption.

3.2 EU Open Source, Standardisation, and Skills Development initiatives

Open technologies, including standards, open-source software (OSS) and hardware (OSH), contribute to economic growth and innovation, and they hold significant potential in strengthening European digital sovereignty.[22] Recognising that foundational cloud-edge technologies are being developed and maintained within open source foundations like the Linux Foundation and Eclipse, the roadmap of the European Alliance for Industrial Data, Edge and Cloud outlines several priorities aimed at strengthening European capabilities and participation in these fora.[23]

In recent years, several initiatives have been launched to strengthen Europe's digital sovereignty, focusing on open source, open standards, and collaborative efforts. These initiatives address various aspects of the digital ecosystem, from hardware to cloud infrastructure and the internet. Below is a summary of key ongoing projects that contribute to this strategic vision.

The **Next Generation Internet (NGI)** initiative is a flagship project funded by the European Commission to create a more human-centric internet. As part of the NGI Commons project (2024-2027), there is a concerted effort to evaluate the impacts of prior NGI funding, which has played a substantial role in advancing digital commons initiatives in Europe. From 2019 to 2024, NGI funded over 1,200 projects with a total investment of approximately €140 million, supporting a broad range of open-source software, open standards, and digital commons projects. This funding initiative continues into the next phase, with an additional €32 million allocated for 2024 to 2027, indicating a strong commitment to building a sustainable, inclusive digital ecosystem across the EU. The NGI Commons project seeks to assess how effectively these investments have contributed to Europe's digital autonomy by examining outcomes in areas such as open-source adoption, interoperability, and the alignment of technological innovation with digital sovereignty goals. By identifying best practices and gaps in previous funding, NGI Commons will help refine strategies for future support.

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[21] *EUR-Lex - 52022PC0454 - EN - EUR-Lex (europa.eu)*

[22] *Blind et al. (2021). The impact of Open Source Software and Hardware on technological independence, competitiveness and innovation in the EU economy. Final Study Report.*

[23] *https://digital-strategy.ec.europa.eu/en/news/european-alliance-industrial-data-edge-and-cloud-presents-its-first-deliverables*

StandICT is a European initiative that promotes skills and capabilities in ICT standardization by combining educational efforts with practical support mechanisms. One of its core activities involves providing funding through open calls, where experts across Europe are invited to contribute to international ICT standards in key areas like AI, cloud computing, and IoT. This financial support empowers professionals to participate actively in shaping the standards that underpin technological innovation and sovereignty. Additionally, StandICT has initiated discussions around creating a dedicated curriculum for standardization education, aimed at boosting engagement across academia, industry, and public sectors. By collaborating with leading standardization bodies, such as CEN, CENELEC, and ETSI, the program aims to structure educational efforts that raise awareness and develop deeper expertise in ICT standards. This approach - combining open calls for expert participation, funding mechanisms, and educational frameworks - could be adapted as a model to promote skills development in open source. Similar initiatives could support open-source collaboration, driving both innovation and Europe's leadership in open digital infrastructure.

The **Sylva** project, hosted by the Linux Foundation Europe, is an open-source initiative designed to build a unified cloud stack for European telecom operators. It brings together major telecommunications companies - including Ericsson, Orange, and Telefonica to address the fragmented telecom infrastructure by creating a production-grade telco cloud framework that supports the deployment of 5G and edge-cloud services.

The **CAMARA** initiative, also hosted by the Linux Foundation, is a joint effort by the Linux Foundation and GSMA. It is designed to standardize APIs for mobile network operators, simplifying the integration between telecom operators and cloud providers. Companies such as Vodafone, Orange, Deutsche Telekom, and Telefonica are key contributors. CAMARA's approach leverages open-source technology to foster vendor-agnostic interoperability, enabling mobile services to be seamlessly deployed across networks and devices. It aims to create an open, interoperable framework for network services, allowing seamless collaboration between different telecom providers.

The **SIMPL** (Secure and Intelligent Methods for Privacy-preserving data sharing in the computing continuum) project is supported by the European Commission, focuses on developing an open-source software ecosystem that enhances privacy and security for end-users. It targets the creation of a framework for "self-sovereign" identity management, allowing individuals to control their personal data across digital platforms. SIMPL is a key part of the Commission's broader push to bolster digital sovereignty within the EU, aligning with policy initiatives that emphasize secure, privacy-respecting technologies. By developing secure data-sharing methods across cloud and edge environments, SIMPL supports Europe's goal of retaining control over sensitive data while enabling collaboration across sectors. This initiative contributes to the larger strategic aim of building secure, privacy-respecting digital infrastructures.

ApeiroRA is an initiative launched by SAP as part of the Important Project of Common European Interest (IPCEI) on Cloud Infrastructure and Services (CIS), aimed at bolstering digital sovereignty in Europe. This project works to create a reference blueprint for a high-performance cloud-edge continuum that prioritizes European values such as interoperability, data sovereignty, and vendor neutrality.[24] ApeiroRA emphasizes the use of open standards and open-source tools like Linux and Kubernetes, enabling a cloud-native environment that is not reliant on a single provider. The goal is to address the fragmentation in European cloud infrastructure by providing a uniform approach across the cloud-edge continuum, allowing for more flexible and resilient deployments.

[24] https://apeirora.eu/content/faqs/

Co-funded by the European Union
Project funded by Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Swiss Confederation
Federal Department of Economic Affairs, Education and Research EAER State Secretariat for Education, Research and Innovation SERI

While the critical importance of OSS for Cloud computing is well established, interest in OSH has developed more recently and is centered on the role that it can play in lowering barriers to entry and thereby mitigating strategic dependencies in the fields of processors and semiconductors. Such dependencies were made salient by disrupted supply chains during the COVID-19 and increased geopolitical volatility in recent years. Currently, the growing role of AI across various sectors is further heightening the strategic importance of semiconductors and the need for the EU to address particular areas of strategic weakness, including chip design.[25]

Of particular interest in this context is the surge in innovation, both proprietary and open source, catalysed by the adoption of **RISC-V**, a free and open instruction set architecture (ISA) standard. The European Chips Act,[26] along with initiatives like the Chips for Europe initiative, is providing an impetus for increased collaboration within Europe, emphasising the importance of RISC-V and open source. Building on open and shared standards, open-source licenses facilitate seamless collaboration between researchers and industry, helping to accelerate innovation and counteract dependencies. However, to fully harness the potential of open technologies in achieving digital sovereignty, a strategic approach is required to build and strengthen competencies in key areas, ensuring Europe has the capacity to branch projects and maintain the code it relies on, thereby reducing dependency.[27]

3.2.1 Open Source's role in enabling a sovereign Automotive industry in Europe

The automotive industry exemplifies one of the main verticals important for Europe's digital sovereignty, where open-source software plays a critical enabler as highlighted, e.g., during the European Commission's 2024 Workshop on Open Source key areas for Digital Autonomy[28].

As noted in a recent report by RISE[29], open-source software (OSS) has become integral to the automotive industry's shift towards software-centric models, enhancing innovation, development efficiency, and product quality. While OSS adoption is more prevalent outside vehicles due to stringent safety standards inside, the industry is moving towards centralized computing architectures and a unified software-defined vehicle (SDV) platform. This transition is driven by the rise of electric and autonomous vehicles, which increase software complexity. However, cultural legacies, safety regulations, and the long lifespan of vehicles slow this shift. Enhancing internal skills and knowledge is crucial for accelerating this evolution, with Open Source Program Offices (OSPOs) playing a key role in fostering an open source culture.

The hierarchical supplier structure in the automotive industry is incompatible with modern interconnected systems, necessitating a shift towards ecosystem-focused collaborations. Governments and institutions like the European Commission can facilitate this transformation by providing neutral platforms for industry stakeholders to collaborate. OEMs and Tier 1 suppliers are increasingly embracing OSS to gain control over their software stacks, complemented by strategic partnerships with tech giants like Google. The industry is also focusing on standardizing non-differentiating technologies to foster innovation. Ensuring the health and sustainability of the OSS supply chain is vital for maintaining safety and security

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[25] Kleinhans (2021). The lack of semiconductor manufacturing in Europe. Policy Brief. SNV Berlin.
[26] EC (2022). European Chips Act: Communication, Regulation, Joint Undertaking and Recommendation.
[27] EC Working Group on OSH and OSS (2022). Recommendations and roadmap for European sovereignty on open source hardware, software and RISC-V Technologies.
[28] https://digital-strategy.ec.europa.eu/en/events/workshop-open-source-key-areas-digital-autonomy
[29] Linåker, J., & Nummelin Carlberg, A. (2024). Open Source Software in the Automotive Industry - A Vision Paper. Eclipse Software Defined Vehicle Working Group, Brussels, Belgium.

over the long lifespan of automotive systems. Achieving digital sovereignty while enhancing competitiveness remains a complex but essential goal for future SDV platforms.

3.3 Initial analysis of the international landscape: The Japanese case

3.3.1 Basic Economic, Industrial and Social Background

Japan is the world's fourth largest single country economy (exceeded only by the United States, China and Germany). It is currently negotiating association with the Horizon Europe program. Historically since the second world war, Japan has been a close economic and security ally of the US, and to some extent the UK, arising out of their joint occupation after the war. Japan's industrial manufacturing base was highly successfully revived from its near-complete war-footing during the second world war and until 1990 was one of the world's most successful economies. The collapse of a real estate and other investment bubble in 1990 has hampered economic growth since, being referred to by 2000 as the "lost decade"[30] and as it continued until the late 2010s, the "lost decades".[31] Early signs of economic recovery in 2019 and 2020 were derailed by the Covid pandemic's impact on both the world economy and internally in Japan perhaps partly due to Covid policy but perhaps also due to the existing weakness of the recent upturn.

Japan's early industrial successes in manufacturing and in particular in manufacturing of high-tech products in the mid twentieth century also stalled after the economic crisis of 1990. The link between these is beyond the scope of this review but through the 90s and to date Japan has lagged behind similar OECD countries, particularly Germany (a similar sized country with a similar manufacturing and export led economy). The economic impact of re-unification in 1990 was followed by continued economic growth, outpacing Japan's and overtaking it in total GDP by 2023 due to strong German recovery/expansion and Japanese decline post-Covid, including a very sharp decline in the value of the Japanese Yen compared to the US$ in 2022.[32]

Japan's economic and industrial future has one big issue looming over it. With the world's most advanced demographic bubble, combining some of the lowest birth rates in the world with some of the highest average, and some of the longest individual, lifespans, with a strong social and political consensus against large scale permanent immigration, pose significant challenges for maintaining economic competitiveness and high levels of social infrastructure. The current Japanese government policy on robotics and information technology (see Society 5.0 and Data-Driven Society policies below) is the Science, Technology and Innovation Basic Law, which was revised in 2020 (first substantial revision since the earlier version's introduction in 1995, despite every five-year update to minor details). This revision expanded the law to include a significant focus on the human and social science aspects of the introduction of Science, Technology and Innovation.

Existing Continuum infrastructure in Japan is a mixed situation with some highly advanced infrastructure capabilities on the national scale, but weaknesses in other infrastructures, and generally very weak local installations and usage by all but the largest industrial concerns.

[30] *Hayashi, F. and Prescott, E.C., 2002. The 1990s in Japan: A lost decade. Review of Economic Dynamics, 5(1), pp.206-235. https://www.sciencedirect.com/science/article/pii/S1094202501901498*
[31] *Funabashi, Y. and Kushner, B. eds., 2015. Examining Japan's lost decades. London: Routledge.*
[32] *From World Bank GDP figures.*

3.3.2 Continuum Infrastructure in Japan

Japan has a world-leading installation of backbone Internet capabilities, with fibre-to-the-premises or at least fibre-to-the-kerb available for almost all urban regions, including the core industrial areas. Japan's large manufacturing concerns such as Toyota, Mitsubishi and Hitachi have high levels of installation of network connectivity to their premises and significant digitisation of their operations. A number of Japanese firms are themselves providers of Continuum products and services such as Fujitsu (a cloud provider) or NEC and Hitachi (with AI development and deployment). The Edge Computing market in Japan is regarded by many analysis firms as a major growth area for investment, particularly for Edge AI applications, with estimates of a market of $10bn within a few years.

The major Japanese telcos NTT, KDDI and Softbank all offer private 5G connections, and all are heavily involved in the development of the 6G standard. Deployment of 4G/LTE/5G services to most of Japan's high density population centres for general access was relative swift and successful, but private 5G was only launched later.

While GAIA-X expanded beyond the EU with a small presence in Japan, its activity has been limited in recent years with a shift of focus towards the data-driven society concept and the DATA-EX platform (see the section Society 5.0 and the Data-Driven Society below).

3.3.3 Continuum Usage in Japanese Government and Firms

On the other hand, small firms in Japan, the backbone of all industrial economies, are often so behind the digitization curve as to be the butt of jokes, partly driven by slow digital transformation in government as well. Only in the last couple of years have government agencies stopped demanding submission of some data from citizens and companies on floppy disk,[33] for example. A significant proportion of Japanese SMEs fall into the micro-enterprise sector, and a large proportion of these are owned and operated by owner-managers and staff approaching retirement age, for whom digitization is hard to understand and hardly a priority since their retirement plans are mostly based on selling the physical assets of their enterprise (primarily land) rather than selling the business as a going concern.

Another aspect that has historically delayed digitisation in Japan is the traditional stamp culture, where physical hand-carved printing stamps have been required to be affixed to many formal and even informal document submissions, both within organisations and in government interactions. Even during the Covid pandemic changes to this were resisted, with physical mailing of documents for stamping replacing in-person collection and submission, or documents sent by fax so that they could be stamped even if prepared on a local computer and printed. For example, PCR test results were sent by fax to local authorities, leading to miscounting of cases.

The government has recognised the stamp culture issue and has been working recently to almost all official requirements for stamps.

A significant conservatism in management teams in both public and private sector organisations in Japan stresses the status quo, and again produces a significant resistance to digitisation efforts.

[33] *Japan government accepts it's no longer the '90s, stops requiring floppy disks. Harding, S. ArsTechnica, 31st January 2024. https://arstechnica.com/gadgets/2024/01/floppy-disk-requirements-finally-axed-from-japan-government-regulations/*

Japanese e-government and general digital readiness lags significantly behind most other developed economies. For example, the Institute for Management Developments digital competitiveness ranking report from 2022 Japan ranks 29th out of 63 developed economies.

Further detailed research on the current landscape in Japan in this area will be needed for development of the Policy Roadmap.

3.3.4 Society 5.0 and the Data-Driven Society

The most relevant current policy document in Japan is the 6th Science, Technology and Innovation Basic Plan,[34] within which two concepts are the most relevant: the Society 5.0 concept (first introduced in the preceding 5th plan) and the Data-Driven Society approach pioneered by the Digital Agency (created under the 6th Basic plan to first drive e-government reform and then expand that to citizen and economic digitization). Japan lacks explicit government policies mentioning issues such as "Digital Sovereignty"[35] with the implementation of these two policies, primarily driven by the Digital Agency awarding their first set of e-government cloud computing contracts in 2022 to US hyperscalers Google and AWS,[36] although a second contract round in 2023 did add Japanese-based multinational Fujitsu to the providers.[37]

Beyond the e-government developments, government and industrial policy in this Continuum space seems to be focused on developing the Data-driven society, primarily via the public/private partnership approach of the Data-Society Alliance. They are aware of the digital sovereignty concerns of the EU, but at present seem far more focused on Data Free Flow with Trust (DFFT) approaches, rather than being concerned about geographic location of data processing facilities or corporate ownership of service providers or software. FOSS (Free and Open Source Software) approaches are also barely mentioned in current policy documents, nor stressed in e-government cloud contracts mentioned above.

3.3.5 Conclusion of Japanese Policy Overview

In this initial brief overview of the Japanese policy landscape, it is clear that Japan is more concerned with catching up in e-government and industrial adoption of Continuum approaches as opposed to worries about digital sovereignty, beyond DFFT. However, Japan's likely association with Horizon Europe (and probably continuation with its successor framework program) and its compatible data protection regime, suggest that as Japanese government and commercial adoption of Continuum resources catch up to the EU and US leaders, that the major policy concerns that led to the establishment of the IPCEI-CIS and the NexusForum.EU project in the EU (the latter specifically calling for inclusion of a Japanese partner leading to this analysis) may well become more important in Japan within the next five to ten years. Thus, ensuring the outcomes of these activities within the EU are compatible with shared sovereignty with Japan (as well as Korea, New Zealand, Canada and other like-minded nations) should be a key aim. This will be reflected in the upcoming development of the NexusForum.EU Policy Roadmap.

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[34] *Outline of the Science, Technology, and Innovation Basic Plan, Cabinet Office,Japan. https://www8.cao.go.jp/cstp/english/outline_plan.pdf*

[35] *Tamaoki, K., 2024. Expanding Digital Sovereignty: The Future of the Conflicting Logic of Freedom and Control/ 拡大するデジタル主権論 せめぎ合う自由と統制の論理の行方. In Japanese. https://www.marubeni.com/jp/research/report/data/20240913_tamaoki.pdf*

[36] *Amazon, Google win Japan Government Cloud Contract. Suzuki, W. NIkkeia Asia, 26th October 2021. https://asia.nikkei.com/Business/Technology/Amazon-Google-win-Japan-government-cloud-contract*

[37] *Fujitsu and Oracle collaborate to deliver sovereign cloud and AI capabilities in Japan. Fujitsu Ltd Press Release, 18th April 2024. https://www.fujitsu.com/global/about/resources/news/press-releases/2024/0418-01.html*

3.4 Input from initial consultation activities

3.4.1 EU Digital Policy Workshop during the NexusForum2024 Summit held in Brussels

Tecnalia, with the support of ONS, organized a workshop during the NexusForum2024 Summit 2024 to gather initial feedback on the methodological approach that will be used to guide the process of defining policy recommendations. The aim was to discuss the factors impacting EU technological sovereignty and the convergence of Edge, cloud, and IoT technologies, as outlined in WP3.

The one-hour workshop was divided into two parts. The first included two presentations: Juncal Alonso (Tecnalia) on the role of NexusForum.EU in EU digital sovereignty, and Chiara Zincone (ONS) on the EU digital policy landscape. The second part was a collaborative session facilitated by Xabier Uriarte (Tecnalia), where participants shared their views on the key factors influencing European technological sovereignty in the computing continuum.

Nearly 100 participants discussed the six proposed factors affecting EU technological sovereignty in Edge Cloud Computing. They summarized their opinions on virtual notes (see Figure 5 below) and debated which factors were most relevant or if any were missing. At the end, the participants whose contributions received the most votes shared their conclusions.

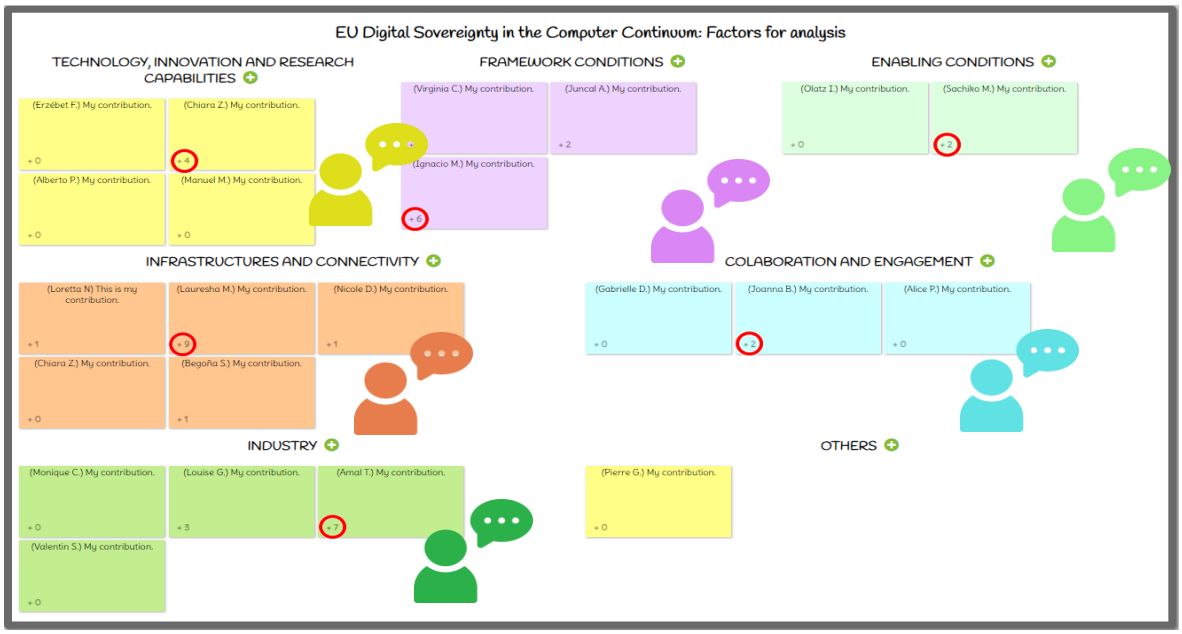

Figure 5. IdeaBoardz used for the workshop at the NexusForum2024 Summit

3.4.2 Preliminary results

The feedback from the workshop will be thoroughly analysed in the next phase of the implementation. At this stage, however, here is the initial feedback gathered from the community present at the NexusForum.EU summit.

Based on the answers to the question: What is the current European situation in the field of the Computing Continuum?

"Open Source Won't Be a Magic Solution: *while open-source solutions can contribute to innovation, they alone will not solve Europe's problems in the computing continuum. This implies that simply relying on open-source initiatives may not be enough to overcome structural*

and systemic issues, such as fragmentation, lack of investment, or reliance on non-European cloud providers."

***"Complicated and Unreliable**: the complexity of managing diverse systems, platforms, or standards across the continent and the unreliability of existing infrastructure or technology to support the growth of the computing continuum."*

Based on the votes received, the factors considered most relevant for promoting European sovereignty in the Computing Continuum are ranked as follows (from most relevant to less relevant):

- Technological innovation and research capabilities
- Framework conditions
- Industry
- Infrastructure
- Enabling conditions
- Collaboration & engagement

According to the voting results, the ideas identified as most important under each of the aforementioned factors are:

- The need for policies that strengthen technological education from the earliest stages.
- Technology evolves quickly, and regulations must allow EU companies (both small and large) to innovate rapidly without fear of restrictive legislation.
- We must ensure that initiatives like IPCEI, the Cloud Alliance, etc., truly address the needs of the industry, and that our industrial sector is willing to invest in these new cloud and edge capabilities.
- Deployments at various scales: not just edge nodes but also data centers, sensors, networks, AI factories, etc., with European ownership, capital, users, and location.
- Policies should prioritize fostering demand for cloud technologies rather than subsidizing supply.
- Using open-source tools while ensuring European maintainability is essential. It's important not to rely solely on U.S. foundations; Europe should have its own counterpart as well.

Another key idea discussed under "Other factors" is the importance of analysing user needs, which should complement the other considerations. This reflects Steve Jobs' famous quote: "*You can't start with the technology and try to figure out where you're going to sell it*."

In conclusion, all the six guiding factors for shaping policy recommendations were identified by the community participating in the workshop as relevant, and several topics and issues were discussed per factor which will be incorporated to the analysis. It is worth to mention that many of the commented topics such as open-source tools, increased needed skills, the role of the regulatory framework and policy initiatives among others are already considered in NexusForum.EU. The incorporation of new factors (such as the user needs) proposed during the workshop will be considered in the next phase.

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4 Initial mapping and gap identification

This section of the document provides a high-level overview of EU policies, examining, in particular, their relationship with the technology domains defined in the Technology Roadmap. This preliminary mapping of relevant policies does not aim at providing an in-depth analysis, but rather at performing an initial mapping exercise to assess the wider digital policy portfolio in its interactions with technologies connected to the Cloud, Edge and IoT domains. The analysis aims to create a pragmatic entry point and the matrix provided should be considered as a general indication: if the matrix does not identify a direct link between a specific policy measure and a technology domain, it does not necessarily imply that that policy measure does not have an impact on the technology, but rather that the policy measure focuses more closely on other technologies.

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Name	Type	Status	Reference	AI for cloud-edge	Cloud-edge for AI	Generative AI for the infrastructure	Telco cloud-edge, integration with 5G and 6G	Cloud-edge use case	Carbon-neutral edge/AI, Carbon Neutral Edge Intelligence	Hardware level (HPC – RISC-V)	Software Engineering/Development	Cybersecurity	Next gen AI systems[38]	Robotics	DevOps for Quantum	Data/data spaces
Cyber Resilience Act	Regulation	Close to adoption	COM/2022/454 final	○	○	○				○	○	○	○	○		
Cybersecurity Act	Regulation	Adopted	(EU) 2019/881	○	○	○	○	○	○	○	○	○	○	○	○	○
Directive on measures for a high common level of cybersecurity across the Union	Directive	Adopted	(EU) 2022/2555									○				
Data Act	Regulation	Adopted	(EU) 2023/2854	○	○	○	○	◑								○
Framework for the free flow of non-personal data in the European Union	Regulation	Adopted	(EU) 2018/1807	○	○							○				○
Chips Act	Regulation	Adopted	(EU) 2023/1781				◑	◑		○				◑	○	
Digital Markets Act	Regulation	Adopted	(EU) 2022/1925	○	○		◑	◑			○	◑	◑			
Digital Services Act	Regulation	Adopted	(EU) 2022/2065	○	○						○					○
Establishing the European Electronic Communications Code	Directive	Adopted	(EU) 2018/1972	◑	◑			◑				○				

[38] *Holistic AI (generative and ML)*

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Name	Type	Status	Reference	AI for cloud-edge	Cloud-edge for AI	Generative AI for the infrastructure	Telco cloud-edge, integration with 5G and 6G	Cloud-edge use cases[Fell B okmärket är inte definierat.]	Carbon-neutral edge/AI, Carbon Neutral Edge Intelligence	Hardware level (HPC – RISC-V)	Software Engineering/Development	Cybersecurity	Next gen AI systems[38]	Robotics	DevOps for Quantum	Data/data spaces
Digital Decade Policy Programme 2030	Decision	Adopted	(EU) 2022/2481	○	○		◑		○	◑		○				
Connecting Europe Facility	Regulation	Adopted	(EU) 2021/1153				◑		◑							
Data Governance Act	Regulation	Adopted	(EU) 2022/868													○
AI Act	Regulation	Adopted	(EU) 2024/1689	○	○	○			○		○	○	○			
eIDAS	Regulation	Adopted	(EU) 910/2014									○				
Gigabit infrastructures Act	Act	Adopted	(EU) 2029/1309				◑									
Cyber Solidarity Act	Regulation	Council´s first reading	COM(2023) 209									○				
An EU initiative on Web 4.0 and virtual worlds	Communication		COM(2023) 442					○								
Establishing the European High Performance Computing Joint Undertaking	Council Regulation	Adopted	(EU) 2021/1173		○					○						

Table 3. Mapping of relevant policies and regulations with the research topics defined in D2.1.

○ This technology is directly addressed by the policy

◑ This technology is indirectly/partly addressed by the policy

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4.1 Policy overview

4.1.1 Cyber Resilience Act

The Cyber Resilience Act, which is close to adoption at the time of writing, is expected to be a cross-cutting policy act: as per its title, it is expected to define "cybersecurity requirements for products with digital elements",[39] meaning that it will regulate virtually all areas of the digital ecosystem.

4.1.2 Cybersecurity Act40

On top of strengthening the EU Agency for cybersecurity (ENISA), the EU Cybersecurity Act "introduces an EU-wide cybersecurity certification framework for ICT products, services and processes"[41], this means that the measures defined in the act are cross-cutting and apply on all digital goods and services.

4.1.3 Directive on measures for a high common level of cybersecurity across the Union

According to Article 1, the Directive lays down:

(a) obligations that require Member States to adopt national cybersecurity strategies and to designate or establish competent authorities, cyber crisis management authorities, single points of contact on cybersecurity (single points of contact) and computer security incident response teams (CSIRTs);
(b) cybersecurity risk-management measures and reporting obligations for entities of a type referred to in Annex I or II as well as for entities identified as critical entities under Directive (EU) 2022/2557;
(c) rules and obligations on cybersecurity information sharing;
(d) supervisory and enforcement obligations on Member States.[42]

This means that the Directive, while potentially having an indirect impact on most of the roadmap technologies, directly targets cybersecurity.

4.1.4 Data Act

The Data Act[43] is a far-reaching Regulation which covers the wider European data ecosystem, regulating the exchanges of data as well of the protection of personal and non-personal data in specific contexts. Given the broad scope of the regulation, it has a direct impact on several technologies identified in the roadmap, as shown in Table 3.

[39] *COM(2022) 454 final*
[40] *Regulation (EU) 2019/881*
[41] *https://digital-strategy.ec.europa.eu/en/policies/cybersecurity-act*
[42] *Article 1, Directive (EU) 2022/2555*
[43] *Regulation (EU) 2023/2854*

4.1.5 Framework for the free flow of non-personal data in the European Union

The Regulation focusses on ensuring the free flow of non-personal data, requiring Member States to avoid the creation of unnecessary barriers hindering the exchange of non-personal data.[44] This Directive has an impact on some of the technologies being analysed. Generative AI, while using large amounts of data, has not been considered as directly impacted by this regulation as also personal data might be used (e.g., also unintendedly in the training of language models).

4.1.6 Chips Act

The flagship "Chips Act" Regulation aims at *strengthening the semiconductor ecosystem at Union level*.[45] The "Chips for Europe" initiative established by the Regulation, lists among its five operational objectives "upgrading the design capacity with ongoing innovative developments, such as processor architectures based on the open-source Reduced Instruction Set Computer Architecture (RISC-V)". This directly addresses the technology examined by NexusForum.EU technology roadmap, i.e., "Hardware level (HPC – RISC-V)".

4.1.7 Digital Markets Act

The Digital Markets Act (DMA) aims at regulating the *functioning of the internal market by laying down harmonised rules ensuring for all businesses contestable and fair markets in the digital sector.*[46] The wide scope of the Regulation means that it directly and indirectly addresses several of the technologies examined in the roadmap.

4.1.8 Digital Services Act

The Regulation aims to regulate the functioning of the internal market for intermediary services *by setting out harmonised rules for a safe, predictable and trusted online environment that facilitates innovation and in which fundamental rights enshrined in the Charter, including the principle of consumer protection, are effectively protected*[47]. As such, the Regulation primarily touches upon *Cloud for AI, AI for Cloud, Software Engineering/Development* and *Data/Data spaces.*

4.1.9 Establishing the European Electronic Communications Code (Recast)

By establishing *a harmonised framework for the regulation of electronic communications networks, electronic communications services, associated facilities and associated services, and certain aspects of terminal equipment*[48], the Regulation impacts indirectly *AI for Cloud, Cloud for AI* and *Continuum as enabling technology*. It directly targets *Cybersecurity* and *Data/Data spaces.*

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[44] *Regulation (EU) 2018/1807*
[45] *Article 1, Regulation (EU) 2023/1781 (Chips Act)*
[46] *Article 1, Regulation (EU) 2022/1925 (Digital Markets Act)*
[47] *Article 1, Regulation (EU) 2022/2065*
[48] *Article 1, Directive (EU) 2018/1972*

4.1.10 2030 Digital Decade Policy Programme

According to Article 3.1 (e), The Decision aims at *developing a comprehensive and sustainable ecosystem of interoperable digital infrastructures, where high performance, edge, cloud, quantum computing, artificial intelligence, data management and network connectivity work in convergence, to promote their uptake by businesses in the Union, and to create opportunities for growth and jobs through research, development and innovation, and ensuring that the Union has a competitive, secure and sustainable data cloud infrastructure in place, with high security and privacy standards and complying with the Union data protection rules.*[49]

The scope of the Decision is quite wide-encompassing, and as such touches upon several of the technologies examined in the roadmap, with particular reference to *AI for Cloud, Cloud for AI, Carbon-neutral edge/AI, Carbon Neutral Edge Intelligence, Cybersecurity* and indirectly addresses *Telco cloud-edge, integration with 5G and 6G* and *Hardware level (HPC – RISC-V).* However, this is not so clear-cut given the wide scope of the Decision, and also other roadmap technologies are likely to be impacted by the 2030 Digital Decade Policy Programme.

4.1.11 Connecting Europe Facility

The Regulation establishing the "Connecting Europe Facility" does not exclusively focus on the European digital ecosystem but rather looks at *trans-European networks in the transport, energy and digital sectors.*[50] This means that, while virtually having the potential to touch upon all the roadmap technologies, it can be found to indirectly address *Telco cloud-edge, integration with 5G and 6G* and *Carbon-neutral edge/AI, Carbon Neutral Edge Intelligence*, considering in particular its energy- and environment- related objectives.

4.1.12 Data Governance Act

The Regulation defines the conditions for reuse of data in the public sector and provides a framework for companies and individual to securely share data, with particular reference for altruistic purposes.[51] The specific focus of the Regulation means it directly impacts the roadmap technology domain identified as *Data/data spaces.*

4.1.13 AI Act[52]

The flagship Regulation aims at regulating the wider European AI ecosystem, defining rules for AI systems aiming to enter the European market, restricting specific AI practices, monitoring requirements and supporting innovation in the field. The Regulation has a direct impact on the roadmap technology domains defined as *AI for Cloud, Cloud for AI, Generative AI for the infrastructure, Carbon-neutral edge/AI, Carbon Neutral Edge Intelligence, Software Engineering/Development, Cybersecurity* and *Next gen AI systems.*

[49] *Decision (EU) 2022/2481*
[50] *Article 3, Regulation (EU) 2021/1153*
[51] *Regulation (EU) 2022/868*
[52] Regulation (EU) 2024/1689

4.1.14 eIDAS

The Regulation lays down conditions and rules for electronic identification, signatures, stamps, documents and certificate services for web authentication. It therefore directly addresses the *Cybersecurity* technology domain.[53]

4.1.15 Gigabit infrastructures Act

With its direct intervention on high-speed connectivity, the Regulation touches upon 5G and 6G, underlying the *Telco cloud-edge, integration with 5G and 6G.*[54]

4.1.16 Cyber Solidarity Act

As described in Article 1, the proposed Regulation *lays down measures to strengthen capacities in the Union to detect, prepare for and respond to cybersecurity threats and incidents, in particular through the following actions*[55]*,* directly addressing the *Cybersecurity* technology domain.

4.1.17 An EU initiative on Web 4.0 and virtual worlds

By targeting Virtual Worlds, i.e., virtual reality, extended reality, mixed reality and augmented reality applications, the Communication[56] targets some of the technologies identified in the roadmap as potentially being supported by *Continuum as enabling technology*.

4.1.18 Establishing the European High Performance Computing Joint Undertaking

As described in its very title, the Council Regulation establishes the initiative on European High-Performance Computing, a Joint Undertaking, directly targeting High Performance Computing,[57] identified in the technology roadmap within the *Hardware level (HPC - Risc V)* domain.

Earlier this year, an “AI Factories” amendment was added to the Joint Undertaking Regulation, to support the growth of a highly competitive and innovative AI ecosystem in Europe.[58]

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[53] *Regulation (EU) 910/2014*
[54] *Regulation (EU) 2024/1309*
[55] *Article 1, COM(2023) 209*
[56] *Communication COM(2023) 442*

[57] *Council Regulation (EU) 2021/1173*

[58] *https://eurohpc-ju.europa.eu/ai-factories-amendment-eurohpc-ju-regulation-enters-force-2024-07-09_en*

Conclusions

This document outlines the methodological framework that the Project will adopt within the realm of digital policies and regulations in the Cognitive Computing Continuum. The approach is structured around the following key pillars:

- **Policy and Regulatory Landscape Analysis**: This includes examining the policy approaches of collaborating countries such as Japan and the Republic of Korea (ROK), while also monitoring various EU policy initiatives and regulatory frameworks that could influence the EU's Cognitive Computing Continuum and its future development. To facilitate this, a concise list of relevant policy initiatives and regulations has been compiled, encompassing Gaia-X, EUCS, HE, DEP, EU Digital Decade Policy Programme, IPCEI-CIS, Digital Markets Act, Digital Services Act, Cyber Resilience Act, Data Act, and Artificial Intelligence Act. The analysis incorporates an external perspective, as demonstrated in the current document through the examination of the Japanese case. This will be extended to assess the impact of the existing regulatory and policy framework in Japan (and other countries) on the EU level.

- **Proposal for a Sovereign EU Computing Ecosystem**: This proposal advocates for the adoption of Open Source, Open Standards, and Collaborative Skillsets to achieve interoperability, vendor neutrality, and technological autonomy within the EU computing ecosystem. The current report explores the role of Open Source in fostering a sovereign automotive industry in Europe, serving as an initial example and best practices model for the Cognitive Continuum ecosystem.

- **Consultations and Participatory Actions**: Establishing stable channels to stay informed about ongoing and impactful policies and regulations. It also aims to facilitate participation in open consultations and other initiatives designed to gather public feedback during the development of the policies.

- **Development of Policy Recommendations**: This involves creating a concrete set of policy recommendations to shape the future Policy Agenda at the EU level for the Cognitive Computing Continuum. During the initial phase of the project (M1-M9), the factors necessary for identifying gaps have been defined. These factors include Technology, innovation and research capabilities, Framework conditions (policies, strategy, plan, regulation, etc.), Enabling conditions (open source, open standards, skills), Infrastructures and connectivity (including space infrastructure and data), Collaboration & engagement, and Industry.

Futures versions of this report, to be produced in M18 (June 2025) and M30 (June 2026), will offer an update on those activities.

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