Building a 6G Ecosystem: Synergies with European and National Initiatives at the EU-level

Authors:
Claudio de Majo (Trust-IT Services), Toon Norp, Prachi Sachdeva Maria Raftopoulou (TNO), Kostas Trichias (6G-IA)

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1. Background

The development of 6G networks represents a strategic priority for Europe, ensuring the region's leadership in next-generation telecommunications. As global competitors accelerate their efforts, the European Union (EU) must align its research, innovation, and industrial strategies to remain competitive. Various national and EU-level initiatives can potentially contribute to the advancement of 6G technologies, but differences in scope, funding mechanisms, and objectives present challenges in achieving cohesion. Stronger collaboration among these initiatives is necessary to maximise impact and avoid fragmentation.

This document provides a detailed examination of the current 6G research and innovation (R&I) landscape in Europe, highlighting both national initiatives and broader EU-level programs. It outlines the key objectives and focus areas of these efforts, analysing commonalities and divergences in their approach. Furthermore, it explores the role of open-source frameworks, standardization efforts, and industrial collaboration in shaping a unified European 6G ecosystem. The document also identifies gaps in coordination and alignment that could hinder Europe's ability to establish global leadership in 6G technologies. Finally, it presents key policy recommendations to enhance synergies between national and EU-level initiatives, ensuring a coherent and effective strategy for the next phase of network evolution.

2. National 6G Initiatives in Europe[1]

Several European countries have established dedicated national programs to support 6G research and innovation. These initiatives are typically funded by government grants and focus on a combination of fundamental research, applied development, and industrial collaboration. While they differ in specific objectives, most initiatives share an emphasis on technological sovereignty, sustainability, artificial intelligence (AI)-driven networking, and advanced wireless communication. These national 6G initiatives are not aligned or coordinated with each other or indeed with the European-level initiatives like SNS-JU.

2.1 Overview of national initiatives

- **Finland**: the country has established two complementary 6G programs: 6G Flagship and 6G Bridge. The 6G Flagship initiative focuses on fundamental research, driving early-stage innovation in key technologies such as terahertz communication and edge computing. The 6G Bridge programme, in contrast, concentrates on applied research and industry collaboration, ensuring that innovations transition effectively from research to market applications.
- **France**: France's national 6G initiative is part of the broader "France 2030" economic strategy and is funded with €735 million. The programme prioritises the development of secure and sovereign telecommunications networks while encouraging domestic industrial participation. It is organised into four main areas: fostering 5G and 6G applications, supporting the local telecommunications industry, advancing research and development, and strengthening technical training programs. The initiative also seeks to accelerate the deployment of advanced network technologies and expand France's influence in international standardization efforts.
- **Germany**: 6G Platform brings together industry and academic stakeholders to develop future network architectures, AI-based communication models, and network security frameworks. The platform includes multiple research hubs, each focusing on a different aspect of 6G technology, such as energy-efficient networks, ultra-reliable communication, and software-defined networking.
- **Ireland**: the Irish National 6G Initiative supports industry-academia partnerships and aligns closely with SNS-JU research priorities. The program facilitates research on next-generation network security, cloud-native architectures, and the integration of AI in telecommunications.
- **Italy**: the RESTART program, funded with €118 million, is structured around eight thematic areas, or "spokes," covering various aspects of telecommunications networks and digital transition. The initiative supports fundamental and applied research, promotes start-ups, and facilitates technology transfer. It also includes funding for PhD programs and industry-academia partnerships, reinforcing the goal of developing a highly skilled workforce for the future telecom sector.
- **Netherlands**: The Netherlands has launched the Future Network Services (FNS) program, with a total investment of €203 million. The program is structured around technical research in intelligent network components, network architecture, and the development of applications across sectors such as healthcare, manufacturing, and urban planning. It also includes an initiative to strengthen the ecosystem by fostering collaboration between industry and academia, supporting start-ups, and establishing a national 6G testbed.
- **Spain**: UNICO 6G R&D initiative is part of the country's Digital Spain 2026 strategy, with €206 million allocated across three funding rounds. The program aims to position Spain as a centre of excellence in 6G research by supporting over 200 research and development projects. It also seeks to integrate with the EU's Smart Networks and Services Joint Undertaking (SNS-JU), ensuring alignment with European priorities. The initiative places significant emphasis on fostering public-private partnerships and increasing Spain's contribution to global telecommunications standardization efforts.
- **Sweden**: the Swedish approach to 6G research is organised under the Advanced Digitalisation initiative and national competence centres. These efforts concentrate on cloud-native telecom networks, AI-driven network management, and energy efficiency in communications infrastructure. The initiative also aims to strengthen Sweden's role in European collaborative projects.

1 More information on National Initiatives is available in the deliverable D2.2 "Findings and Trends from European 6G R&I Initiatives" available here: https://smart-networks.europa.eu/csa-s/#SNS-ICE

2.2 Main coordination challenges

Despite variations in structure and funding, these national initiatives share common objectives related to digital sovereignty, sustainability, and industrial competitiveness. Their combined research investment exceeds €2 billion, complementing the €900 million allocated by the SNS-JU. However, while there are clear points of alignment, several challenges remain in ensuring efficient collaboration, avoiding duplication, and integrating national efforts into a coherent European strategy.

- **Fragmentation**: one of the main challenges is the fragmentation of research priorities across different countries. While all national initiatives focus on advancing 6G technologies, their specific objectives, thematic focus areas, and funding structures vary significantly. Some countries prioritise network architectures and AI-driven automation, while others focus more on hardware components or industry-specific applications. This lack of a unified approach makes it difficult to establish a common European roadmap for 6G development.
- **Coordination**: another significant issue is coordination between national and EU-level funding mechanisms. National initiatives operate independently of the SNS-JU, leading to difficulty in alignment of projects and programs. There is an annual SNS-JU work programme, funding new projects every year. But many national initiatives have budgets committed for multiple years, with very limited flexibility for starting new projects mid-term. Without a structured mechanism for synchronising funding calls and aligning project scopes, the potential for cross-collaboration is limited and the danger of overlaps, gaps and conflicting solutions, high.
- **Governance**: differences in governance and stakeholder engagement models across national programs complicate collaboration efforts. Some initiatives are led by government agencies with strong regulatory oversight, while others are primarily industry-driven. This results in varying levels of openness to international cooperation and different approaches to intellectual property (IP) management, data sharing, and open-source contributions. Establishing a framework that allows these diverse governance models to interact efficiently remains a challenge.
- **Decentralisation**: the absence of a centralised information-sharing platform further exacerbates these issues. While initiatives such as SNS-JU provide a European-level perspective, there is no standardised system for exchanging research findings, identifying common technological gaps, or coordinating testbeds and experimental facilities. Without a more integrated approach to information-sharing, opportunities for collaboration between countries and research institutions may be missed, slowing down overall progress.
- **Competition**: the global race for 6G leadership adds additional pressure on European initiatives to move swiftly and cohesively. Competitors such as the United States, China, and South Korea have established aggressive national strategies for 6G development, often with strong government-industry partnerships and well-defined roadmaps. If Europe fails to create a more harmonised and strategically coordinated effort, it risks lagging behind in setting global standards and shaping the future 6G ecosystem.

3. Alignment with Related EU Initiatives

In parallel to national programs, the EU has established several initiatives that contribute to 6G development, with a particular focus on addressing the strategic challenges of cloud infrastructure, open-source ecosystems, and the increasing dominance of hyperscalers in telecommunications. The most significant of these is the Smart Networks and Services Joint Undertaking (SNS-JU), which has a dedicated budget of €900 million under Horizon Europe. SNS-JU supports research and innovation projects that align with European priorities for 6G, focusing on technological leadership, sustainability, and integration with existing infrastructure. The initiative also facilitates cooperation between national programmes, providing a platform for information exchange and coordinated research efforts.

3.1 Relevant initiatives

- **Chips** JU: the Chips Joint Undertaking (Chips JU) is another critical EU initiative, focused on semiconductor research and the development of microelectronics essential for 6G networks. Given the increasing reliance of telecom networks on specialized hardware, this initiative aims to ensure that advancements in microelectronics—such as energy-efficient chipsets and hardware accelerators for AI-driven networking—align with the broader 6G research agenda. This is particularly important as European telecom providers seek to reduce dependency on non-EU technology suppliers.
- **Photonics Europe**: plays a key role in advancing optical communication technologies, which will be fundamental for high-speed, low-latency 6G networking. The initiative supports research into integrated photonics, aiming to enhance data transmission efficiency and reduce energy consumption across the network infrastructure.
- **ADRA**: in terms of automation, a key potential synergy is the he AI, Data, and Robotics Partnership is focused on the role of AI-driven automation in future telecom networks. AI will be central to optimizing 6G networks, enabling self-organizing capabilities, predictive maintenance, and automated resource allocation. However, ensuring that AI solutions are developed within European frameworks, rather than relying on external providers, remains a key challenge.

3.2 Telco-Cloud integration

A particularly critical area for Europe's 6G strategy is cloud and edge computing. The deployment of 6G will require a robust, decentralised, and sovereign cloud-native telecommunications infrastructure, yet much of the global cloud ecosystem is currently dominated by non-European hyperscalers. This raises concerns about digital sovereignty, security, and control over core network functions. Several EU initiatives are attempting to counter this dependency and build a more competitive European telecom cloud ecosystem.

In this context, the Important Projects of Common European Interest on Cloud Infrastructure and Services (**IPCEI-CIS**) seeks to establish a European cloud ecosystem that is secure, scalable, and interoperable. The goal is to provide telecom operators with European-built alternatives to the cloud services offered by major global hyperscalers, reducing dependence on external providers for critical network infrastructure. Similarly, the **European Alliance for Industrial Data, Edge, and Cloud** promotes the development of decentralized cloud architectures, ensuring that network intelligence and computing resources are distributed closer to the end-user, improving efficiency and security.

However, one of the main gaps in current EU efforts is the lack of coordination between these various cloud initiatives and the telecom sector. The growing adoption of cloud-native technologies in telecommunications, particularly Network Functions Virtualisation (NFV) and Cloud-Native Network Functions (CNF), means that the success of Europe's 6G strategy is increasingly dependent on its ability to build an independent cloud ecosystem. Today, many EU-funded projects are developing cloud-based telecom solutions, but without a unified approach, these efforts risk fragmentation. There is a need for stronger alignment between SNS-JU and initiatives like Gaia-X, IPCEI-CIS, and other telecom open-source initiatives such as CNTi (Cloud Native Telco Initiative), Sylva, and Anuket to ensure that European operators can deploy cloud-native 6G networks without relying on external platforms.

Open-source collaboration is another critical component in countering the influence of hyperscalers in 6G infrastructure. Many of the largest cloud-native technologies used today—including Kubernetes, service meshes, and observability stacks—are driven by open-source communities, often led by US-based hyperscalers. While telecom-specific open-source initiatives such as O-RAN (Open Radio Access Network), Sylva, and Anuket are gaining traction, their impact remains limited without a concerted European-wide strategy. The absence of a unified, well-funded European open-source effort means that telecom operators continue to adopt solutions that, while open-source in principle, are still largely controlled by the same dominant cloud players. A stronger push toward a European-led open-source telecom ecosystem is essential to ensure long-term control over network innovation.

4. Conclusions and Policy Recommendations

Despite these efforts, achieving full alignment remains a challenge. Many national initiatives operate independently, and differences in funding mechanisms and strategic priorities can hinder coordination. Additionally, while EU programs provide overarching research direction, they often lack mechanisms to integrate national research outputs effectively. Cloud and open-source strategies remain fragmented, and without a clear path toward convergence, European telecom operators risk being locked into non-European platforms for their 6G deployment. Addressing these gaps requires targeted policy interventions to streamline collaboration, optimise funding distribution, and establish clear frameworks for joint research efforts. A more structured approach is needed to coordinate national and EU-level funding for telecom cloud R&D, integrate open-source projects into mainstream European initiatives, and create a unified European strategy to compete with global hyperscalers in the 6G era.

Building a strong European 6G ecosystem requires a coordinated, well-funded, and strategically aligned approach that bridges national and EU-level initiatives. Through a European 6G Coordination Hub, aligned funding mechanisms, strengthened open-source collaboration, expanded testbeds, and a focus on security and sustainability, Europe can position itself as a global leader in next-generation telecommunications. Without decisive action in these areas, European operators risk becoming overly reliant on external technology providers, undermining long-term digital sovereignty. By taking a proactive and collaborative approach, Europe can ensure that its 6G networks are secure, competitive, and optimised for the future. In this context, some key recommendations to further boost activities include:

- Establish a European 6G Coordination Hub led by the European-level SNS-JU to facilitate structured information exchange and strategic alignment between national initiatives and EU programs. This would serve as a central mechanism to share research outcomes, reduce redundancies, and coordinate funding allocations more effectively.
- Align funding mechanisms by ensuring that national research investments complement EU-level initiatives. This could be achieved through co-funded projects and joint calls for research proposals, allowing for a more efficient use of financial resources across Europe.
- Strengthen collaboration on open-source development and standardization to ensure European leadership in defining global 6G specifications. A concerted effort is needed to integrate European stakeholders into international standardization processes, particularly in 3GPP and ITU-R[2].
- Expand industry-academia partnerships and testbeds to accelerate 6G innovation and commercialization. Coordinated investments in shared test environments will allow researchers and companies to validate new technologies under real-world conditions.
- Prioritise security and sustainability in the design of European 6G networks. This includes adopting energy-efficient architectures, integrating AI-driven security measures, and ensuring regulatory frameworks support resilient and trusted infrastructure.

2 Note for some standardization organizations like 3GPP the support for enhanced European participation should be focused on large industry players to ensure such funding actually has an impact.

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