

SRG REPORT

OVERVIEW OF LARGE NATIONAL 6G INITIATIVES IN EU MEMBER STATES
STATE REPRESENTATIVE GROUP EDITION 2024/2025



Foreword

The development of next-generation smart networks and services is a strategic priority for Europe. As 6G research accelerates globally, the ability of European stakeholders to cooperate, align national strategies, and jointly shape technological and societal ambitions has become more important than ever. The States Representatives Group (SRG) plays a central role in this effort. By providing coordinated strategic guidance, the SRG ensures that national visions, priorities, and capabilities are reflected in the broader European agenda, supporting both technological excellence and long-term societal goals.

This report provides an overview of major national 6G initiatives across several EU Member States. It highlights progress in research and innovation, funding approaches, organisational models, and emerging perspectives on cooperation. It also identifies opportunities for deeper alignment with the European Smart Networks and Services Joint Undertaking (SNS JU), ensuring that national efforts complement and reinforce Europe's common strategic direction.

The work presented here is the result of close collaboration between the SRG, national programme representatives, and the SNS-ICE project partners, who have provided essential input and analysis. Their contributions have made it possible to establish a consolidated overview of Europe's large-scale 6G national programmes.

The SRG remains committed to fostering cooperation among Member States, strengthening Europe's technological leadership, and ensuring that sustainability, inclusion, and societal value remain at the core of Europe's future digital infrastructure. The report aims to serve both as a reference and a catalyst—supporting informed decision-making and enabling continued joint progress toward resilient, secure, energy-efficient and globally competitive 6G networks and services.

SRG Chair, Sarmīte Mickeviča (Latvia):

"This report demonstrates the growing strength of cooperation among Member States and the commitment to a shared European vision for next-generation networks. Our national initiatives show not only substantial investments in 6G research but also a strong willingness to work together, exchange knowledge, and align strategies. Sustainability is becoming an integral part of this journey: our networks must be designed to be energy-efficient, resilient, and beneficial for society as a whole. The SRG will continue to promote dialogue, coordination, and joint actions, ensuring that Europe advances toward 6G with both technological ambition and responsibility."

SRG Vice-Chair, Hakima Chaouchi (France):

"Strengthening Europe's influence on 6G relies on a shared commitment to aligning national and European priorities, thereby maximizing our impact on international standardisation. Through this partnership, we can effectively integrate European values, societal expectations, and strategic interests into global standards. Ultimately, translating these joint research and innovation efforts into market leadership is essential for maintaining an active, influential presence in global standard-setting."

The special SRG session on Synergies on Standardisation (2024)

The Face to Face SRG meeting at the EUCNC 2024 in Antwerp, run a closed workshop on 6G standardisation challenges and the need for gathering policy makers from EU, JU SNS, National initiatives, and industrials active in 3GPP standardisation. The session was attended by the members of the State Representative Group and invited subject matter experts. The topic of the day was **Standardisation**, and this was addressed through several presentations and a panel session comprising industrial experts.

The session covered the SNS JU roadmap of R&D and standardisation. It also reminded the EU DG Connect view of the EU standardisation landscape, shares EU success stories, and summarizes the resources available for the R&I industry. The session also invited ETSI to present the benefits of standardisation for Europe, the 3GPP path to 6G was also presented and explains the process and the best practices to effectively contribute to 3GPP. Active EU industrials also presented the standardisation strategies of different areas, such as the US, Europe, China, etc., and sheds light on the deviation of O-RAN standardisation from 3GPP, concrete best practices from the industrial participants in different 3GPP groups were presented during the SRG to show the industrial strategies and the challenges that policy makers from the EU, JU and national initiatives could assess and consider in their agenda.

The session focused on the challenges related to Standard Essential Patents (SEP) and patent families, and sheds light on the possible impacts of the EU SEP regulation. While the EU industrial association 6G-IA presented an update on the 3GPP SA1 Use Cases workshop held in Rotterdam in May 2024 and presented the European view that was shared during the 3GPP workshop. It is important to mention the importance of this collaborative action which was triggered in the previous SRG 2023 in Gothenburg as a concrete action of synergies between JU SNS 6G-IA members and its WG on pre-standardisation and the JU SNS Flagship Hexa XII and the national initiatives. In fact, a co-creation session prepared at the Techritory 2023 at Riga, by the CSA SNS-ICE on ideas and plans to enforce synergies between national initiatives and JU SNS, has selected 3 potential actions for collaboration and one of them was the Joint proposal from EU to the 1st SA1 3GPP workshop in Rotterdam seeking 6G Use cases from different regions of the World. This contribution in May 2024 is the most concrete synergy action achieved on vertical use cases presented to the 1st strategic 3GPP meeting¹; thanks to the SNS-ICE coordination actions between all the concerned parties: JU SNS Hexa XII flagship, 6G-AI WG on standardisation, national initiatives.

A special message was related to the effort of JU SNS with regards of the concepts KVI (Key Value Indicator) introduced in the program and in the JU SNS project, this concept was presented and discussed at this 3GPP important meeting to remind the values importance and not only performance (KPI) to be considered in the standardisation process which is a first time in the history of telco standardisation process.

This important synergy action was presented in the SRG face to face meeting at EUCNC in Antwerp, It has brought these important takeaways and invites to follow up on the synergies between the national initiatives and the JU SNS:

- Standardisation is a long-term commitment and not a one-shot success. The different regions and its players are very competitive, and to make an impact and reap returns, you must stay in the game for a long time.
- More people need to be trained to represent European interests in standards, such as, on-the job training, training students, etc. These contributors must come from industry, research, SMEs, etc.
- Collaborating and building a more cohesive ecosystem may benefit all players involved, such as, big industry players training SMEs.
- There are many tools and programmes available for support, such as the Stand-ICT.

¹ www.3gpp.org/technologies/stage1-imt2030-uc-ws

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- The 3GPP SA1 Use Cases workshop was a success, and we must consider replicating this activity whenever we see an opportunity to have impact.
 - Government representatives must align with national experts to create one voice in 6G for Europe and align on KVis.
 - The SNS programme must align with standardisation to push our efforts in the same direction from the programme perspective, to create impact.

Report of the SRG session on Sustainability

A dedicated sustainability session of the States Representatives Group (SRG) was held on 3 June 2025 during the EuCNC conference in Poznań, Poland. Coordinated by the SRG, the workshop brought together Member State representatives, national 6G initiative experts, SNS JU project coordinators, as well as representatives from the European Commission and the Joint Research Centre (JRC). This high-level gathering provided a timely forum for structured exchange on the role of sustainability in the evolution of future network technologies and helped clarify expectations for European policy, research, and investment in the 6G era.

1. Context and Objectives

Sustainability is a central pillar of the Smart Networks and Services Joint Undertaking (SNS JU), which aims to reinforce Europe's technological leadership while supporting the EU's digital and green transitions. A key objective is to develop and deploy energy-efficient and resource-aware network technologies that can significantly reduce the environmental impact of digital infrastructure by 2030. This ambition is captured in two complementary concepts: **"Sustainable 6G,"** focusing on minimising the environmental footprint of networks, and **"6G for Sustainability,"** where advanced connectivity enables broader environmental and societal benefits across vertical sectors.

Sustainability in 6G spans environmental, economic, and societal dimensions—including circularity, resilience, ethics, and long-term public value. The SRG session therefore aimed to frame the European debate on sustainable 6G, review progress from the Sustainability Task Force and key SNS JU projects, identify policy priorities for Member States, and reinforce sustainability as a strategic European differentiator in the global 6G landscape.

2. Contributions and Presentations

2.1 Vision and Programme Orientation

The session opened with an overview of the SNS JU's long-term vision for sustainable 6G, highlighting the ambition to embed energy efficiency, reduced environmental impact, trustworthiness, digital rights, safety, and societal inclusion into the core design of future connectivity systems. Sustainability was presented not as an add-on to 6G research, but as a defining strategic objective shaping architectures, technologies, and deployment models.

2.2 Sustainability Task Force and Working Group

An update was provided on the work of the SNS Technology Board Sustainability Task Force, including its objectives, key deliverables, and methodological foundations. The Task Force is transitioning into a permanent SNS Sustainability Working Group, aimed at improving cross-project coordination and strengthening Europe's engagement in global standardisation bodies such as 3GPP, ETSI, and ITU.

2.3 Key Findings and Recommendations

Consolidated insights from project questionnaires, interviews and analyses were presented. Key messages included:

- sustainability approaches across projects are evolving but require greater harmonisation,
- while energy efficiency is widely addressed, other aspects—circularity, lifecycle environmental impact, supply-chain transparency, maintainability, and end-of-life considerations—are less consistently integrated,
- trade-offs between performance, energy use, and societal impact remain a challenge,
- Key Value Indicators (KVIs) show strong potential but require shared frameworks and common baselines across the programme.

Recommendations emphasised the need for policy incentives to embed sustainability systematically into future SNS JU work programmes, and for national authorities to support interdisciplinary expertise as well as strengthened standardisation efforts.

2.4 Project Insights

Three major SNS JU projects showcased their contributions to sustainability:

- **Hexa-X-II** introduced a three-dimensional definition of sustainability (environmental, social, economic) and distinguished between “Sustainable 6G” and “6G for Sustainability.” It presented an expanded value-based framework linking KPIs to broader human and planetary Key Values and KVIIs.
- **SUSTAIN-6G** presented a holistic assessment methodology focused on sustainability “by design,” exploring how 6G technology enablers intersect with vertical use cases such as agriculture, e-health, and smart grids. The project also highlighted pathways for contributions to international standards.
- **6G4Society** focused on societal sustainability, including public acceptance, ethical aspects, inclusive design, and insights from citizen engagement activities. It stressed the importance of coherent frameworks for assessing social and economic impact in future 6G systems.

Collectively, these inputs demonstrated substantial progress but also highlighted the need for more coherent, comparable methodologies across the programme.

2.5 Session Conclusions

The session concluded by noting that a significant number of SNS JU projects already address energy efficiency and sustainability. Participants underlined the strategic role of the SRG in reinforcing sustainability in future work programmes. It was suggested that establishing an SRG Working Group on Sustainability could strengthen Europe’s strategic positioning and support more coordinated policy and standardisation efforts.

3. Key Issues for Policy Makers

The workshop highlighted several strategic questions for Member States, including how to embed all dimensions of sustainability—environmental, societal, and economic—systematically into future SNS JU calls and evaluations. Participants noted the need for clearer methodological expectations, including agreed sustainability requirements, use cases, and KVIIs to guide 6G research. Member States were invited to reflect on existing national measures that support sustainable network design, the inclusion of interdisciplinary expertise (e.g., ethics, lifecycle analysis, regulation), and incentives for testbeds to assess sustainability KPIs and KVIIs in real environments. The discussion also underlined the need for stronger support mechanisms for standardisation efforts and guidance on managing trade-offs between energy efficiency, performance, accessibility, and security. Overall, these questions point to the importance of enhanced coordination across Member States to ensure a coherent European approach to sustainable 6G.

4. Overall Conclusions

The session confirmed that sustainability is becoming a core pillar of Europe’s 6G vision, with broad agreement that it must be embedded *by design* and supported through interdisciplinary expertise, real-world validation, and strong engagement in standardisation. Achieving this will require closer cooperation across national initiatives, shared European sustainability frameworks and KVIIs, clearer requirements in future SNS JU calls, better coordination on standardisation, and potentially an SRG Working Group on Sustainability. Overall, the session marked a significant step in aligning Member States and reinforcing Europe’s ambition to develop sustainable, trustworthy, and human-centric 6G networks, positioning sustainability as a strategic European differentiator globally.

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Abbreviations List

Abbreviation / Term	Description
3GPP	3 rd Generation Partnership Project
5G-PPP	5G Public Private Partnership
5GA	5G Advanced
6G-IA	6G Smart Networks and Services Industry Association
AI	Artificial Intelligence
B5G	Beyond 5G
CEF	Connecting Europe Facility
CFP	Call For Proposals
CSA	Coordination and Support Action
EM	Electro Magnetic
ERDF	European Regional Development Funds
EU	European Union
FNS	Future Network Services
ICE	International and European Cooperation Ecosystem
ICT	Information and Communication Technology
KPI	Key Performance Indicator
NTN	Non-Terrestrial Networks
R&D	Research and Development
R&D&I	Research and Development and Innovation
R&I	Research and Innovation
RCoF	Research Council of Finland
RESTART	RESearch and innovation on future Telecommunications systems and networks, to make Italy more smART
SDG	Sustainable Development Goals
SME	Small and Medium Enterprise
SNS	Smart Networks and Services
SNS JU	Smart Networks and Services Joint Undertaking
STEM	Science, Technology, Engineering and Mathematics
TRL	Technology Readiness Level
UN	United Nations

Introduction

While the Horizon Europe Smart Network and Services (SNS) programme issued its first call in January 2022, with 900 MEuro of European funding over the period 2021-2027 and at least the same contribution from industry, in several countries in Europe large national initiatives have also started with a combined funding budget of almost 2.5 Billion Euro. From the perspective of the SNS Programme, which has the goal to facilitate and develop industrial leadership in Europe in 5G and 6G networks and services, it makes sense to investigate how these national initiatives can make European 5G/6G research even stronger. The objective of this report is therefore two-fold; 1) presenting the large (i.e., >100 MEuro) national initiatives in the EU Member States and 2) thus enabling the identification of synergies with the SNS programme.

Within SNS, the SNS ICE project is a CSA that amongst others has the goal to establish dialogues with national initiatives targeting the exchange of information, plans, and priorities. This is to enable a better understanding of activities among the involved stakeholders and to potentially enable a better alignment of plans. As a first step to establish such dialogues, the SNS ICE project has established contacts with the different national initiatives. As a second step information is collected about these national initiatives based on publicly available information (e.g., based on presentations and websites). In a third step, interviews were held, using a common interview template with representatives of each of the national initiatives. This report is representation of the information that was collected from public sources and from the interviews.

In most EU Member States there are publicly funded 5G/6G R&D or trial activities. These may be EU funded through e.g., the Horizon Europe programme, Connecting Europe Facility (CEF) or European Regional Development Funds (ERDF). In this document however we have focused on initiatives that are funded by Member States national governments². In several European countries, we see large national initiatives with budgets of hundreds of MEuros: Finland, France, Germany, Italy, Spain, Sweden, and the Netherlands. We focus on these initiatives because the size of these large national initiatives becomes comparable with the budget of SNS. Note furthermore that in this overview we have concentrated on 5G/6G research and innovation funding that has a similar scope as the SNS programme. We have not included national funding for the roll out of 5G (e.g., Spain has funding calls for 5G deployments in rural areas and corridors), which would be more like the European CEF.

The budgets for these large national initiatives are made available by national governments, either through a ministry related to economy and/or telecommunications or a ministry related to education and research. Note that in Finland there are two initiatives, one funded from each type of ministry.

We see different ways how these large national initiatives are organized. In some cases, the national government directly issues calls for proposals. This implies a very direct control of funding by the government (e.g. in France and Spain). In other cases, a separate organisation is founded, which organises the national initiative as a program and distributes the funding (e.g. in The Netherlands and Italy). There is also a difference on the flexibility of budget allocation. In e.g. Germany, budgets are largely pre-allocated for the full duration of the program, whereas in France there are regular calls where priority can be given to specific topics per call. In Finland, with the Finnish Flagship, funding was allocated to the university of Oulu, who then decides on how the money is spent in a thematic approach. Another difference is that in some national initiatives, funding for individual projects is provided to a consortium of academia/industry, while in other national initiatives funding for individual projects is provided to a single university or research institute. We have tried in the interviews to see what can be considered as a comparable as a project in the SNS context, but there are quite some differences between the different national initiatives.

² Note that there are also 5G/6G research activities that are funded by local/regional governments (e.g. regional governments, metropolitan areas, or municipalities). Some of these can be found in the Member States Initiatives report (<https://5g-ppp.eu/report-in-5g-6g-member-states-initiatives/>). None of these qualify as large initiatives.

These distinctions are relevant when trying to organise collaboration between the national initiatives and between the national initiatives and the SNS Programme. E.g., when a national initiative uses an approach similar to SNS with yearly calls, collaboration can be considered in the next call for projects. When the funding is assigned to a foundation or university for the duration of the program, there is less flexibility at least on the side of the national initiative to adjust distribution of funding. Similarly, organising collaboration between projects works best if there is a similar concept of what is a project.

In the interviews we have asked the national initiatives how they see collaboration with other national initiatives. Some national initiatives have already some measures in place or have taken collaboration into account in their organisation. Other national initiatives have a less clear vision on what they want to do to collaborate with other national initiatives.

To facilitate synergies between related activities in the large initiatives and the SNS Programme, we propose to use a categorization of activities inspired by the SNS work programme. This categorization consists of the following topics:

- 5G evolution R&I;
- System network architecture and Control;
- Edge and Ubiquitous computing
- Radio technology and Signal processing;
- Optical networks;
- Network and Service security;
- Non-terrestrial networks;
- Special purpose networks/sub-networks;
- Opportunities for devices and components;
- Micro-electronics;
- Experimental infrastructures;
- Trials and pilots with verticals;
- Human capital; and
- Policy aspects.

Good to note that Human Capital is not included in the SNS programmes, however, it is a part of several of the National initiatives. It relates to strengthening the academia to attract more students and researchers, and/or promotion of spin-off activities and start-up companies. We have asked each of the national initiatives to rate to what extent the topics above are covered in their national initiative. We are using a star rating, where 3-stars means 'main focus area', 2-stars is 'relevant area', 1-star means 'also addressed' and zero stars means 'not addressed'.

The remainder of this document describes for each of the 8 countries how the projects are organized what the approximate budget is, and what kind of topics are addressed. For each of the national initiatives, there is also a section on the view from that national initiative on collaboration within Europe. In section 6, we have added a short overall perspective on collaboration, with an overview of all the topics addressed in the different national initiatives and goals and possible actions for collaboration that were collected in earlier discussions on collaboration between national initiatives.

Note that each of the sections on the national initiatives have been reviewed by the respective national initiative. This implies that the text reflects how the national initiatives want to portray themselves.

1 The Netherlands

1.1 Introduction

The Netherlands aims to work on 6G through a national programme called Future Network Services (TNO, 2023). The Future Network Services (FNS) programme is funded through the National Growth Fund, a fund of € 20 billion for the period 2021-2025 for investments in fields which have the highest potential for structural and durable economic growth. The Dutch government will invest up to 203 M€ in the Future Network Services programme. The programme aims to build a leading position in certain parts of 6G technology, which will strengthen the future earning power of the Dutch economy. Also the core values, ‘digital autonomy’, ‘reliability’, and ‘sustainability’ are important drivers behind the Future Network Services programme.

The proposal for a multi-year public-private Future Network Services (FNS) programme focusses on specific and connected topics in 6G: intelligent radio components and antennas, intelligent networks, and leading applications in key sectors. The details on how the work is organised within this programme can be found in the next section. The table below summarizes some key information for this programme.

KEY INFORMATION	
Responsible Ministry	Ministry of Economic Affairs and Climate Policy
Total Budget	315 M€ (203 M€ Governmental funding)
Expected Start Date	Q1 2024
Expected End Date	Q3 2030

Table 1: Key information on the Dutch National Programme

1.2 Funding

The FNS programme will be shaped around two phases; phase 1 runs from Q1 2024 up to the end of Q2 2026 with a budget of 61 million euros. Funding is made available to the programme by the Ministry of Economic Affairs and Climate Policy. At the end of phase 1, the programme is expected to undergo an evaluation and will report on the KPIs agreed upon with the ministry. Although 142 M€ of funding is already earmarked for the second phase of the FNS, the programme still needs to make a proposal for phase 2 and demonstrate at the end of phase 1 that it can indeed deliver on its promise of economic growth. Phase 2 of the programme will run from Q3 2026 till Q3 2030.

A certain amount of matched funding is expected from the partners within the programme, in line with EU state aid rules. Universities and research centres bring in almost no funding of their own (or a very small percentage) whereas industry is expected to match funding with on average with 50-75% private investment. SMEs enjoy special benefits and receive up to 70% public funding and are expected to bring in the rest of the investment themselves.

Within the second phase of the programme, the intention is to set part of the budget aside for different open calls. Funding needs to be matched by the partners selected. The scope of the open calls will be defined in line with the planned FNS activities. Furthermore, budget is reserved to support academic startups and SMEs, and for development of human capital.

1.3 Organisation of work

In FNS, three technical programme lines are linked by a fourth programme line aimed at strengthening the ecosystem.

The four program lines carry the following focus:

- Intelligent Components:** This programme line is organised in four work packages, namely, Highly efficient transmitters, Joint communication and sensing technology, Over-the-air testing, and Optical wireless communication. This programme line is mainly driven by the microelectronics industry in the Netherlands.
- Intelligent Networks:** This programme line is organised in three work packages. The first work package focuses on requirements, architecture and integration, WP2 focuses on 6G DevOps platform and digital twin, and lastly, WP3 will work on AI-assisted networking.
- Leading Applications:** This programme line will focus on developing application demonstrators in various market sectors, such as, transport hubs, collaborative surgery, smart grid, wireless detection, 6G factory, e-commerce, and XR gaming. These are also the verticals or key industry sectors that the programme focuses on.
- Strengthening the Ecosystem:** This programme line will strengthen the overall 6G ecosystem through various activities, such as, setting up a national 6G testbed, technology-policy co-development, supporting start-ups and SMEs, standardisation and international collaboration, etc.

The four program lines have been summarized in the image below:

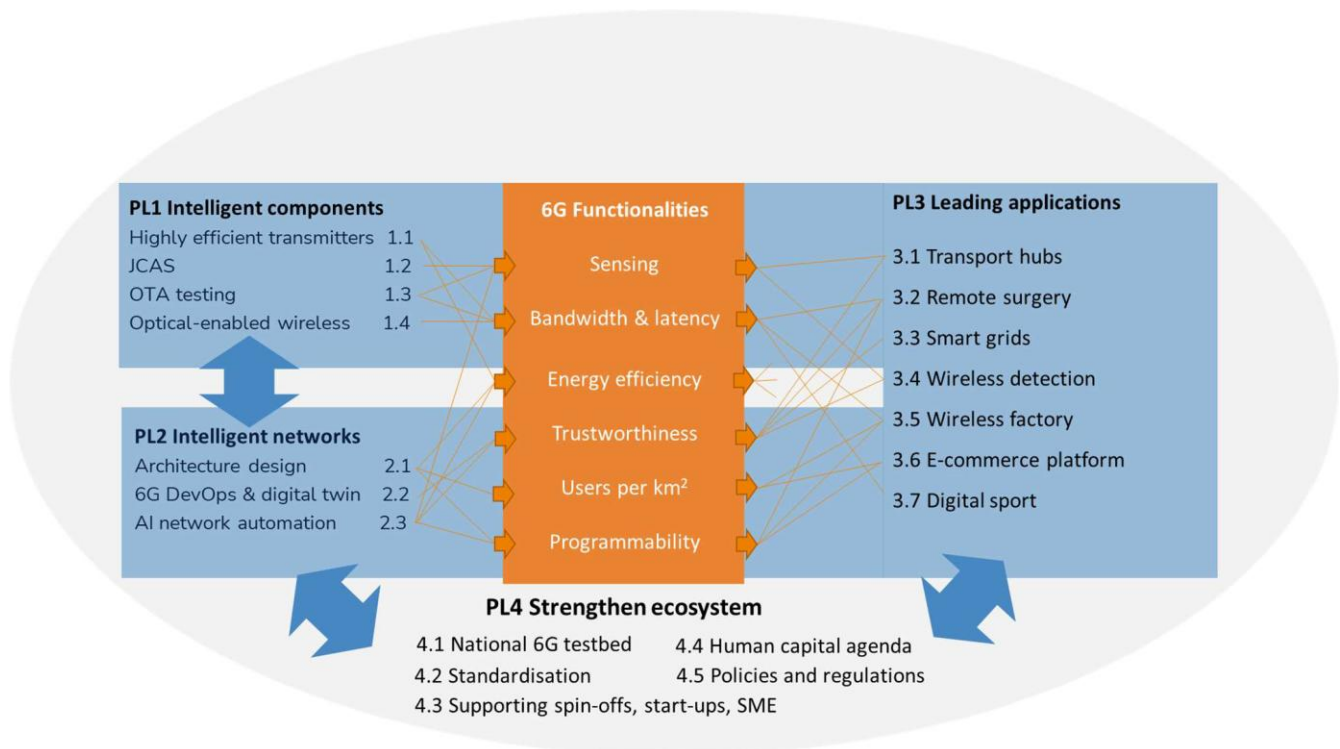


Figure 1: Overview of Program Lines

The overall management of the programme is done by a Programme Board under supervision of the Supervisory Board, which will decide on strategic matters and will provide advice and guidance. In addition to the Supervisory Board, there is also an Advisory Board that has been set up for broader consultation and project steering. The

programme lines report directly to the Programme Board on progress, which in turn interfaces with the Advisory Board and the Supervisory Board.

The scope of the programme is more or less fixed, with an opportunity to add new topics or partners only through the open calls in phase 2.

FNS aims to contribute to standardisation through a dedicated work package within programme line 4 on Standardisation and International collaboration. In addition, it also aims to contribute to several existing open-source initiatives.

The overall project aims to achieve work within the TRL range of 2 – 6.

1.4 Topics covered

Using the categorization described in the introduction, we see the Future Network Services programme covering the following main topics.

Topic	Relative importance
5G evolution R&I	-
System network architecture and Control	***
Edge and Ubiquitous computing	**
Radio technology and Signal processing	***
Optical networks	-
Network and Service security	*
Non-terrestrial networks	*
Special purpose networks/sub-networks	*
Opportunities for devices and components	** (only on the network side)
Micro-electronics	***
Experimental infrastructure	***
Trials and pilots with verticals	***
Human capital	**
Policy aspects	**

Table 2: Topics covered in the Dutch national initiative

In addition to the above topics, FNS also works on several societal and policy aspects such as sustainability, earning power, digital autonomy (same as sovereignty) and trustworthiness. FNS will explore policy aspects such as spectrum, competition in network sharing, urban planning for 6G, etc.

Human Capital is also one of the focus areas within the programme. This is realized through an investment of several million euros into developing learning communities. This will be facilitated through a dedicated open call, which will allow companies to develop courses and trainings for this purpose. The programme also envisions to provide work for about 75 PhD candidates, which ultimately adds to the talent pool in the Netherlands in the future. The programme is also working with a specific organisation to develop talent for all areas of technology and at all levels of education (vocational studies as well as university).

1.5 Perspective on Collaboration

The Future Network Services initiative has a dedicated work package for Standardisation and International collaboration within the Programme line 4. This work package aims to facilitate at a program-level contacts with other national initiatives within and outside the EU in order to allow information sharing. The package also aims to organize and attend workshops to align goals and organize collaboration. FNS also plans use other projects such as the SNS-ICE to establish the right contacts and boost collaboration.

The FNS programme understands the value of collaboration and sees that as the only way to truly achieve a global 6G. In order for industry within a country to access the global 6G market, it must be aligned internationally, and work towards a shared vision on 6G. For Dutch industry it makes sense to start alignment with other European players.

2 Spain

2.1 Introduction

The Spanish national initiative on 6G, called UNICO 6G R&D, is a part of the Digital Spain 2026 initiative started by the Ministry for Economic Affairs and Digital Transformation as a part of the country’s digital transformation roadmap. Within this roadmap, several plans have been launched at national, regional and local level. Initially the ‘España Digital 2025’ initiative was launched in July 2020, but in July 2022 it was updated to ‘España Digital 2026’. For Research and Innovation (R&I), additional bottom-up funding in all digital areas is made available by the Ministry for Science and Innovation in the context of the Spanish ‘Strategy for Science, Technology and Innovation 2021-27’. In both cases, the initiatives launched are synchronized with EU strategies / programs. (Ministry of Economic Affairs and Digital Transformation, 2023)

The first phase of public investments in digitalization of “España Digital 2026” is about 20.000 million €. Additionally, 11 strategic projects “PERTE” have been launched, with a public investment of more than 30.000 million €. These comprehensively cover the most relevant digital areas from different perspectives: R&I, technology uptake, deployment, skills, regulation and other investments. However, this report only focusses on the national developments with regards to research and innovation in 6G as well as certain expansions of the 5G technology, and thus will only focus on the UNICO 6G R&D programme.

KEY INFORMATION	
Responsible Ministry	Ministry for Economic Affairs and Digital Transformation
Total Budget	205 M€
Start Date	2021
Expected End Date	2026

Table 3: Key information on the Spanish national initiative

2.2 Funding

A total funding of 206 M€ is allocated to the UNICO 6G R&D programme and is distributed to the partners through the means of three open calls, one in 2021, 2022, and 2023 each. Within the 2021 call, a total amount 94.5 M€ was directed to selected entities. The call directly funded 9 public universities and 3 public research centres, all of which had participated in the 5G PPP programme. These entities had to subcontract to other companies a minimum of 70% of the funding received, out of which a minimum of 60% had to go to private companies, and a minimum of 15% had to go to SMEs.

Within the 2022 call, 13 M€ was awarded to private companies for R&D projects and 36 M€ to academia and research centres for equipment and infrastructure. The last call within the programme is in 2023 and carries a total budget of 62 M€. In the 2022 and 2023 calls there are specific areas/themes for R&D projects. Partners that receive the money are allowed to subcontract 50% of their funding, but they have no obligation to do so.

Public universities and research centers receive 100% funding, and thus do not need to provide any matched funding. Private companies have to match the funding received based on European regulations and contribute on average about 36% of funding. SMEs receive more funding than big private players and thus have to put up less of their own money.

Overall, within all the calls there are two subprograms, one for public academia and research centres meant only to fund equipment and infrastructure, and one for R&D projects by private entities. Proposals are accepted from individual applicants (i.e. only one company), but a subcontracting is also allowed for up to 50% of the project.

The funding received for the UNICO 6G R&D is from Recovery and Resilience plan fund (component 15, investment 6) from EU, and within Spain this is handled by the Ministry of Economic affairs and Digital Transformation.

2.3 Organisation of work

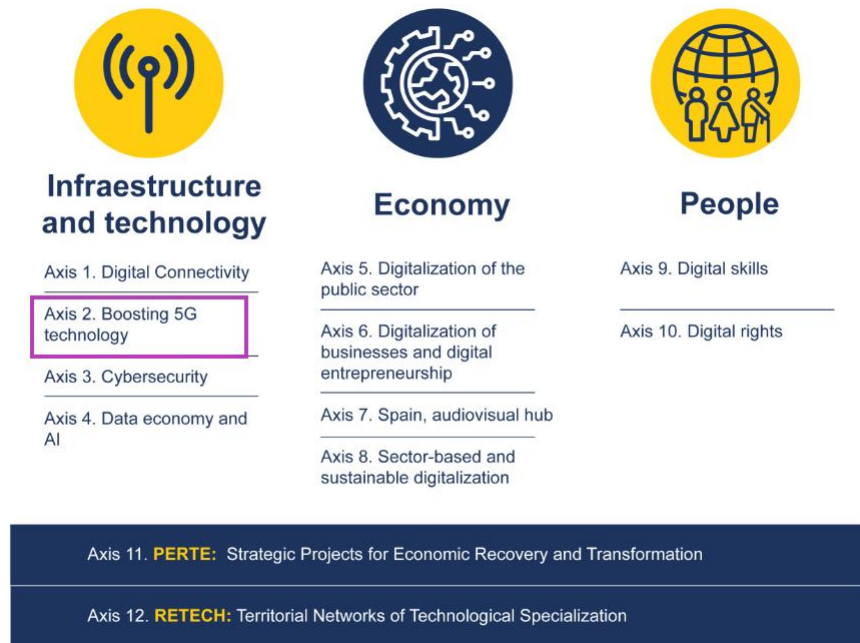


Figure 2: Organisation of work within Digital Spain 2026

There are 10 axes planned to promote high-impact strategic projects through public-private collaboration and joint governance of the Nation and Autonomous Regions (Figure 2). These focus on a broad range of activities that are not all within our scope. But within Axis 2 on ‘Boosting 5G Technology’, there are several measures that are focussed on 5G (figure 3), including R&D on 5G and 6G. This program carries the following goals:

- Achieve digital sovereignty for Europe
- Support at least 200 R&D&I projects to develop the ecosystem of 5G and 6G technologies
- Position Spain as a center of excellence in 5G and 6G R&D

The UNICO R&D 5G Advanced and 6G Program funds public research foundations, Spanish public universities and private organisations for the development of research and innovation projects. It plans to support the creation of a ‘5G+6G R&D&I ecosystem’ that attracts investment, fostering the emergence of start-ups and innovative research companies that will develop products and services in 5G advanced and 6G. This is planned such that it is closely linked to the creation of stable and high-quality employment throughout the country. This program plans to bring about a significant improvement in energy efficiency and decarbonization in the long term, as well as fostering public-private collaboration to favour the creation of a research ecosystem and attract foreign talent. The goal of this initiative is to enable European players to develop R&D&I capabilities for 6G technologies as the basis for future digital services between now and 2030.

The UNICO R&D 5G Advanced and 6G Program is organized into three calls:

1. **2021 Call** – This call led to projects being awarded to 12 entities in Nov 2021 for a total amount of 94.5 M€. The duration of the projects will be 3 years with expected TRL levels of 2-4.
2. **2022 Call** – Through this call a total budget of 49 M€ was awarded to 48 projects. The duration of the projects will be up to 3 years with expected TRL levels of 3-6 .
3. **2023 Call** – This call was published in December 2022 and carries an indicative budget of 62 M€. The duration of the projects will be up to 3 years with expected TRL levels of 3-6

The work priorities within the programme are set through the Digital Spain 2026 agenda and the Implementation of the programme is overseen by the Secretariat of State for Telecommunications under the Ministry of Digital Transformation. Beneficiaries that have received the money have to submit a yearly report on milestones achieved, progress, updates, etc. to a dedicated unit that is following up on the progress of the project. There are no yearly evaluations done on whether projects are on the right track (e.g., to provide steering), but financial reporting is expected. Project evaluation is only done once, at the end of the project.

No there is no flexibility within the programme to add new topics or broaden the scope beyond the current call topics. The beneficiaries that have received the money have to get an approval from unit that is supervising when they outsource money to other partners, and this is done through a standard competitive procedure to ensure fair selection. Budget cannot be increased, and new partners cannot be added along the way (once a project has started). Project budgets are typically between 300K and 2M€ per project.

2.4 Topics covered

The UNICO R&D 5G Advanced and 6G Program covers the following topics with relative importance as specified:

Topic	Relative importance
5G evolution R&I	**
System network architecture and Control	**
Edge and Ubiquitous computing	**
Radio technology and Signal processing	**
Optical networks	**
Network and Service security	**
Non-terrestrial networks	**
Special purpose networks/sub-networks	-
Opportunities for devices and components	-
Micro-electronics	-(addressed in a different programme) PERTE Chip project (axis 11)
Experimental infrastructure	***
Trials and pilots with verticals	-(addressed in a different programme UNICO SECTORIAL 5G)
Human capital	*
Policy aspects	-

Table 4: Topics covered in the Spanish national initiative

The programme also focuses on the societal and policy aspect of Sovereignty. No specific funding is dedicated for this, and is covered within the overall scope of the projects. In addition, 3 M€ was set aside in the 2021 call for promoting telecommunications studies.

2.5 Perspective on Collaboration

The Spanish national initiative greatly values collaboration with the SNS. For this purpose, within the 2021 call there was an obligation imposed on the beneficiaries to contribute to the SNS JU work programme for at least 70% of the funds they’ve received from the national programme, after excluding the funding they’ve outsourced. Thus, they need to apply with a proposal to the SNS JU with a budget of at least 70% of the aid they’ve received through the national programme. No such condition was imposed in the 2022 and 2023 calls.

Currently, no collaboration has been initiated with other national initiatives within or outside the EU. The UNICO 6G R&D does not foresee any collaborations being initiated at the program level but rather encourages partners within the projects to forge their own collaborations as they see fit.

3 Italy

3.1 Introduction

The national initiative from Italy is called RESTART: ‘RESearch and innovation on future Telecommunications systems and networks, to make Italy more smART’. The programme is planned to run from Jan 2023 to Dec 2025, with a funding of 118 M€, and comprising of a total of 25 partners. (Fondazione Restart , 2023)

The RESTART partnership includes several research projects, to be jointly carried out by universities, research centres, companies and public administrations. The program includes the following activities: fundamental and applied research; technology transfer and exploitation of research results, including dissemination activities; support for the creation and development of start-ups and spin-offs from research, promoting the activities and services of incubation and venture capital funds; training led in synergy by universities and enterprises, with particular reference to SMEs, to reduce the mismatch between the skills required by enterprises and those offered by universities; PhDs program.

The focus of the project is the structural improvement of research and development in improving the ability to use telecommunications in a wide variety of sectors: agriculture, trade, energy, finance, industry, media, health, security, transportation, all while strengthening the link between scientific excellence and business.

KEY INFORMATION	
Responsible Ministry	Ministry of University and Research
Total Budget	118 M€ (116 M€ received from Ministry)
Start Date	Jan 2023
Expected End Date	Dec 2025

Table 5: Key information on the Italian National Initiative

3.2 Funding

The RESTART project is run by the RESTART foundation, which has been established as an independent legal entity with its own administration. While the total funding of the project is 118 M€, 116 M€ are provided by the Ministry of University and Research, while the remainder amount comes from the private sector. The scope of this funding includes fundamental research, applied research as well as pre-competitive research.

The RESTART project started with an initial funding of 0% from the Ministry, and in regular cycles of 6 months receives more money from the Ministry, after an evaluation and reporting of the last phase. The RESTART project prepares reports on the work accomplished over the last period which are then submitted to external evaluators for feedback. These external evaluators have been selected by the Ministry. The reports together with the feedback is then submitted to the Ministry for review. If all is in order, money is released for the next phase by the Ministry.

The RESTART foundation only manages the project. Project R&D activities are carried out by partners that contribute also in-kind, such as through personnel, equipment, labs, etc.. There is no mandated matched funding expected by the partners, but the average trend shows that partners bring in about 20% of the funding in-kind.

The current funding of the RESTART project (till Dec 2025) is limited to the funding received by the Ministry as well as the contribution of the partners. However, if the foundation wants to continue beyond 2025, it will seek out other funding instruments in order to continue its work.

3.3 Organisation of work

RESTART is organized in a Hub and Spokes structure, where the Hub is the foundation itself and it manages and coordinates the Spokes that carry out the activities to achieve the project goals. There are 8 spokes related to eight major scientific themes. The whole organisation will collaborate on the implementation of 32 research projects. The spokes can be seen in figure 4 below, and are as follows:

1. Spoke 1: Pervasive and Photonic network technologies and infrastructures
2. Spoke 2: Integration of networks and services
3. Spoke 3: Wireless networks and technologies
4. Spoke 4: Programmable networks for future services and media
5. Spoke 5: Industrial and digital transition networks
6. Spoke 6: Innovative architectures and extreme environments
7. Spoke 7: Green and smart environments
8. Spoke 8: Intelligent and Autonomous systems



Figure 3: Organisation of work in the RESTART programme

The 25 partners of the project are considered affiliates, and each affiliate is linked to one or more spokes. Funding is received by the hub, which transfers it to the spokes and to the affiliates. Similarly, reporting for the project starts with the affiliates, moves to the spokes and finally reaches the Hub.

The programme focusses on 7 missions, namely:

1. **Research:** The research mission comprises of 14 structural projects that define the research program and give a structure to the overall work, as well as 18 focused projects which are smaller endeavors. These smaller projects complete the structural projects towards more specific directions (industrial, theoretical).
2. **Laboratories, Proof of Concepts, Demonstrators:** The goal here is to enlarge existing laboratories and create new, shared, ones.

3. **Innovation and Technology transfer:** This mission carries the goal to increase the TRL of results generated so as to transfer research results into innovation exploited in new products and solutions.
4. **Support to start-ups and spin-offs:** This mission will operate in three main directions, namely, provide cultural and educational instruments, issue program specific calls for research oriented to start-up creation, and offer specific support for the development of proof-of-concepts from initial ideas.
5. **Education and training activities:** Within this mission, RESTART will pursue three main interrelated objectives
 - a. increase the number of students in STEM (Science, Technology, Engineering and Mathematics) and more specifically in telecommunications engineering and incentivize the access to PhD. programs
 - b. foster the development of entrepreneurs, transversal, and soft skills
 - c. strengthen the linkage between ICT universities and industry to support the up-skilling and re-skilling process of students and employees.
6. **PhD programs:** This mission includes extensive recruitment, broader research areas, nation-wide cross-fertilization and innovation and product-oriented research training.
7. **Communication, standardisation and open-source solutions:** RESTART will publish and contribute to peer-reviewed publications in top-referred scientific journals and conferences capitalizing the experience from research partners. Blog posts, position papers, white papers, citizen factsheets, podcasts, and other non-scientific publications will be also released.



Figure 4: Missions within the Italian initiative

The 14 structural projects are as indicated in the figure below:

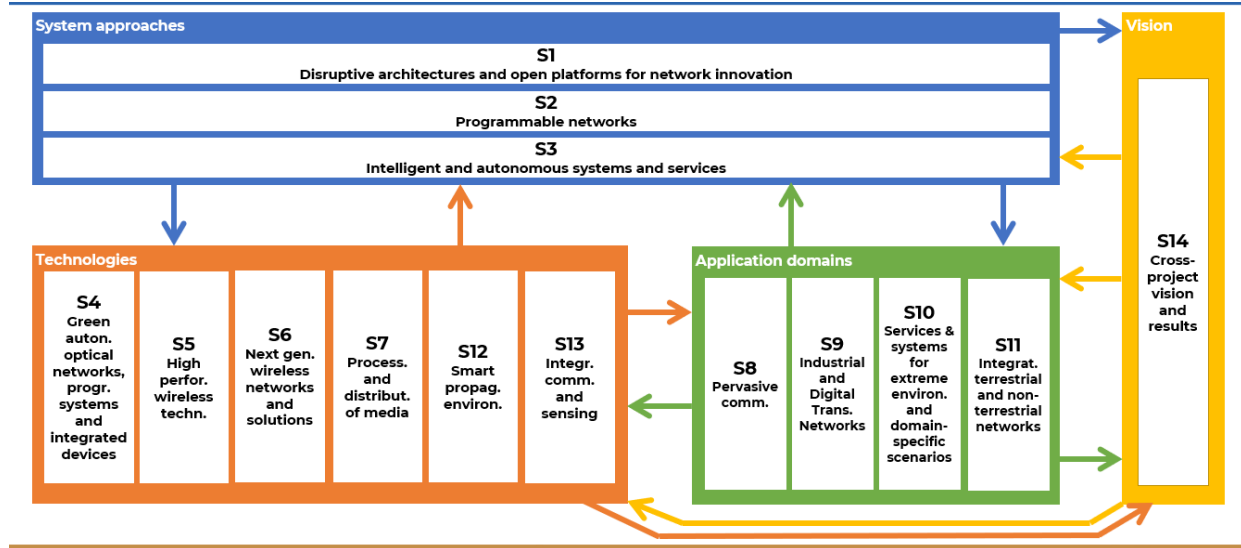


Figure 5: Structural projects within Italian initiative

In addition to the work structure described above, there are also open cascade calls. The topics for these cascade calls are decided by an international committee based on the input it receives from the various missions. The input provided by these missions should indicate the work topics which they feel still need to be addressed within their respective missions. This procedure allows for new topics to be introduced into the project, as well as new partners to join. Some of these open calls also specifically target SMEs and offer incentives for them to participate.

There is one call envisioned in 2023 and another one in 2024. The cascade calls offer a funding of 34 M€ from the overall budget. The entities which are awarded projects through one of these calls will become affiliates and will follow a similar reporting structure to the existing affiliates. In addition to the funding available for the cascade calls, there is also a contingency fund available within the project that allows for flexibility to include new topics in the future.

The overall project aims to achieve work within the TRL range of 2 – 6.

3.4 Topics covered

Using the categorization described in the introduction, we see the RESTART initiative covering the following main topics.

Topic	Relative importance
5G evolution R&I	***
System network architecture and Control	***
Edge and Ubiquitous computing	***
Radio technology and Signal processing	***
Optical networks	***
Network and Service security	* (also addressed in another national programme)
Non-terrestrial networks	***
Special purpose networks/sub-networks	***
Opportunities for devices and components	*
Micro-electronics	*

Experimental infrastructure	***
Trials and pilots with verticals	**
Human capital	*
Policy aspects	*

Table 6: Topics covered in the Italian national initiative

Aside from the topics addressed above, the project also focuses on sustainability (energy efficiency in particular) and sovereignty. These topics are included in the scope of many structural projects. Aside from this, the project also has a mission dedicated to human capital, which is funded directly.

3.5 Perspective on Collaboration

The RESTART project aims to establish collaborations with several other national/international initiatives and European programs in the future. These collaborations can be established both at a program and a project level.

4 France

4.1 Introduction

The French National Initiative is a part of the ‘France 2030’ recovery plan which has ecology, competitiveness and cohesion as its three main themes. While the plan aims to transform key economic sectors in the country including energy, automotive, aeronautics and space, the government says 5G and future telecommunications network technologies represent a key lever of competitiveness. Launched in 2021 by the French Ministry of Economy, Finances and Industrial and Digital Sovereignty, this initiative is coordinated at national level by the Directorate-General for Enterprise/Ministry of Economy and Finance, in collaboration with other competent ministries, government agencies and the national telecoms regulatory authority (ARCEP). (Gouvernement, 2023)

France 2030 has 10 objectives and 6 conditions for success which make up the plan. One of the conditions for success is to ‘Master sovereign and secure digital technologies’ and includes the following strategic priorities:

1. Capitalize on France’s scientific excellence in the field of quantum technology to fulfil France’s potential of becoming a leading technological and industrial player
2. Create a French and European technological alternative that makes France a sovereign economic power in the cloud
3. Develop expertise in the technological building blocks required for 5G and speed up the development of uses while meeting the requirements of 6G
4. Stimulate training, research and uses in artificial intelligence and its adoption by the whole of French society, in accordance with our values
5. Guarantee the security, environmental sustainability and availability of talent in all areas of digital technology (AI, cloud, telecoms, quantum computing, etc.)

KEY INFORMATION	
Responsible Ministry	Ministry of Economy, Finances & Industrial and Digital Sovereignty
Total Budget	735 M€ (Governmental funding)
Start Date	2021
Expected End Date	2030

Table 7: Key information on the French national initiative

4.2 Funding

The French national initiative started in 2021 and is funded with 735 M€ from the General Secretariat of the Prime Minister (SGPI), managed by Direction Générale des Entreprises (DGE) of the Ministry of Economy and the Ministry of Research. The whole initiative is divided into four axes (addressed in detail in section 4.2). The Axis 2 of the work focuses on the development of French sovereignty on telecom networks and is funded with 1 B€ with 360 M€ of public funding. The Axis 3 focuses on consolidation of research and development forces on future network technologies and carries a funding of 410 M€ including 203 M€ of public investment and 30 M€ dedicated to SNS. The funding is allocated for the whole duration of the programme from the onset.

With the Call for Proposals, co-funding is expected from the participants. Public funding for industrial research is between 65% and 100%, for academic developments. The Agence Nationale de Recherche (ANR) operates national academic calls for projects, and the funding varies between 30% and 100% for fundamental research projects and between 25% and 100% for experimental development projects. The funding comes from the national acceleration strategy for 5G and future networks technologies via the Banque Publique d’Investissement (BPI), from industrial chairs (Orange’s chair on 6G and environmental developments). For industrial projects funding is between 50% and 80%, for experimental developments it is between 25% and 60%, and for academic

actors/projects it is up to 100%. It is also possible for projects to take out loans/refundable advances (avances remboursables) from the BPI.

4.3 Organisation of work

The French Acceleration Strategy on 5G & Future Network Technologies as 6G is focused on the following goals:

- Development of 5G applications and increased usage of 5G based services by the French ecosystem and society;
- 5G acceleration of deployment and vertical services offer;
- Supporting French companies, including SME and start-ups, working in the telecom industry
- Strong support of R&D and standardisation of future telecommunications network technologies, such as 6G;
- Joint European effort to ensure digital sovereignty;
- Development of human resources in the field of telecommunications.

The acceleration strategy is based on 4 axes:

- **Axis 1:** support for the development of 5G uses for the benefit of territories and industry;
- **Axis 2:** the development of French solutions on telecom networks;
- **Axis 3:** consolidation of research and development forces on future network technologies;
- **Axis 4:** strengthening the training offer.

Several projects along all the 4 axes have already been launched and some others will be launched soon. The axis 3 is the axis 4 is most related to 6G R&D and include projects such as:

- The PEPR (Programme et Equipement de Recherche Prioritaire) is a part of the third axis of the national strategy. It is backed by 65 million euros of public support and addresses topics such as enabling technologies for NAN and core networks in 5G+ and future networks such as agile network architectures, cloud based and mobile edge cloud based and SDN, interoperability of heterogeneous systems, new physical layer technologies such as signal processing algorithms, advanced & intelligent hardware, etc. Its goal is to ensure a cohesive research effort on future end-to-end telecom solutions and increasingly great involvement of industrial actors in R&D topics.
- Call for Proposals (CFP): Backed by 221 million euros of public support, CPFs focus on projects which foster an interest in 5G applications, 6G developments, cyber, backhaul and submarine networks. The projects submitted are collaborative and include both industrial stakeholders and academic entities.
 - o France's latest CPF 'Innovative solutions (R&D of B5G, 6G, Future networks)' funds projects which focus on 5G, 6G and hybrid solutions.
 - o Frame xG. This project is the result of the CFP "Maturation and Pre-maturation". It focuses on technology transfer from research to industry via the creation of a patent factory. This project focuses on the transfer of technologies & the creation of companies, as practiced by research organisms and valorization structures on the one hand. On the other hand, Frame xG will provide guidance to national stakeholders with regard to the standardisation of their IP assets.
- France 6G. Various themes and goals are set out as part of the France 6G initiative. That is, for example, the development of cohesive and structured national initiatives for 6G developments, from research to standards, facilitating the exchanges between the academic and the industrial worlds, providing guidance for standardisation of IP assets.
 - o Announced in July 2023, Ministry of Economy & Ministry of Research are creating a French hub to connect all projects linked to 6G in France, provide guidance regarding 6G developments and coordinate national actions to create a common national position for industrial stakeholders as well as academic.
 - Reinforce cooperation between national actors;

- Strengthen IP assets valorisation held by stakeholders;
- Help solidify a national industrial and academic position regarding the development of certain matters.

Also, the other axis have activities relevant such as:

- CFP on 5G experimentation: A total of 21 experimental platforms with 163 M€ of investment and 62 M€ of public support (in Axis #1)
- French – German CFPs on 5G private networks: A funding of 20 M€ on 8 projects with 27 companies/entities supported (in Axis #2).
- CFP Skills and Professions of the Future, including projects to design academic training courses of the future in the field of telecoms (in Axis #4)
- EDEC (Engagement du Développement de l’Emploi et des Compétences) is a project dedicated to the development of human resources in telecommunications area. Various stakeholders take part in it (Ministry of Economy and Finance, Ministry of Labour, Infranum, Afnum, industrial actors, laboratories).

In addition to the above, France national initiative also supports work done in the open-source domain. One of France’s most active actors is Eurescom, which manages the Open Air Interface Alliance, develops network cores and RAN solutions. This solution is used by academics & startups to build their own activities. France also finances companies whose solutions are based on OAI.

The national initiative also has a heavy focus on industry 4.0. Previous programs in France have heavily contributed to the development of automotive industry, health, agriculture, transportation, mobility, and aviation.

The 6G projects targeted by the PEPR vary from TRL 1 to 6, while the BPI’s Call for Proposals vary from TRL 4 to 6, for the ANR this is TRL 1 to 4. The projects under France 6G work on TRL is 1 to 6.

4.4 Topics covered

Using the categorization described in the introduction, we see the France 2030 initiative covering the following main topics.

Topic	Relative importance
5G evolution R&I	***
System network architecture and Control	***
Edge and Ubiquitous computing	***
Radio technology and Signal processing	***
Optical networks	**
Network and Service security	** (addressed in the PEPR : “Network support to global security”)
Non-terrestrial networks	***
Special purpose networks/sub-networks	***
Opportunities for devices and components	**
Micro-electronics	*** (addressed in the national strategy of Electronics)
Experimental infrastructure	*** (PEPR’s project: “An open and integrative experimental infrastructure for 5G and Networks of the future”)

Trials and pilots with verticals	*** (ex. Edge computing in the vehicular context)
Human capital	** (via the Work Group Innovation [GT Innovation] and the EDEC)
Policy aspects	**

Table 8: Topics covered in the French national initiative

The French national strategy also addresses sustainability issues, for example within the PEPR in ‘Work Package 2: energy-efficiency of future network infrastructures’ and ‘WP3 : sobriety of EMF exposure and of energy consumption’. It also works on societal acceptance, cybersecurity and sovereignty concerns along with a focus on the development of human resources. France collaborates with the ecosystem to discuss the attractiveness of telecommunications ecosystem to student and workers.

4.5 Perspective on Collaboration

France views collaboration positively and aims to leverage collaboration for good results and faster development. Collaboration is initiated at the programme level and then implemented within the projects. There are collaboration agreements in place with Germany regarding 5G developments, including a joint CPFs (private networks & industrial 5G) with Germany. Both parties involved fund the activities carried out on their respective side. France 6G also encourages national stakeholders to engage with foreign entities and participate to regional and international programs.

While France values collaboration, it also faces some impediments. The timing of the national & European calls poses a problem since their processes are different and require different forms of engagement. In order for smaller entities to participate in SNS, they need to be known and pulled into consortiums by bigger actors. This requires considerable efforts in terms of human and financial resources, which smaller stakeholders cannot partake in while applying to national calls. Additionally, in order to submit projects, companies need to deploy significant effort. The prerequisite to do so is to have access to considerable disposable resources, both human and financial. Smaller stakeholders do not necessarily have access to such resources.

An important benefit of collaboration with other initiatives and the SNS program is the opportunity to guide the work towards certain chosen and precise developments.

5 Finland

Within the Finnish R&D landscape, there are two large initiatives that are currently active:

- The 6G Bridge
- The 6G Flagship

There is also 6G Finland, an independent network of 6G excellence of key organisations that aims to build the nations' innovation, competitiveness and international standing. It is an active coalition of Finnish 6G R&D organisations, and handles several aspects of 6G technology, such as policy-related work in regard to spectrum sharing and frequency allocation. The coalition helps initiate dialogues with the government in order to realize regulations on several topics of importance for 6G technology. While the 6G Bridge and 6G Finland mostly focus on business and technology, the 6G Flagship focuses on science.

As 6G Finland is not a (large) national initiative that provides funding, it is not further considered here.

5.1 6G Bridge

5.1.1 Introduction

The 6G Bridge program aims to make Finland the global leader in providing new value with 5G Advanced and 6G technologies for sustainable industries and societies e.g. in smart cities, smart energy, smart ports and smart factories with different ecosystem players. While the 6G Flagship is focused primarily on fundamental research, 6G bridge reduces the gaps between fundamental research and applied research. The two national programmes do not compete with each other but rather offer complementary services and insights. (Business Finland, 2023)

The 6G Bridge offers the following program services:

- Business: innovation funding for Finnish companies for business development
- Internationalization services for Finnish companies
- Research: funding for Finnish research organisations
- Invest in Finland services for foreign companies
- Business: innovation funding for foreign companies that are register in Finland

The 6G Bridge focuses on verticals such as Health, Automotive, Manufacturing, Energy.

5.1.2 Funding

The 6G Bridge receives a funding of 130 M€ for a period of 4 years from the Ministry of Economic Affairs and Employment. This money is transferred by the Ministry to Business Finland, a service organisation supporting innovation in Finland, which then distributes the money to various projects in Finland working on 6G technology. Next to funding and managing the 6G Bridge programme, Business Finland offers over 50-80 other services and operates under a total yearly budget of approximately 600 M€. Currently 25 M€ out of the 130 M€ budget for 6G Bridge have been allocated to projects, with 105 M€ remaining.

The partners within the 6G Bridge projects are expected to bring in co-funding but the amount depends on the funding instrument that is being requested. There are two funding instruments available to projects – grants and R&D loans without any collateral requirement (usually for projects that are high TRL/closer to market). The amount of co-funding expected ranges from 25% - 60%, with SMEs receiving a maximum of 75% funding and thus needing to add only 25% of their own funding. For large private companies, the funding provided by Business Finland is about 40-50%. The co-funding by the parties always needs to be a cash contribution, as in-kind contributions do not count towards the co-funding.

The 6G Bridge programme does not directly report to the Ministry on its progress, but to the board of Business Finland. Business Finland in turn reports to the Ministry annually, however, not specifically on the progress of 6G Bridge but on overall KPIs that indicate the state of innovation within Finland. These could be KPIs such as impact

on economy through employment, R&D activities, investment in Finland, etc. Finland aims in the future to reach 4% of its GDP through R&D activities.

While the initial funding set out by the Ministry is 130 M€, it is not limited to that. If there are relevant projects that need funding, extra funds can be released. These extra funds can allow for new topics to be addressed and/or new partners to be added to 6G Bridge.

KEY INFORMATION	
Responsible Ministry	Ministry of Economic Affairs and Employment
Total Budget	130 M€
Expected Start Date	2023
Expected End Date	2026

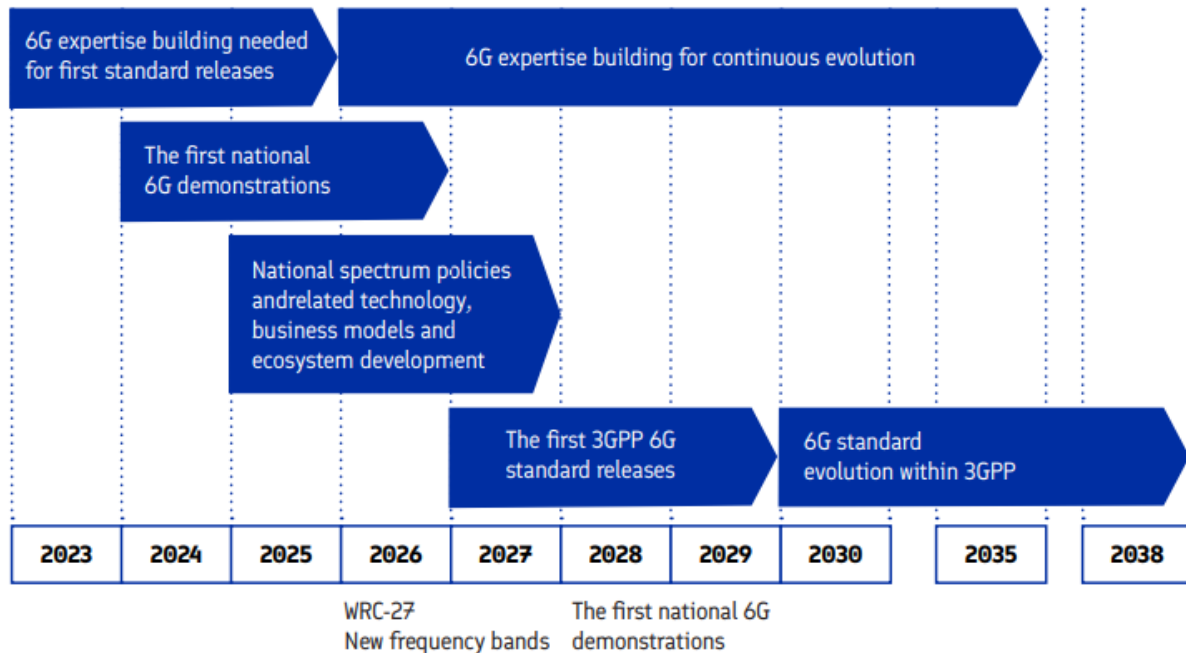
Table 9: Key information on the 6G Bridge initiative

5.1.3 Organisation of work

The work within the 6G Bridge is guided by the Finnish national Strategic Research and Innovation Agenda which defines the framework for R&D&I activities. The figure below shows the 6G roadmap as set out by the SRIA.

The 6G Bridge program encourages Finnish researchers and companies to increase radically both national and international collaboration – also outside the EU. The program goals will be met e.g. by:

- Increasing ecosystem-driven collaboration in research and innovation for 5GA/6G
- Building future business ecosystems in 5GA/6G and attracting international investments
- Strengthening the key capabilities in 5GA/6G
- Fostering testing and experimentation facilities in 6G



- 2023 – 2025 **6G expertise building needed for the first standard release;** to lay the foundations for 6G basic system, standards, and first national 6G demonstrations etc.
- 2024 – 2026 **The first national 6G demonstrations;** demonstration of potential 6G technology enablers and system components, definition of end-to-end system KPI/KVI validation criteria etc.
- 2025 – 2027 **National spectrum policies and related technology, business models and ecosystems development;** technology development, setting national spectrum policies, contributions to global 6G regulations and further development of national ecosystem etc.
- 2026 – 2028 **6G standard first version within 3GPP;** contributions and development of first 6G standards, enhancement of national 6G demonstration capabilities and use case demonstration of 6G basic system etc.
- 2035 **6G expertise building for continuous evolution;** building the expertise for 6G evolution, technology enabler development, research of use cases etc.
- 2038 **6G standard evolution within 3GPP;** contribution to standardization, development of technology enablers etc.

Figure 6: 6G Roadmap as set out by the Strategic Research and Innovation Agenda

The stakeholders of the 6G Bridge initiative includes 190 organisations, main industry ICT including companies such as Nokia and Ericsson, as well as other Finnish initiatives such as 6G Finland, 6G Flagship, 5G Momentum, Allied ICT Finland, Academy of Finland, Technology Industries of Finland.

The priorities set out by the SRIA along with the internal KPIs of Business Finland allow them to decide which projects are relevant and which are not. Projects can be carried out by a single entity or a consortium and usually have a budget somewhere between 50k and 3 M€, with a typical length of 1-3 years. Projects are welcome to apply for funding at any time and are not bound by call deadlines. The projects cover a TRL range of 3-8.

Reporting by the projects towards Business Finland has to be done at minimum once at the half-way point and once at the close of the project. The report must include a financial update as well as an update on the progress. At the start of the project, Business Finland agrees on KPIs together with the project partners which forms the basis for evaluation of the project. Funding is not withheld based on poor performance, but poor performance may result in hesitation to fund further projects with the same partner/consortium. In general, Business Finland looks for high risk, high reward projects, which implies some projects will not be successful.

5.1.4 Topics covered

Using the categorization described in the introduction, we see 6G Bridge covering the following main topics:

Topic	Relative importance
5G evolution R&I	***
System network architecture and Control	***
Edge and Ubiquitous computing	***
Radio technology and Signal processing	***
Optical networks	-
Network and Service security	***
Non-terrestrial networks	**
Special purpose networks/sub-networks	***
Opportunities for devices and components	*
Micro-electronics	**
Experimental infrastructure	*
Trials and pilots with verticals	***
Human capital	**
Policy aspects	*

Table 10: Topics covered in the Finnish 6G Bridge programme

6G Bridge also focuses on policy and societal aspects such as sustainability and sovereignty. There is no dedicated funding for this within 6G Bridge but is at the core of the whole development. Business Finland, 6G Flagship and 6G Finland collaborate on their views on policies for 6G. While the Ministry guides the overall policy aspects to be considered for 6G technology, Business Finland does not impose any rules on its projects and customers. The projects have their own freedom to pursue policy and societal topics in the manner they see fit.

Business Finland and its internal departments also work on human capital; however, this does not form a part of the 6G Bridge project. Work in Finland is one of the internal departments that focuses on attracting talent to Finland and its projects. Invest in Finland is another department that can aid with companies that would like to establish themselves in Finland. Other activities focusing on human capital include sharing knowledge with the community and matching research knowledge with industry, and also looking into software and tools needed for 5G and 6G.

5.1.5 Collaboration

Business Finland (and in turn 6G Bridge) address collaboration at various levels – national, within the EU, and outside the EU. They actively participate in projects such as KDT, SNS, EUREKA, EUROSTAR etc. in order to work together with like-minded countries. MoUs have been signed with some countries as well as some states in the US, however, Business Finland prefers to realize collaboration through joint projects such as the ones mentioned above, bilateral calls such as under EUREKA or directly within another country to create joint projects for similar R&I.

6G bridge doesn't sign MoUs on its own, this is always done at the Business Finland level. If a project is started on 5G/6G and funded by Business Finland, then it automatically falls under the scope of 6G Bridge.

Business Finland understands that a major benefit of collaboration is the accumulation of expertise from various countries, to solve the challenges of the future together. However, barriers to such collaborations are the difficulties in finding the right SMEs and deep-tech companies within other countries. It is hard to find the right match within another country and finding the right funding instrument for such collaborations is also a challenge.

5.2 6G Flagship

5.2.1 Introduction

6G Flagship is a part of the Finnish government’s national research spearhead programme from 2018 to 2026. The goal is to create the essential 6G technological components, the tools, and the equipment to build a 6G Test Network, develop chosen vertical applications for 6G to accelerate societal digitization and continue to be a recognized vision leader and sought-after research partner in worldwide 6G research. The initiative is run by the Centre for Wireless Communications (CWC) at the University of Oulu in Finland. (University of Oulu, 2023)

KEY INFORMATION	
Responsible Ministry	Ministry for Education and Culture
Total Budget	250 M€ (19.7 M€ Governmental funding)
Start Date	2018
Expected End Date	2026

Table 11: Key information on the Finnish 6G Flagship initiative

5.2.2 Funding

The programme is funded by the Research Council of Finland (RCoF) for a period of 8 years with an amount of 19.7 M€. University of Oulu contributes 16 M€ to the programme, bringing the total dedicated funding to 35 M€. However, the project operates with a total budget of 250 M€. This is organized such that the rest of the funding is received from faculty of ITEE, external projects, such as those funded by Horizon Europe, SNS, Business Finland, private companies, etc. The dedicated funding of the 6G Flagship (35 M€) is not distributed via projects, but instead contributes to the salaries of the staff working on the programme, such as professors, post-doctoral researchers, PhDs, etc.

The funding received from the RCoF is divided over two grants for the whole duration, given out in three instalments. The first grant is for the first 4 years of the project for an amount of 9.1 M€, and then two instalments over a period of 2 years each contributing a total of 10.6 M€. Since this internal money does not fund any projects, there is no obligation for the partners within the externally funded projects to bring in any co-funding. The co-funding expectations of those projects are set by the body from which the funding is received.

The 6G Flagship has ambitions to continue its work beyond 2026 as well. There are currently discussions ongoing with the Ministry to explore options for additional funding. In case additional governmental funding is not available, the programme can still continue with additional funding received from University of Oulu and through the externally funded projects.

5.2.3 Organisation of work

This programme carries the following goals:

- **6G Technology Enablers:** 6G Flagship will carry out technology and system pilots for selected verticals by co-creating with companies, ensuring timely relevant wireless expertise availability for industry needs, and enabling economic growth via an early adoption of critical smart society technologies.
- **6G Test Network Development:** creating a nationwide test network environment.
- **6G Vertical Applications:** to gain a deeper understanding of the selected vertical applications: health, energy, automotive, and industry, security, and defense; what they will require and how they fit into the 6G ecosystem.

- **6G Vision Leadership:** assessment of future risks and possibilities.

The programme focusses on four strategic research areas, as described in the figure below.

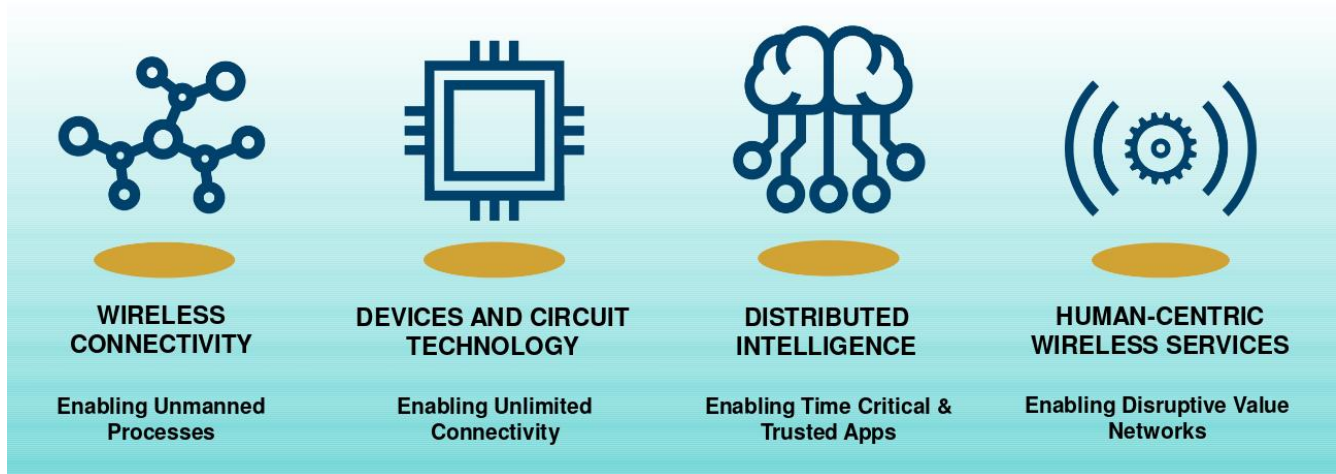


Figure 7: Strategic research areas within the Finnish 6G Flagship initiative

The strategic research areas are further subdivided in research themes as follows:

Strategic research areas	Research Themes
Wireless connectivity	Advanced networking technologies
	Wireless access technologies
	Massive wireless automation
Devices and circuit technology	Radio platforms
	Radio hardware
	Experiments and proofs of concept
Distributed intelligence	Computing on the edge-to-cloud continuum
	Distributed AI
	Multimodal sensing and modelling
Human-centric wireless services	5GTN to 6GTN (experimentation platform)
	Strategic vertical areas
	Sustainability, business, and regulation

Table 12: Research themes in 6G Flagship

The 6G Flagship currently has about 300 externally funded projects under its umbrella; these are Horizon Europe projects, SNS, KDT, etc. 6G Flagship does not release any calls of its own; partners wishing to start projects must apply for other calls such as the ones mentioned above. As long as the work being done in the project aligns with one of the strategic research areas, the project is accepted as a part of 6G Flagship. In the 6G Flagship ecosystem there are three different levels of partners: an affiliate, a project member and a co-creator i.e. strategic member. Only co-creators (strategic partners) are expected to bring money into the project, but this could also be money in the form of equipment instead of cash.

The 6G Flagship is guided by the 6G Flagship Steering Group and the Research Leadership Group. The Steering Group advises the programme from the point of view of the research strategy of the University of Oulu but is not a decision-making body. The Research Leadership Group on the other hand makes operative decisions and defines and accepts proposed research agendas, including making changes to the usage of the budget. The individual projects, operating under the 6G Flagship umbrella, report on their progress to the particular Strategic Research Area they are linked to. The SRAs report to the Research Leadership Group, which in turn reports to the Steering Group. Every second year the 6G Flagship has to report to the RCoF on the progress of the programme.

The projects within 6G Flagship work within the TRL range 1 – 6.

5.2.4 Topics covered

Using the categorization described in the introduction, we see 6G Flagship covering the following main topics.

Topic	Relative importance
5G evolution R&I	***
System network architecture and Control	***
Edge and Ubiquitous computing	***
Radio technology and Signal processing	***
Optical networks	*
Network and Service security	***
Non-terrestrial networks	*
Special purpose networks/sub-networks	**
Opportunities for devices and components	***
Micro-electronics	***
Experimental infrastructure	***
Trials and pilots with verticals	***
Human capital	-
Policy aspects	***

Table 13: Topics covered in the Finnish 6G Flagship initiative

Sustainability and UN SDGs are the main driving factors in the research. There is a dedicated project (with its own funding) within the 6G Flagship umbrella, called the 6G-Enabled Sustainable Society (6GESS) program, which capitalizes on 6G Flagship’s technological expertise to develop the scientific framework for a data-driven, hyper-connected future society. Additionally, the programme has one dedicated person who specializes in topics on sustainability. Sustainability is considered cross-sectional across all SRAs and verticals.

Human Capital is neither a research area nor a topic within the 6G Flagship, but it is addressed within the Human Centric Wireless Services strategic research area and its projects, where user need is considered. The programme

also has a global pilot project (funded by the Ministry of Culture and Education) in countries like India, where education is one of the focus areas. The countries involved in these pilots bring their own funding as well.

5.2.5 Perspective on Collaboration

The 6G Flagship collaborates with many national and international partners as well as other national programmes through the 300+ projects under its umbrella. They cooperate widely with international science communities, academia and universities across the globe, including many European countries, US, Brazil, Japan, Korea, China, India, Singapore, etc. These collaborations are realized mostly via joint projects and academic cooperations.

The starting point for these collaborations can be an MoU but as soon as it reaches to a joint project, project agreements come into place. Collaboration agreements are always drawn up at the programme level even though work is often pursued with one of the strategic research areas or one of the projects.

6G Flagship recognizes that by working together through collaboration, good results can be achieved faster, and they can influence the upcoming standards. However, in some cases collaboration is quite challenging. Some national regulations could be a limiting factor. But a bigger challenge is that not every country, even within the EU, is at a position to start work on 6G yet. There are many countries that are still struggling with 4G deployments. Local readiness within Europe for 6G varies greatly, and this factor influences collaboration.

6 Germany

6.1 Introduction

The German national initiative on 6G or the German 6G Programme comprises different kinds of projects. The “6G Platform Germany” or more precisely the ‘Platform for Future Communication Technologies and 6G (6G Platform)’ acts as an umbrella project for the national program. It is intended both to make scientific contributions to the content design of 6G and to ensure the scientific-organisational support for the processes that are necessary for the successful implementation of the German 6G programme. The German 6G Programme was announced in April 2021 and is structured as follows:

- 6G Platform Germany, October 2021 –2025
- Four 6G Research Hubs, 2021 –2025
- Eighteen 6G Industry Projects, 2022 -2025
- Seven Projects on Resilience, 2023 –2025
- AI-NET, 2021 -2024
- Projects on high-speed networks for hyper connectivity, 2024 - 2027

KEY INFORMATION	
Responsible Ministry	Federal Ministry of Education and Research
Total Budget	700 M€
Expected Start Date	2021
Expected End Date	2029

Table 14: Key information on the German 6G initiative (status Sept 2023)

6.2 Funding

The 6G Programme is funded by the German Federal Ministry of Education and Research (BMBF). At the time of writing this report, the total budget of the programme was estimated to be 700 M€, however, since the programme continues to add new funding calls and projects, the final number cannot yet be ascertained.

The programme officially started in 2021, although the CELTIC-NEXT AI-NET project, which was included under the German 6G programme when the national initiative started, was already active before that. Currently the programme is expected to end in 2025, however, the projects being funded with the new instruments are expected to continue till 2029.

The hubs have a duration of 4 years, and they received additional funding in 2022. Within the allocated budget, the budget is allotted on a yearly basis. The administrative framework for funding – in particular, the need for co-funding - follows the BMBF standard procedures. Universities don’t need to co-fund, research institutes have differing rules, e.g., Fraunhofer doesn’t need to provide co-funding, however, the German Research Center for Artificial Intelligence (DFKI) needs to provide co-funding. Private companies are subject to different rules but information on these rules is not public information. These rules also differ for big private companies versus start-ups, SMEs etc. Participation of SMEs is viewed positively during the evaluation of projects. SMEs can – under specific conditions - receive a higher funding rate of the public funding than big companies , and hubs are encouraged to look for SMEs to be suppliers within the projects.

6.3 Organisation of work

Themes and topics for the projects within the scope of the German 6G Programme were defined based on the submissions received in response to open calls. These calls were pretty broad. The submissions were evaluated by an evaluation board and recommendations by this board were made towards the BMBF. However, the final

decision of selection and fund allocation rests with the BMBF. There were several calls, including one call for a platform, one call for industry projects, one for research hubs, one for resilience projects, etc.

When a new project is added to the German 6G Programme, it could be linked to an existing project or a hub. Cooperation with the 6G-Platform is mandatory though. Whenever a new topic seems important and budget becomes available, calls might be put out. The new calls allow for new partners and new topics to be added to the current pool, and additional budget could be made available by the BMBF for this purpose.

The overall TRL covered within the German 6G Programme is 1-4, in exceptional cases up to 5. Regarding higher TRL in the areas of 5G evolution and with regard to policy aspects of future 6G, BMBF is closely working together with the German Federal Ministry for Digital and Transport (BMDV).

6.3.1 6G Platform

Main instrument of the 6G Platform are “Working Groups”. Participation in these Working Groups is open to all participants from partners funded in the BMBF 6G Programme. This part of the programme was initially designed keeping in mind the structure of the 6G-IA / SNS JU working groups and tries to simplify the collaboration with 6G-IA, SNS-JU, and other national initiatives. Additional Working Groups are set up based on demand. Note that the 6G Platform is not some kind of supervision body for the German 6G Programme. It depends on voluntary contributions of the projects. All other projects have their own governance structure, and they operate independently, i.e., there is no formal reporting to the 6G Platform project, although the 6G Platform aims to keep in touch with all projects.

1. **WG1 Science Communication:** This group is responsible for bilateral communication with all stakeholder groups relevant to 6G. An important motivation is to increase acceptance for 6G networks, services, and applications. Topics that get addressed are concerns about electromagnetic exposition, privacy issues, technological sovereignty, and participation (in particular in rural areas).
2. **WG2 Societal perspective:** This group will focus on sustainability and participation.
3. **WG3 Maximizing impact:** The focus here will be on involving vertical industries, SMEs, and management of innovation.
4. **WG4 Building a global 6G vision:** This group will focus on building the vision, use cases, and roadmaps for 6G.
5. **WG5 Security, Resilience, and Trustworthiness**

Additional working groups are currently set up.

6.3.2 6G Research Hubs

Within the German national 6G initiative, four 6G research hubs were started in 2021, with an overall budget of approximately 275 M€. These hubs comprise of about 160 research groups at overall 21 universities and 15 research institutes. More than 40 SMEs are already part of the research network. The figure below shows the location of the coordinating partners.



Figure 8: Research hubs within the German national initiative

6.3.3 6G Industry Projects

Within this part of the national initiative, 18 projects were started in 2022 all led by industry. This includes a total of around 70 industry partners, 20+ universities, and 9 research institutes. In total, the funding provided is approximately 150 M€.

Industry participation includes major infrastructure vendors, four major MNOs, test-and measurement equipment and service providers, major semiconductor manufacturers, OEMs in automotive, airplanes, drones, robots, automation equipment, commercial vehicles, medical equipment, infrastructure operators (factories, airport), and more than 40 small and medium companies with products completing the 6G ecosystem or benefiting from 6G connectivity.

The use case scenarios and application areas which will be in focus are:

- Campus networks (automation, campus logistics),
- Medical scenarios (hospitals, emergency, operation theatre)
- Mobility (automotive, commercial vehicles, drones)
- Global coverage (satellites, rural areas, in-X networking)

Germany also constantly evaluates the use-cases included and expands when needed. For example, in discussion with other national programmes Germany identified certain verticals they missed, such as tourism.

6.3.4 6G Projects on Resilience

These projects focus on the resilience of communication infrastructure and digital systems: System architecture, technologies and modules (Hardware and Software), and network management aspects are addressed. About 24 M€ of funding is provided by the BMBF.

Within this part of the initiative, seven projects were started in January 2023, addressing the cyber(-physical) resilience, security and protection of connectivity infrastructure, data, and data processing. The results from these projects will be input to 6G Platform Working Groups.

The resilience projects could achieve a TRL level 5, while the rest of the programme caps technology readiness at TRL 4.

6.3.5 Projects on High-speed networks for hyper connectivity

The funding call was released in March 2023. First projects are intended to start in the first half of 2024. The aim of the funding is to support research into new optical data transmission technologies that can be used to build

high-speed networks for the highly networked society in order to create favorable framework conditions for the development of innovative communication systems in Germany.

6.4 Topics covered

The German national initiative covers the following main topics, with the assigned relative importance:

Topic	Relative importance
5G evolution R&I	***
System network architecture and Control	***
Edge and Ubiquitous computing	***
Radio technology and Signal processing	***
Optical networks	***
Network and Service security	***
Non-terrestrial networks	***
Special purpose networks/sub-networks	***
Opportunities for devices and components	***
Micro-electronics	***
Experimental infrastructure	**
Trials and pilots with verticals	*
Human capital	**
Policy aspects	**

Table 15: Topics covered in the German national initiative

The experimental infrastructure within the German 6G programme focuses on building facilities to carry out experimentation on technologies and test certain applications, etc. The programme builds on existing experimental facilities to make them suitable for use within 6G. Trials and Pilots are not yet addressed within the programme, because there are no trials yet for 6G, but this topic remains in the scope for the future.

The German 6G programme already identifies the expressed need for information in 3GPP and will be contributing on topics such as channel models for 6G through the research output of the projects. During the pre-standardisation phase, the projects will work mostly on the identification of requirements, use-cases, KPIs, etc. Although the programme itself does not itself engage in any standardisation work, at a later stage, the industry partners and some research partners will contribute to international standardisation. Some partners aim to contribute to existing open-source initiatives as well as provide its own open source products for results of the hubs.

The programme also focuses on several societal and policy aspects such as sustainability, sovereignty, privacy and data protection, EM compatibility, scientific communication and gaining acceptance, trustworthiness, gender equality(women in 6G). The 6G Platform has the dedicated responsibility of working on these topics. In addition, the hubs and industry projects also work on this and the platform has the task to bring it all together and harmonize it.

Human capital is one of the strong motivations for the programme as Germany recognises the need for good, qualified talent. However, there are limited funding instruments dedicated to this, as this forms a part of the general activities of the research hubs. The research hubs offer opportunities to researchers from all over the world and also have budget for scientific exchange programs, workshops, conferences, etc.

6.5 Perspective on Collaboration

The German initiative addresses collaboration both via the 6G Platform as well as through their flagship project, 6G ANNA. Currently they have collaborations with several countries within Europe and outside the EU. They have an MoU with 6G-IA, joint projects with Japan are under discussion, two workshops conducted together with Japan in Berlin and Tokyo, two more planned for 2024, a workshop at the EUCNC on non-terrestrial networks where they invited all parties working on NTN to contribute, planned workshops with Singapore. HEXA-X / HEXA-X II is always invited to the 6G Platform events and presenting their latest results. Further collaborations are planned. The collaborations are initiated mostly at a programme-level, but the matchmaking is done at a project-level. Eurescom has been engaged as a subcontractor by the programme to help organize such matchmaking events to find fruitful collaboration opportunities.

Through collaboration the German national initiative aims for a harmonized view on 6G. In addition, they find it to be a useful tool in identifying overlapping areas of work and complementary activities within the projects of other countries. The programme identifies long legal procedures to be a barrier for establishing collaboration but also recognises these to be a necessary evil.

7 Sweden

Sweden has a collaborative approach to 6G R&D. The large initiatives in Sweden that relate to 6G are built on previous experiences of setting up collaborative programmes between the state and private sector stakeholders. There are two ongoing national initiatives and two that are in set-up phase. They all have a clear dimension of European and international collaboration.

The current active initiatives are:

- Advanced Digitalization
- R&D Competence Centres

The decided initiatives that are currently under set-up are:

- 6G R&D programme
- Centre for 6G R&D satellite communication

7.1 Advanced Digitalisation

7.1.1 Introduction

The program is based on collaboration between the Swedish Government, mainly through the innovation agency Vinnova, and industry. The aim is to promote and accelerate the uptake of digitalization in Sweden and increase the industry’s ability to provide digital solutions of the future. The program is broad where 6G has a significant role.

The set-up of the program has the character of a partner organisation with representatives from the Swedish state and industry with a dedicated support office. The industries represented in the board of the program are Ericsson, SAAB, ABB, Volvo Group, Swedish Science Parks and Incubators as well as the Association of Swedish Engineering Industries.

Advanced Digitalization offers the following program services:

- Open calls for collaborative research and innovation projects
- Test and demonstration facilities
- Model for integrated learning
- Arena for meetings to enhance take-up of R&D and best-practices

KEY INFORMATION	
Responsible Ministry	Ministry of Climate and Enterprise
Total Budget	210 M€
Expected Start Date	2023
Expected End Date	2027

Table 16: Key information on the Advanced Digitalization programme

7.1.2 Funding

The funding from the Swedish Government is 210 M€ 2023-2027. The budget and the official representation of Sweden is handled by the innovation agency Vinnova. The partners of projects will finance at least the same level, hence the total budget of Advanced Digitalization with funding from the private sector is 420 M€. The program office is financed by industry in addition to Vinnova.

The program started 2021 and so far, up until end of 2023, over 400 unique organisations have participated in 180 projects. 12 open calls have been launched.

7.1.3 Organisation of work

There are 4 advisory committees within the program that develops recommendations to the governing board of the program, primarily on implementation of calls and other R&I activities The advisory committees:

- Enabling technologies
- Electrification
- Digital infrastructure and communication
- Learning and skills

The program office handles external meetings, external communications and overall promotion of the program including results.

Vinnova is the agency handling budget allocation, calls, contractual agreements with participants in projects and follow-up of on-going projects. The programme aims to increase cooperation with other national programmes to strengthen synergies and to disseminate results as well as knowledge.

7.1.4 Topics covered

Using the categorization described in the introduction, Advanced Digitalization covering the following main topics.

Topic	Relative importance
5G evolution R&I	**
System network architecture and Control	***
Edge and Ubiquitous computing	***
Radio technology and Signal processing	*
Optical networks	-
Network and Service security	**
Non-terrestrial networks	*
Special purpose networks/sub-networks	***
Opportunities for devices and components	*
Micro-electronics	-
Experimental infrastructure	**
Trials and pilots with verticals	***
Human capital	**
Policy aspects	*

Table 17: Topics covered in Sweden's Advanced Digitalization Programme

7.1.5 Perspective on Collaboration

International collaboration is at the core of the industrial partner’s as they are multinational companies. In the program Advanced Digitalization itself there are links to programmes such as Chips JU and EUREKA.

7.2 6G R&D Competence Centres

7.2.1 Introduction

During 2023 totally 11 new R&D Competence Centres were decided for funding in a competitive national call. Vinnova, industry partners and universities together invest 100 M€ 2023-2028. The funding decision and contracts with the centres was made after international expert evaluation. Vinnova, the Swedish innovation agency, handled the call. The goal of the Competence Centre program is to develop knowledge and new enabling technologies to accelerate the green and digital transition. There are 6 new 6G related R&D Competence Centres starting 2024.

7.2.2 Funding

The funding of each competence centre is divided:

- 1/3 from the Swedish Government through Vinnova
- 1/3 from the universities
- 1/3 from the participating industries and SMEs.

Each 6G related Competence Centre has a budget of 9 – 16 M€ 2023-2028 from Vinnova, universities and industries plus SMEs. The Vinnova budget is in the table below.

KEY INFORMATION	
Responsible Ministry	Ministry of Climate and Enterprise
Total Budget	20 M€
Expected Start Date	2023
Expected End Date	2028

Table 18: Key information on the 6G R&D Competence centres

7.2.3 Organisation of work

NextG2Com: A Competence Centre focused on advanced communication systems including radio-based communication and networks but also software, data, cyber security and applications. Host of the centre is Lund University.

The research is integrated into demonstrators and proof-of-concepts to ensure that research results are validated and implemented in practice. The partners of NextG2Com has relevant use-cases that are in-line with targets of Agenda2030.

There are 17 contractual partners in NextG2Com. Amongst them SMEs such as Sensative, Cognibotics and Codescene. Industry partners include Volvo Cars, Ericsson and Robert Bosch.

WiTech: A Competence Centre focusing on energy efficient semiconductors as well as advanced antennas and sensors to decrease environmental impact of wireless systems. Host of the centre is Chalmers University (Gothenburg).

There are 19 contractual partners in WiTech. Amongst them SMEs such as Qamcom, Low Noise Factory and Omnisys Instruments. Industry partners include Ericsson, SAAB and Volvo Cars.

SEDDIT: A Competence Centre focusing on sensor information and decision-making for Digital Transformation. Climate change and security is in focus by developing autonomous systems and mathematical methods. Host of the centre is Linköping University.

There are 12 contractual partners in SEDDIT. Industry partners include Scania, SAAB and Atlas Copco.

ACT: A Competence Centre focusing on advanced chip technology through new processes and methods. The research targets high-speed-electronics, opto-electronics and power electronics. Host is Lund University and KTH, Royal Institute of Technology in Stockholm.

There are 17 contractual partners in ACT. Amongst SMEs are NordAmps, AlixLabs and KISAB. Industry partners include Alstom Transportation, Ericsson and Volvo Cars.

SweWIN: Swedish Wireless Innovation Network. A Competence Centre with focus on sustainability and energy efficiency in wireless communication and applications based on sustainable materials. Host is KTH, Royal Institute of Technology in Stockholm.

There are 8 contractual partners in SweWIN. Amongst SMEs are BeamWave and Northern Waves. Industry partners include Ericsson, ABB and SAAB.

CoDig: Continuous Digitalization. A Competence Centre with a vision of a substantial increase of enterprises competitiveness through transformation of software intensive industries’ to continuously delivering increased value based on next generation of data and communication infrastructure. Host is Chalmers University in Gothenburg

There are 16 contractual partners in CoDig. Industry partners include Ericsson, Grundfos and Siemens.

7.2.4 Topics covered

Using the categorization described in the introduction, Competence Centres in Sweden covers the following main topics.

Topic	Relative importance
5G evolution R&I	*
System network architecture and Control	***
Edge and Ubiquitous computing	**
Radio technology and Signal processing	***
Optical networks	*
Network and Service security	***
Non-terrestrial networks	*
Special purpose networks/sub-networks	***
Opportunities for devices and components	**
Micro-electronics	***
Experimental infrastructure	**
Trials and pilots with verticals	**
Human capital	***
Policy aspects	**

Table 19: Topics covered in Sweden's 6G R&D Competence Centres

7.2.5 Collaboration

International collaboration is at the core of the Competence Centers. Several have international partners on contractual basis. They are to a large extent the foundation for collaboration through projects in Horizon Europe, SNS JU, Chips JU, EUREKA etc. The Swedish Competence Centres are not visible through CORDA or in Grant Agreements with European Commission. Rather they are visible in CORDA through the legal names of the partners such as KTH, Chalmers, Lund University, Ericsson, Scania etc.

7.3 6G initiatives under set-up

Vinnova together with the Swedish Research Council has an assignment from the Swedish Government to start a 6G program 2024. Detail of implementation is in process and launch of program is scheduled Q2-2024.

6GSAT is an open call for a multidisciplinary research centre. Next generation of mobile communication system is now developed. 6G will be integrated with satellites in space. The focus of the centre is energy efficient integration of mobile communication and satellite communication. The plan is to start the centre 2025-Q1. Swedish Foundation for Strategic Research funds 6GSAT with 6 M€.

7.4 Other 6G initiatives

Vinnova has an assignment from the Swedish Government to finance and enable Strategic Innovation Programmes. Vinnova, the Swedish Energy Agency and Formas fund seventeen strategic innovation programs. One of the programs is Smarter Electronic Systems and there several cutting-edge collaborative projects have been financed in Radio technology and Signal processing, Micro-electronics, 5G evolution R&I, Edge and Ubiquitous computing and Optical networks. The program is however in a final phase of its life-time. There have been several 5G/6G related projects in other Strategic Innovation Programs such as in Process IT and Industrial Automation, Internet of Things and Production 2030.

Vinnova is engaged as the national Public Authority of Sweden in EUREKA Celtic Next. One of several international projects where Swedish participants receive funding from Vinnova is the Celtic Next flagship project AI-Net 2021-2024.

8 Ireland

8.1 Introduction

CONNECT is the world leading Science Foundation Ireland Research Centre for Future Networks and Communications. CONNECT is funded under the Science Foundation Ireland Research Centres programme, which has established a network of SFI Research Centres focusing on key research areas in Ireland. CONNECT brings together world-class expertise from ten Irish academic institutes to create a one-stop-shop for telecommunications research, development and innovation. CONNECT engages with over 40 companies including large multinationals, SMEs and start-ups.

Key Information	
Responsible Ministry	Research Ireland
Total Budget	30 M€
Start Date	2021
Expected End Date	2026

Table 20: Key information on the Irish national programme

8.2 Funding

In order to carry out research, there is about 30 M€ in core funding available from Research Ireland to CONNECT Ireland. This funding has been allocated for a period of 6 years, starting in 2021. The programme has a target to add funding from industry collaborations, non-exchequer/non-commercial, including also in-kind contributions, which should bring the total budget to about ~75M€.

There is a specific scheme in place to promote the involvement of SMEs in the programme, whereby SMEs may choose to bring in in-kind contributions instead of cash when contributing to the budget for a project (and CONNECT adds the cash balance exchanged by in-kind).

The programme does not foresee any other funding instruments.

8.3 Organisation of work

CONNECT is basically structured into a set of Themes and each of them has a Working Group associated with them. The current themes are:

- **Dependable Networks:** Mission-critical innovations such as remote surgery, autonomous vehicles and Industry 4.0 will require an exceptionally high quality of service from ultra-reliable, low-latency communications networks.
- **Sustainable Internet of Things:** Energy harvesting and storage, efficient protocols and networking principles for connecting devices at the edge to the network, Highly reconfigurable software-defined devices, Resilient security mechanisms
- **Link Performance:** 5G and beyond networks will require multi-Gbps wired and wireless data transmission. In addition to increased capacity, ultra-reliable low latency links will be required.
- **AI-driven Network Customisation:** The shared network is the essential platform to build affordable customised networks where resources can be sliced and stitched together to provide an end-to-end network substrate with an allocation and configuration of resources to suit niche operators.
- **Network Ecologies:** Telecommunication networks and the research that produces them exist within, and as part of, larger social and environmental networks. Network Ecologies brings research from broad disciplinary contexts into networks research.
- **Quantum & Satellite Communications:** Quantum and satellite communications are on the cutting edge of technology, offering transformative solutions for secure and high-speed data transmission. Our

research at the Connect Centre focuses on advancing the frontiers of quantum and satellite communication technologies to revolutionise how information is transmitted globally.

- **Cybersecurity:** In the realm of cybersecurity, our research theme centers on the pivotal concept of trust within network connectivity. We understand that establishing and maintaining trust is essential in an interconnected digital world.
- **Smart Cities & Connected Autonomous Vehicles:** Smart cities are at the forefront of urban innovation, harnessing technology to enhance the quality of life for their residents. Our research at the Connect Centre is dedicated to understanding the intricate dynamics that shape the evolution of smart cities and exploring innovative solutions to urban challenges.

There are two types of projects being funded at CONNECT:

- Platform projects, i.e. basic research, addressing challenges along the lines of the thematic areas as listed above. Each get a funding from CONNECT through which an Investigator can hire a post-doctoral researcher or a student, any can purchase any materials or equipment needed for the research.
- Targeted Projects, generally co-funded with an industry partner, addressing more applied research of mutual interest to CONNECT and to the industry partner. These types of projects have an agreed budget which is used to hire post-doctoral researchers or students, as well as purchase any materials and equipment needed.

CONNECT is governed through a Governance Board. Operationally, the Executive Committee makes all decisions in relation to the funding of projects, appointing new investigators etc. The projects have a minimum duration of 1 year and a maximum duration of 4 years. There are calls regularly released, averaging one call per year.

The programme offers a great deal of flexibility to allow for new topics and challenges to be introduced during the running of the programme. New industry partners may join at any time as well as acceding new academic partners from within Ireland.

8.4 Topics covered

Using the categorisation described in the introduction, the Irish National Programme is determined to cover the main topics showcased in table below.

Topic	Relative Importance
5G evolution R&I	*
System network architecture and Control	**
Edge and Ubiquitous computing	***
Radio technology and Signal processing	***
Optical networks	***
Network and Service security	***
Non-terrestrial networks	-
Special purpose networks/sub-networks	**
Opportunities for devices and components	***
Micro-electronics	***
Experimental infrastructure	***
Trials and pilots with verticals	**
Human capital	-
Policy aspects	**

Table 21: Topics covered in the Irish national programme

Sustainability is crucial aspect of the research conducted at CONNECT, including other social aspects, which are often embedded as a part of the research for e.g. in Smart City projects. CONNECT also participates in pre-standardisation and standardisation activities through European Telecommunications Standards Institute (ETSI). The programme focuses on specific verticals such as Smart Cities as well as Connected Autonomous Vehicles, and to a good extent, Connect Health. The majority of the research focuses on TRL 1-4, with some projects stretching up to TRL 7.

8.5 Perspective on collaboration

Collaboration with other National Initiatives is often done within the scope of European funding instruments such as Horizon Europe. However, in some cases, there are specific agreements in place. One such example is the US-Ireland instrument to do cross-border research involving academics from Ireland, Northern Ireland and US.

Industry collaborations are often put in place using one Memorandum of Understanding (MoU) with all the involved partners in each project. One such MoU is the one that CONNECT has for their 6G-ONE initiative, which involves Trinity college as well as a number of industry partners such as Analog Devices, Dell, VMware, etc. Additionally, there is a legal agreement in place between all the participating universities in CONNECT, valid for the duration of the programme.

One of the barriers to collaboration with other National Initiatives on 6G is that there is no specific instrument available to foster collaborations between different countries. A great deal of benefit can be extracted if it would be possible to integrate the national initiatives into a broader platform for test, experimentation and research, and where SNS would work as a complement and an integrator.

9 Overview of the topics covered by the different national initiatives

Concerning the collaboration with or among the large national initiatives, it is important to identify what topics each of the national initiatives focuses on and common topics being addressed by multiple national initiatives. Based on the structured interviews with each of the national initiatives, we have summarized the relative importance of each item in a specific list of topics. Every national initiative was given the same list of topics to be scored by them, to make comparison feasible. An overview of the relative importance is presented in the table below.

Topic	Relative Importance									
	Netherlands	Spain	Italy	France	6G Bridge Finland	6G Flagship Finland	Germany	Sweden Advanced Digitalisation	Sweden Competence Centers	Ireland
5G evolution R&I	-	**	***	***	***	***	***	**	*	*
System network architecture and Control	***	**	***	***	***	***	***	***	***	**
Edge and Ubiquitous computing	**	**	***	***	***	***	***	***	**	***
Radio technology and Signal processing	***	**	***	***	***	***	***	*	***	***
Optical networks	-	**	***	**	-	*	***	-	*	***
Network and Service security	*	**	*	**	***	***	***	**	***	***
Non-terrestrial networks	*	**	***	***	**	*	***	*	*	-
Special purpose networks/sub-networks	*	-	***	***	***	**	***	***	***	**
Opportunities for devices and components	**	-	*	**	*	***	***	*	**	***
Micro-electronics	***	-	*	***	**	***	***	-	***	***
Experimental infrastructure	***	***	***	***	*	***	**	**	**	***
Trials and pilots with verticals	***	-	**	***	***	***	*	***	**	**
Human capital	**	*	*	**	**	-	**	**	***	-
Policy aspects	**	-	*	**	*	***	**	*	**	**

Table 22: An overview of topics covered by the different National Initiatives

10 European Collaboration

10.1 Goals of collaboration

While each country within the Member States has a different set of objectives and goals for their B5G and 6G programmes, it has also been recognized that several goals can be achieved through collaboration. The SNS programme can collaborate with the national initiatives to create a stronger 6G ecosystem, as well as collaboration between the different national initiatives can yield productive outcomes. Some of the goals that can be achieved via European collaboration have been identified as follows:

- Ensuring European leadership for 6G: This can be achieved through exchange of results to avoid duplication of 6G research work, aligning standardisation input to get globally accepted results, and setting up EU federated infrastructures to demonstrate EU 6G technology.
- Improving the operation of digital industries: This can be achieved by increasing the uptake of 6G technology by the verticals, creating advanced infrastructure for the verticals to use, and engaging large industry players and well as SMEs to participate in 6G.
- Address societal needs and policy objectives: 6G technology across Europe should focus on addressing societal needs such as sustainability, technological sovereignty and resilience. Focus should also be on creating a knowledge base of education and trainings for all member states to access.

In addition to the goals identified above, collaboration between the national initiatives and the SNS should also focus on addressing challenges such as mobilizing the European stakeholders in a synchronized way, combining resources and creating a critical mass of European solutions and testbeds, and work on minimizing the technological gap among EU countries.

10.2 SNS-ICE proposed collaboration actions

During the National Initiatives co-creation event at 5G Techritory 2023, organized by SNS ICE, multiple experts from EU side (SNS JU, 6G-IA, SNS ICE) and representatives from the various National Initiatives (NI) brainstormed in sub-groups about the next steps that could reinforce collaboration on various fronts. Based on the output of these brainstorm sessions, as well as additional contacts that SNS ICE partners have maintained with EU partnerships, working groups and national representatives, a set of concrete recommendations were established for three main topics, which SNS ICE partners can follow up on. These proposed collaboration actions are described in the below sub-sections focusing on the **What**, **Who** and **When**, in order to highlight a concrete way forward.

10.2.1 Exchange of Information

In multiple interactions with the National Initiative representatives, as well as during the SNS ICE Techritory 2023 event, it has been highlighted that an improved flow of information between the various EU instruments and (at least) the main EU Initiatives would be desirable. This concept describes the need for a designated convergence point where relevant information may always be available for interested parties, as well as an established way of communication for information exchange among the various EU and NI representatives. The goal of such a “mechanism” would be for NI representatives to be kept up to date with developments regarding SNS JU funded projects and other relevant EU R&I activities, while on the other hand EU officials and representatives would also have an easy way of discovering key information about specific National Initiatives and how these align with the EU roadmap. Further, this mechanism would include a common communications channel, where relevant information (e.g., on upcoming events, webinars/presentations, announcements, etc.) would be easily and efficiently exchanged among the various representatives, hence facilitating dynamic information exchange and ensuring that all key developments, results and events are known to all stakeholders.

With that in mind, the brainstorming session that took place during the National Initiatives co-creation event at 5G Techritory 2023, proposed some concrete steps forward to set in place such a mechanism. These steps were

subsequently discussed with the SNS OPS project as they implement most of the information exchange facilities within the SNS JU. The resulting key elements proposed are explained in Table 20.

Information Exchange – Brainstorm Session Outcome			
WHO (information/service to be provided)	WHAT	DESCRIPTION	WHEN
<p>SNS ICE (Overall organisation + Provision of SNS JU information)</p> <p>National Initiatives Representatives (Provision of relevant information from NI side)</p>	<p>Overview shared document with:</p> <ul style="list-style-type: none"> Catalogue of Experimentation Facilities National Initiatives Key Info 	<p>A publicly shared overview document should be created which brings together key information both related to the SNS JU projects as well as related to the various national initiatives in the EU. More specifically the following elements of such a shared document were identified:</p> <p>Catalogue of Experimentation Facilities: A catalogue of the available B5G/6G experimentation facilities around Europe (both from SNS JU projects and from national Initiatives) and their key characteristics should be available. This would offer a quick overview of the experimentation landscape in Europe and would provide relevant links for further, more detailed information</p> <p>National Initiatives Key Information: A webpage containing key information about the main EU National Initiatives including research topics of focus, available testbeds, available funding, relevant links for more detailed information and contact persons for further inquiries.</p>	<p>Provision of information by SNS ICE, and NI by <u>end of March 2024</u>.</p> <p>Distribution of document by <u>end of April 2024</u>.</p>
<p>SNS ICE (Overall organisation)</p>	<p>Online Calendar for upcoming Events</p>	<p>A common online calendar where each party can enter relevant events, keeping</p>	<p>Common online calendar</p>

<p>SNS OPS (Provision of calendar)</p> <p>NI Representatives + SNS projects (enter relevant events on calendar)</p>		<p>other stakeholders aware of upcoming events. NI representatives and SNS JU representatives (SNS projects, 6G-IA, SNS JU office) may provide information on upcoming events / webinars / sessions, to create awareness and to allow for other representatives to join open events.</p>	<p>implementation by <u>end of April 2024.</u></p>
<p>SNS ICE (email list creation)</p>	<p>Common list of e-mail contacts</p>	<p>A list of e-mail contacts containing key representatives from the SNS JU (SNS JU office, CSA projects, 6G-IA) and at least 1 representative from each main EU National Initiative, to facilitate communication among stakeholders and widescale reception of relevant announcements. This list can also be used for the organisation of common events.</p> <p>Attention: caution should be taken by all participants in the list to not misuse the list with intensive messaging (spam) and to treat the list in accordance with GDPR rules.</p>	<p>Email list implementation by end of February 2024.</p>

Table 23: Suggestions to improve information exchange

10.2.2 Aligned approach towards standardisation (EU use case input)

As the research and innovation work towards the next generation of networks is progressing around the globe, the availability of timely and effective inputs towards the relevant standardisation bodies will become of utmost importance. It is the intention of the SNS JU and the National Initiatives that a certain degree of alignment is achieved among the European stakeholders with regards to specific key issues, to present a “united front” in the relevant standardisation discussions and to maximize the potential impact of EU-originated ideas/solutions within global standardisation.

One such opportunity is the upcoming 3GPP Workshop to discuss the main use cases that will be considered for next generation (6G) networks. This workshop, which will likely take place in May 2024, will set the priorities with regards to the main use cases to be considered / targeted during the development of 6G features & technologies.

During the NI co-creation event at Techritory 2023, a group of experts from both the SNS JU and the National Initiatives brainstormed on ways to better prepare for this global workshop and on how the various EU

stakeholders could potentially align, based on their respective work on 6G use cases, to maximize the impact achieved by EU side during the global 3GPP workshop. The approach proposed in the table could also form a model for future collaboration between the SNS JU and the National Initiatives in other relevant matters. The outcome of this brainstorming session and the agreed next steps are presented in Table 18.

Aligned EU approach towards global 3GPP workshop on 6G use cases	
WHO (information or service to be provided)	<ul style="list-style-type: none"> • SNS JU (SNS JU office + SNS ICE + 6G-IA) <ul style="list-style-type: none"> ○ Lead the organisation of this exercise, the preparatory work and organize the preparatory meeting • National / Sectoral Initiatives <ul style="list-style-type: none"> ○ Provide their experts and views with regards to the 6G use cases • SNS Projects <ul style="list-style-type: none"> ○ Provide input based on their work on 6G use cases • 6G-IA Pre-Standardisation WG <ul style="list-style-type: none"> ○ Provide consolidated input based on their expertise <p>*The SRG should also be leveraged to include the view of the EU member states.</p>
WHAT	<p>A consolidated European contribution to the 3GPP workshop on 6G Use cases: The goal is to bring all relevant EU stakeholders and experts together, both from the SNS JU side as well as from the NI side, to discuss their priorities with regards to the envisioned 6G use cases and to eventually agree on a common proposal to be supported towards the 3GPP workshop.</p> <p>Input from all the EU experts should be consolidated and all relevant bodies (such as the SNS JU office, the 6G-IA GB, the SNS SB/TB, the SRG) should be included in the process. The resulting contribution to the 3GPP workshop should reflect the needs and priorities of all the key EU stakeholders and should be supported by all relevant EU bodies during the workshop.</p>
WHEN	<ul style="list-style-type: none"> • November 2023 – March 2024: Preparatory work, with offline alignment between experts/stakeholders, exchange of relevant documents and formulation of early draft of EU consolidated contribution. • March 2024: Preparatory meeting among all key stakeholders to discuss and generate stable draft of EU consolidated contribution. • March 2024 – May 2024: Application of discussed comments/feedback during the meeting, review period and generation of final version of EU consolidated contribution. • May 2024: Contribution to the 3GPP workshop & promotion of EU consolidated contribution.

Table 24: Suggestions to align EU approach towards standardisation

10.2.3 Identification of topics and areas for collaboration

Many of the National Initiatives are interested in collaborating with other national initiatives or with the SNS JU programme. However, it is often not clear which topics would be of mutual interest. The idea is to organise a workshop where different National Initiatives could brainstorm and discuss what specific topics can benefit from joint activities. Topics that are identified may e.g. lead to bilateral or multilateral joint project or or could potentially be included in a future edition of the SNS JU work programme.

To influence the SNS JU work programme, a workshop early in 2024 would be preferable. However, it was requested to collocate the workshop with another event (e.g. EUCNC) to allow for more participation, also from smaller national initiatives.

Identification of R&I topics for collaboration	
WHO	<ul style="list-style-type: none"> • SNS JU (SNS JU office + SNS ICE + 6G-IA) <ul style="list-style-type: none"> ○ Organisation of a workshop ○ Aim to get workshop on EUCNC agenda or co-located with EUCNC • Large and small National Initiatives <ul style="list-style-type: none"> ○ Provide input on possible collaboration topics
WHAT	<p>A workshop to identify topics for R&I collaboration: The goal is to identify R&I topics where additional joint activities between national 6G initiatives or between national initiatives and SNS are beneficial. Topics may be identified that address a specific joint interest, or a gap, between national or EU 6G initiatives. Also, topics may be identified that are not currently in the 6G R&I programmes, but now with hindsight of the first years of 6G research, deserve to be addressed. The topics that are identified may lead to bilateral collaboration projects or could potentially be included in a future edition of the SNS JU work programme. The workshop should not be exclusive to the large National Initiatives only. Also, smaller National Initiatives should be invited to participate.</p>
WHEN	<ul style="list-style-type: none"> • EUCNC June 2024: The idea is to organize a physical workshop to enable brainstorming and discussion. The intention is to co-locate such a workshop with another event of interest to the R&I community (such as EUCNC). Co-locating with an event that already has many researchers attending will stimulate attendance to the workshop. On the other hand, June 2024 will be late to incorporate any results in the SNS JU 2025 work programme.

Table 25: Suggestions to find specific R&I topics for collaboration

10.3 Additional possibilities for collaboration

Next to the three main actions described in the preceding paragraphs, the co-creation event at 5G Techritory on National Initiatives also identified other possible collaboration actions. These were either identified based on the results of the special SRG workshop, interviews and talks with National Initiatives, or presentations at the Techritory co-creation event. The following possible collaboration actions were not selected as one of the three main actions for SNS ICE to elaborate. Nevertheless, they may be of interest to pursue, e.g. by the National Initiatives themselves.

- Building open and accessible pan-European infrastructures: Investing in infrastructures that may be used by several countries, such as an experimental test network for 6G, could be a great way to increase collaboration at a European level.
- Stimulate National Initiatives to consider not only R&I activities but also raising awareness on 6G: It was noted that during 5G R&I, insufficient resources and focus was laid on raising awareness among the general public, which led to a negative attitude towards the technology. For future technologies and their eventual adoption by the public, it is important to raise awareness in a timely and correct manner.
- Boost the engagement of (deep tech) SMEs: It is important to ensure that SMEs are able to take advantage of the national initiatives to become present at a pan-European level.
- Align timing of calls in national initiative with timing of SNS calls: It would be beneficial to align the timings of the calls such that these opportunities are exploited in an optimal manner.

- Use CELTIC-NEXT framework for specific collaborations between different countries: The CELTIC-NEXT already offers a framework that allows for specific collaborations, and leveraging this might be a great way to collaborate with other national initiatives.
- Leverage the SNS SRG: The State Representative Group consists of representatives from all member states of the EU and meets regularly to discuss matters. This is a common point where all countries collect and could serve as an excellent opportunity to discuss collaboration and derive actionable suggestions.
- Federating universities: universities are the breeding grounds of new ideas and federating universities could serve the larger purpose of more R&D&I collaboration on 6G.
- National initiatives should be able to participate in SNS / 6G-IA Working Groups: Representatives from the NI being included in the regular working groups of 6G-IA is an easy way to increase collaboration between SNS projects and national projects.
- Provide a solution for legal issues that can be a barrier for collaboration (e.g. collaboration agreements): the SNS office can provide a generic template for collaboration agreements, NDAs, etc., that is agreeable for all countries as well as for 6G-IA/SNS such that collaboration between them may be established swiftly and without bureaucratic delays.
- Member states report provides information on national and regional initiatives: This report is published on a yearly basis and provides a comprehensive overview of not only the large national initiatives but also other national and regional initiatives and can help identify suitable areas for collaboration.
- Allow SNS flagship projects to act as a communication booster between the SNS JU and the national initiatives (e.g., roadmaps, match-making opportunities, etc.): The flagship projects of the SNS, such as the HEXA projects, generally include contributions from many countries, and thus serve as an excellent platform for starting collaboration.

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Annex – results of the special SRG session on collaboration

At a special SRG session on collaboration with national initiatives 6th of June 2023 at the EUCNC conference in Gothenburg, a list of possible collaboration actions has been identified in group brainstorm discussions. These actions can be both at an SNS-level as well as the level of the national initiatives themselves. These actions are summarized below:

- Align strategies, where possible, to empower EU stakeholders and expand business models (e.g., technological sovereignty, policies on sustainability, societal challenges, etc.)
- Create a complete picture of the EU ecosystem on Smart Networks and Services (identify opportunities, strengths, gaps). The national initiatives can provide contact persons to facilitate this information exchange.
- Build open and accessible pan-European federated infrastructures.
- Disseminate 6G benefits to increase public awareness and engagement and attract new workforce to the ICT technologies. A wider set of actors needs to be engaged (e.g., from the social sciences).
- Steer national initiatives to consider providing resources not only on R&I activities but to raising awareness on 6G (citizens, verticals, etc.)
- Improve communication among the national initiatives and the SNS, through workshops, a common repository, newsletters, and match-making support.
- Exchange information on standardisation priorities and opportunities.
- Design a framework to transform 6G knowledge and results into a format suitable for (life-long) learning and training.
- Best practices dissemination activities for verticals to increase their 6G uptake and the verticals' digitization process
- Plan for coordinated efforts on activities to ensure physical resilience of 6G.
- Boost the engagement of (deep tech) SMEs by helping them presenting their portfolio and giving them information on opportunities on SNS and national projects.
- Ensure that SMEs are able to take advantage of the national initiatives to become present at a pan-European level.
- Allow flagship projects to act as a communication booster between the SNS JU and the national initiatives (e.g., roadmaps, match-making opportunities, etc.)

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