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Finland's 6G roadmap

Guidelines for developing and deploying next-generation mobile communication technologies for the 2030s

Working group for promotion of 6G communications technologies

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AND COMMUNICATIONS

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Abstract

On 10 May 2024, the Ministry of Transport and Communications appointed an interadministrative working group involving stakeholders to promote 6G communications technologies. The aim of the working group was to prepare a national 6G roadmap and encourage cooperation and exchange of information in the field of future-generation wireless network technologies. The term of the group ended on 31 May 2025.

Finland is a pioneer in mobile networks and aims to remain among the world's leading countries in developing and utilising the mobile networks of next generations. Finland's 6G roadmap provides an up-to-date national situation picture identifying its strengths, weaknesses, opportunities and threats. The roadmap describes the international framework for 6G, creates a vision for Finland for the 2030s and identifies the key steps for promoting this for 2025–2030. The identified key steps are related to spectrum and regulatory work, network security, standardisation, RDI activities and competitiveness of businesses.

The working group's efforts support the 6G advocacy work Finland is carrying out internationally. The national 6G roadmap will provide important input for a project launched by the Ministry of Transport and Communications on Security and New Economic Growth from Information Networks (TUUTTI) as well as for other topical projects on digitalisation and communications policy. The TUUTTI project will also provide a framework for monitoring the achievement of the goals presented in the roadmap.

Keywords	mobile services, communications networks, mobile networks, technology, technological development, broadband networks, digitalisation		
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Kuvailulehti

22.9.2025

Kansallinen 6G-tiekartta
Suomen askelmerkit 2030-luvulle seuraavan sukupolven matkaviestinteknologioiden kehittämiseen ja käyttöönottoon

Liikenne- ja viestintäministeriön julkaisuja 2025:7

Julkaisija	Liikenne- ja viestintäministeriö		
Yhteisötekijä	6G-viestintäteknologioiden edistämisen työryhmä		
Kieli	englanti	**Sivumäärä**	35

Tiivistelmä

Liikenne- ja viestintäministeriö asetti 10.5.2024 poikkihallinnollisen ja sidosryhmiä osallistavan 6G-viestintäteknologioiden edistämisen työryhmän. Työryhmän tavoitteena on ollut Suomen kansallisen 6G-tiekartan valmistelu sekä tiedonvaihdon ja yhteistyön edistäminen tulevan sukupolven langattomien verkkoteknologioiden osalta. Työryhmän toimikausi päättyi 31.5.2025.

Suomi on matkaviestinverkkojen pioneerimaa ja Suomen tavoitteena on olla maailman kärkijoukoissa myös seuraavien sukupolvien mobiiliverkkojen kehittäjänä ja hyödyntäjänä. Kansallisessa 6G-tiekartassa muodostetaan ajantasainen kansallinen tilannekuva ja tunnistetaan siihen liittyvät Suomen vahvuudet, heikkoudet, mahdollisuudet ja uhat. Tiekartassa kuvataan 6G:hen liittyvää kansainvälistä viitekehystä sekä muodostetaan Suomen tavoitetila 2030-luvulle ja tunnistetaan tämän edistämiseksi keskeiset avainaskelmerkit vuosille 2025–2030. Tunnistetut avainaskelmerkit liittyvät taajuus- ja regulaatiotyöhön, verkkoturvallisuuteen, standardointiin sekä TKI-toimintaan ja yritysten kilpailukykyyn.

Työryhmän työ tukee Suomen kansainvälistä 6G-vaikuttamistyötä. Kansallinen 6G-tiekartta antaa myös tärkeitä syötteitä liikenne- ja viestintäministeriön käynnistämälle turvallisuutta ja uutta talouskasvua tietoverkoista (TUUTTI) -hankkeelle sekä muille ajankohtaisille digitalisaatioon ja viestintäpolitiikkaan liittyville hankkeille. Samalla TUUTTI-hanke mahdollistaa tiekartan tavoitteiden jatkoseurannan.

Asiasanat	mobiilipalvelut, viestintäverkot, matkaviestinverkot, teknologia, teknologinen kehitys, laajakaistaverkot, digitalisaatio		
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Presentationsblad

22.9.2025

Nationell 6G-färdplan
Finlands färdplan för utveckling och införande av nästa generationens mobilkommunikationsteknik på 2030-talet

Kommunikationsministeriets publikationer 2025:7

Utgivare	Kommunikationsministeriet		
Utarbetad av	Arbetsgrupp för att främja 6G-kommunikationsteknik		
Språk	engelska	**Sidantal**	35

Referat

Kommunikationsministeriet tillsatte 10.5.2024 en sektorsövergripande arbetsgrupp som involverar intressenter för att främja 6G-kommunikationsteknik. Arbetsgruppen har som mål att bereda en nationell 6G-färdplan för Finland och främja samarbete och informationsutbyte inom nästa generations trådlösa nätteknik. Arbetsgruppens mandatperiod gick ut 31.5.2025.

Finland är ett föregångsland i fråga om mobiltelenät. Målet är att vara ett av världens ledande länder inom utveckling och användning av nästa generations mobila nät. Den nationella 6G-färdplanen bildar en aktuell nationell lägesbild och analyserar Finlands starka och svaga sidor samt möjligheter och hotbilder. Färdplanen beskriver den internationella referensramen för 6G och formulerar Finlands målläge för 2030-talet. Dessutom identifieras viktiga utvecklingsetapper för 2025–2030. Etapperna anknyter till frekvenser och reglering, nätsäkerhet, standardisering samt FUI-verksamhet och företagens konkurrenskraft.

Arbetsgruppen stöder Finlands internationella 6G-påverkansarbete. Den nationella 6G-färdplanen bidrar också till kommunikationsministeriets pågående projekt för säkerhet och ny ekonomisk tillväxt via datanät (TUUTTI) samt andra aktuella projekt relaterade till digitalisering och kommunikationspolitik. Samtidigt möjliggör TUUTTI fortsatt uppföljning av färdplanens mål.

Nyckelord	mobiltjänster, kommunikationsnät, mobiltelenät, teknik, teknisk utveckling, bredbandsnät, digitalisering

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Contents

1 Introduction: Guidelines towards the next generation

Finland is a pioneer in mobile communication technologies and, despite its size, among the global leaders as a developer and user of network technologies. However, the country will only be able to maintain this leading position in the steps towards the next generation of mobile networks by making continuous efforts and setting clear objectives. In order to succeed, a country of Finland's magnitude needs comprehensive cooperation between the public and private sectors, as well as systematic measures towards a common goal.

The Ministry of Transport and Communications appointed a working group for the promotion of 6G communication technologies for the period 10 May 2024–31 May 2025. The aim of the working group is to identify guidelines for Finland to develop and utilise next-generation mobile communication technologies. In addition to preparing Finland's 6G roadmap, a key objective was to promote the exchange of information and cooperation between various parties, such as the research community, the business sector and the central government.

The exploration of security issues as an aspect of the promotion of 6G technologies is also a key priority for Finland. The Advisory Board for Network Security appointed by the Government has supported the 6G working group in the preparation of the roadmap to ensure that different areas of security, such as network security, resilience and supply chain security, are taken into account in the development, standardisation and deployment of 6G in a proactive manner. Finland's objectives include the creation of a comprehensive early risk management model at the national level. At the EU level, Finland aims to promote an integrated security management model before the next generation of networks enters the market.

Finland has no technology-specific strategy for mobile communication technologies, which the 6G roadmap would implement. However, many documents serve as references for the 6G roadmap work. Finland's digital compass sets a frame for the roadmap, guiding the development of digitalisation as part of the Europe's Digital Decade 2030 programme and also including objectives and measures related to network infrastructure and technologies. The Government's Digital Compass report contains, for example, objectives related to research on 6G and RDI funding, as well as the coverage of communications connections and cybersecurity.

Meanwhile, Finland's Cyber Security Strategy 2024–2035 and the related implementation plan serve as key reference documents for network security matters. The strategy has identified that the rapid development of 6G technology and other disruptive technologies such as artificial intelligence, quantum computing, cloud services and satellite technologies poses challenges to cybersecurity. The strategic development proposals presented by the Cyber Security Strategy include proactive efforts to prepare for the threats and opportunities stemming from the development of new disruptive technologies, such as regulation and active advocacy related to international standardisation.

Finland was among the first countries to adopt a Climate and Environmental Strategy for the ICT Sector 2021, which also sets a framework for ecologically sustainable 6G research, development and deployment. While the construction and use of 6G networks affects the carbon footprint of communications networks, 6G can simultaneously promote the achievement of the Sustainable Development Goals (SDGs) in other sectors and enable more energy-efficient transfer of data. The planning, construction and operation of 6G communication technologies should aim for energy efficiency in accordance with the Climate and Environmental Strategy for the ICT Sector.

The purpose of Finland's 6G roadmap is to complement the objectives these three strategy documents set for each 6G technology for the 2030s and to list the key steps for achieving these targets for 2025–2030.

In the coming years, Finland's communication network policies until 2037 will also be formulated in the Ministry of Transport and Communications' Security and Growth through Information Networks (TUUTTI) project launched in March 2025. The project will also cover the topics of technological developments and changes in the global operating environment. Finland's 6G roadmap provides key inputs to the project's work, including aspects related to mobile communication networks. At the same time, the TUUTTI project enables further monitoring of the objectives of the roadmap.

2 National situation picture 2025

Finland's work related to 6G is built on a strong and comprehensive competence base. However, the operating environment is marked by uncertainties, including changes in geopolitics, as well as increasingly fierce competition. Technology, security and competitiveness are intertwined in a changing operating environment. The table below presents factors that affect Finland's chances of success.

Table 1. SWOT analysis of Finland's situation picture, 2025.

6G in Finland SWOT	
Strengths	**Weaknesses**
Long experience in the research and development of mobile communication technologies and a high utilisation rate of mobile technologies in Finland Strong public-private cooperation and joint RDI activities between research organisations and commercial players Extensive high-quality expertise, industry and business throughout the supply chain Innovation enabling testing infrastructure and environmentally friendly energy production Spectrum management, granting of network licences and security regulation that encourage investments Sustainable value base and political will for 6G development	Limited investment capacity and asset poverty in Finland and Europe Limited resources due to Finland's small size: RDI funding, competent workforce, narrow business sector, challenges related to the scaling of SMEs Untapped potential in industrial verticals and 5G technology deployment in businesses Decentralisation of research organisations' resources, lack of specialisation and marginalisation of research topics relevant to standards and regulation Challenges related to decision-making anticipating future technological and geopolitical developments

6G in Finland SWOT

Opportunities	Threats
Scope of innovation opportunities in 6G technologies: verticals, applications and new technologies such as quantum, AI and satellite technologies	A further decline in limited resources, such as funding or the availability of experts. Insufficient spectrum resources for 6G.
Growing demand for sustainable, energy-efficient and secure network solutions	Challenges related to the implementation and monetisation of complex 6G technology due to issues such as the different timing of technological development and investment cycles
Reputation as a reliable international partner and the business opportunities emerging from international partnerships, such as Finland's NATO membership	New cybersecurity threats, more extensive attack surfaces, and risks posed by harmful dependencies
Possibility of take proactive and well-timed measures to ensure competitiveness and security before 6G investments	The impacts of geopolitics and technological sovereignty on companies' prerequisites for competition and a threat caused by the fragmentation of standardisation

2.1 Finland's agility as an asset in a changing operating environment

Finland's strength in 6G technologies lies in its long history and experience in the research and development of mobile communications systems. Finland has a strong competence base, a dedicated research sector and domestic equipment suppliers of network technologies. Cooperation between research organisations and commercial players has resulted in the establishment of a strong 6G ecosystem in Finland, which has attracted high-quality expertise and industry to Finland, also from an international perspective. Finland has extensive expertise that covers the entire service and production chain of the mobile communications system. Finland also has a testing infrastructure that enables innovation, which is supported by flexible opportunities for obtaining radio licences for testing activities. Finland's low-carbon, relatively stable and affordable energy production provides a good starting point for the ecologically sustainable deployment of 6G.

Finland has a strong reputation, a sustainable value base and a political will for 6G development, which is also reflected in high-quality 4G/5G mobile networks and the high utilisation rate of mobile technologies. Finnish operators offer mobile data subscriptions with unlimited data transfer at a reasonable price and invest in new mobile technologies at an early stage. The country's communication networks are highly resilient against information security incidents, and Finland is also a pioneer in preparedness related to information networks. The regulatory model used for network security and applied to all network technologies is flexible and enables the development of networks.

Finland has also developed and promoted the use of local and private mobile networks. The deployment of these networks has been made possible by legislative changes, licence conditions and spectrum allocations, as well as the adoption of 5G technology. The opportunities of new communication services in the vertical sectors will be further enhanced by 6G deployment.

Strong investments in the work revolving around 5G will promote the utilisation of 6G technology, and, in relative terms, Finland has already made a lot of progress in 6G development and research. There is a strong culture of collaboration and joint activities between companies, universities and public administration in Finland. The country’s small size lends itself to implementing the coordination of advocacy work efficiently. For example, as network security has been developed in Finland for a long time through cooperation between the private and public sectors, as well as cross-administrative cooperation, Finland is capable of identifying security threats in an anticipatory manner. The regulatory work carried out in Finland, especially in the context of regulation and spectrum management, is valued globally, and Finland has actively participated in the development of regulation in the sector. The active spectrum management and allocation carried out in Finland, free from fiscal objectives, serves as a good example for other countries, as it has contributed to promoting Finland’s position as a leading country in mobile communications. In RDI activities, Finland successfully influenced the European perspective in EU flagship projects and obtained EU funding through its participation in international projects. Finland has also participated in international cooperation, for example, in the International Telecommunication Union (ITU) and in the field of military networks and dual-use items, which has become increasingly active as a result of Finland's NATO membership. This also increases business opportunities related to the use of 6G in defence use.

Finland’s small size creates agility and adaptability to new situations. At the same time, many of Finland's weaknesses in the promotion of 6G stem from the country's small size. Finland has limited resources when it comes to the size of its

national economy and domestic market, the amount of RDI funding in relation to larger countries, infrastructure investments or skilled labour. The business field in the sector is narrow and the number of Finnish companies operating on the international market is small. SMEs are faced with challenges related to scaling, which can be explained by factors such as the asset poverty of Finland and Europe and the scarcity of RDI funding on a global scale. The current low level of 5G technology utilisation in industrial verticals and the business sector does not promote an increase in domestic demand. In addition, there is a challenge related to coordinating business investment cycles with access to technology.

In the field of research, Finland is challenged by the decentralisation of resources and a lack of systematic cooperation and specialisation. On the other hand, the sector also has significant research ecosystems identified to play a strategic role. The significance of standardisation and its connection to regulation could be identified better in 6G research. The scarcity of funding instruments and the fact that public RDI funding cycles are not always compatible with the needs of research organisations and industry create bottlenecks in research activities. The basic funding of research organisations plays an important role in enabling the launching of cooperation between companies and higher education institutions flexibly. Finland's limited ability and opportunity to attract international experts also pose a hindrance. There is a risk that Finland will lose more and more of its research and development activities to other countries.

2.2 Need to seize innovation opportunities while managing security risks

A new generation means new opportunities for Finland's success story in mobile technology. Although the specification of 6G technologies is only in its early stages, 6G emerges as a versatile channel for communication and environmental observations in difference scenarios. The development of mobile technologies will be influenced by the convergence of different disruptive technologies. In particular, the use of artificial intelligence and robotics will play a significant role, and the importance of augmented reality (AR) and other immersive technologies will gain emphasis. In addition to developing radio technologies, semiconductor technologies are key network components and critical success factors for technology companies. 6G will enhance the utilisation of decentralised and edge computing, which means that data processing will take place closer to the operations instead of in cloud centres. Decentralised artificial intelligence and computing will enable new services, such as hologram meetings and genuine

virtual interactions between people. In addition, the combination of new satellite technologies with 6G will enable global connections on land, at sea, in the air and in space. In addition, undersea communication and new long-range radio technologies will create new innovation opportunities.

The convergence of technologies and the utilisation of disruptive technologies such as artificial intelligence, satellite and quantum technologies in mobile networks will create opportunities for different parties to innovate and develop 6G-related services, and create services and products based on 6G. 6G technologies enable smart, real-time and high-performance computing tasks and applications, which will provide application developers with significant innovation opportunities. New business opportunities that increase productivity exist across nearly all sectors of society, from industry to smart cities and from the health sector to the extended reality enabled by the metaverse, i.e. XR.

6G technologies will also provide monetisation opportunities in the defence industry through the commercial application of new security solutions. For example, satellite-based services utilising mobile communications technology may provide new opportunities for the safety and rescue authorities to operate in different operating environments independently of specific location and coverage areas. Meanwhile, the software-based nature of 6G networks and the utilisation of artificial intelligence and quantum technology will promote anomaly detection and network security. The network's sensor functionality will also enable the observation of the physical environment to improve security, which will also create new business opportunities for the defence sector and smart city projects, among others.

Demand for secure network solutions arises from new cyber security challenges. As Finland has expertise in both security and technology, the country is well placed to develop resilient 6G network solutions that can be developed into an export product for the international market and also meet the needs of the security and defence sector. Finland may also benefit from the business opportunities brought about by its NATO membership. There is also a growing demand for solutions enabling sustainable development, and 6G may become part of the solution to sustainability challenges, such as higher energy efficiency, which was one of the goals set in the Climate and Environmental Strategy for the ICT Sector, as well as better service availability. Finnish companies and research organisations can promote solutions to sustainability challenges by developing green technology and environmentally friendly network solutions. Finland's 6G story also has the potential for the early utilisation of 6G in vertical sectors.

Encouraging this will play a key role in tapping the potential of the 6G business market. Multidisciplinary and cross-sectoral cooperation is also needed, especially to utilise disruptive technologies in 6G development.

Indeed, Finland needs joint efforts not only to seize opportunities but also to manage security risks as we transition towards the next generation of mobile communications. Finland's geographical location and conditions, such as Finland as a sparsely populated country, create security risks and challenges for network construction.

At the same time, the changing operating environment and increasingly fierce competition involve new threats to Finland's success story. Geopolitical and geoeconomic competition is ramping up. Risks related to harmful dependencies are growing both in networks as well as in the cloud services they use. As a result of changes in the geopolitical operating environment, the questions of economic security and technological sovereignty are also gaining emphasis in Europe. Sufficient self-sufficiency levels in Europe and better availability of European alternatives will play a more central role than before.

There is also a threat of fragmentation of international spectrum regulation and standardisation. In the context of spectrum regulation, the question is whether Finland will be able to ensure sufficient spectrum resources for the introduction of 6G in international cooperation with other progressive countries. Meanwhile, in 6G standardisation, there is a risk that instead of a single international standard, the standards will, instead, be fragmented into regional ones, which would pose challenges to the commercial feasibility of 6G, as well as the access to hardware, software and services. From the perspective of regulation, the risks include the fact that regulation has not been coordinated in a timely manner with the introduction of new technologies and technological developments, which was the case with, for example, the 5G Cybersecurity Toolbox. At the national level, it is also worth considering what would be a correct relationship between technology-neutral regulation and technology-specific regulation to ensure that the regulation will also reach the new special features of 6G, such as serving as a sensor network.

While 6G technologies involve opportunities, they also pose threats to the future of Finland's success story. 6G is emerging as a complex entity composed of different technologies, and the management of the resulting complex family of technologies, enabled by technologies ranging from artificial intelligence to microelectronics and from cloud implementations to software development, requires multidisciplinary

competences. There is also a risk that 6G will not meet the expectations of end-users or that the business incentives to introduce the new features of 6G are insufficient.

The relatively low investment capacity of the vertical industry in 6G development could result in challenges related to commercial application and monetisation. In addition to the consumer market, the business market will become an increasingly important driver for demand for mobile communication technologies, including private mobile networks. The different timing of investment and technological development cycles, referring to a mismatch between the available technology and demand at a specific time, may also emerge as a challenge to deployment.

6G will also introduce certain new security threats. For example, in the integration of telecommunications networks and AI, it is important to pay attention to ethical and security challenges related to AI, which are among the key problems to be solved in research and product development in the near future. In addition, as technology becomes increasingly complex and software-based, the possibilities of ensuring the security of technology through technical means in advance will decrease, while the role of trust in technology suppliers will increase. A persisting threat related to 6G is the emergence of potential dependencies with authoritarian countries. A more extensive threat involves a risk of the management of key network components and the transfer of data outside the EU, due to aspects such as the increasing use of satellites and cloud services. There will also be an increase in software-based solutions and the use of cloud services from a supply chain perspective. Growth in the number of devices will also increase the attack surface of the network.

Together, comprehensive risk management and seizing the opportunities of new technologies ambitiously create the prerequisites for redeeming Finland's strong reputation at the international level. Finland's brand is to be a reliable international partner country and a leading country in democracy, wellbeing and sustainable development.

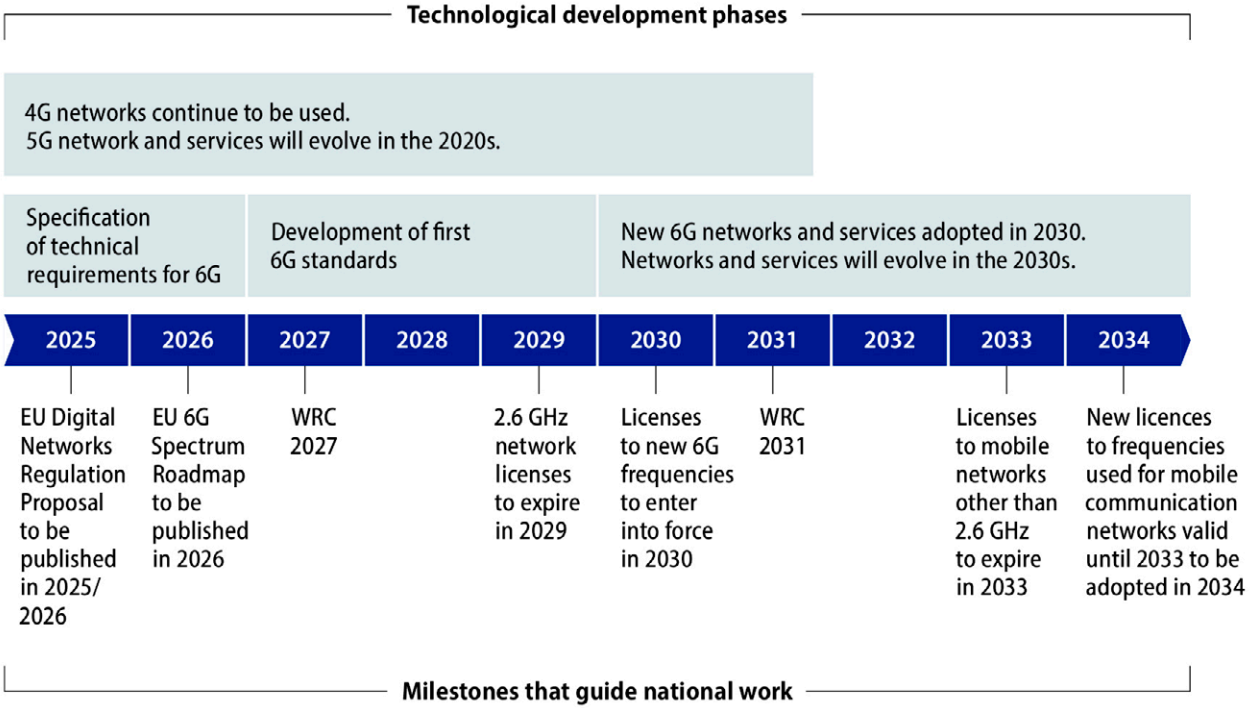
International partnerships, including EU and NATO membership, create a stable operating environment and new business opportunities. In addition, one of the benefits brought by Finland's early involvement is the opportunity to take well-considered measures to ensure competitiveness and security already during the development and standardisation phase of 6G technologies before investments become topical.

3 International framework and vision for Finland for the 2030s

Finland's pioneering role in the development of mobile communication technologies gives it a head start at the international level, and Finland has good prerequisites to be among the leading countries in 6G deployment when national measures are planned in view of the international timeline and framework. The implementation of the International Telecommunication Union ITU's IMT towards 2030 and beyond (IMT-2030) timeline would begin in 2030 and continue for a decade. The technical specification of requirements is guided by the 6G vision prepared by the ITU and its use scenarios and principles. The international 6G vision creates a framework for Finland's national vision for the 2030s.

3.1 Timeline for 6G deployment

Figure 1. Timeline for 6G deployment



Finland's mobile networks are based on 4G technology introduced in the early 2010s and 5G technology introduced in the early 2020s.

5G technology continues to evolve and will continue to offer new features and opportunities for at least the rest of the 2020s. Telecommunications operators closed their 3G networks in the period 2023–2024, and the frequencies they used in the past will be deployed for newer mobile communications technologies. Telecommunications operators also have an obligation to maintain their networks based on 2G technology until the end of 2029 in mainland Finland.

In June 2023, the ITU adopted a new recommendation on the 6G (IMT-2030) framework. As a result, a global agreement was reached on the development targets for 6G technology for the first time. There are currently highly active research, development and innovation activities in the area, and Finland is one of the pioneers. The development of 6G aims at deployment in 2030, but the work to develop technology and services is likely to continue throughout the 2030s.

Spectrum and regulatory work will develop the preconditions for the construction of 6G networks and the utilisation of new services and use cases. Key milestones for spectrum work include the EU's 6G spectrum roadmap, which is expected to be completed in 2026, and the World Radiocommunication Conferences (WRC) organised under the ITU to be held in 2027 and 2031. Currently, the EU's legal project most relevant to 6G is the Digital Networks Act, for which a proposal is planned to be issued at the end of 2025. At the national level, important milestones also include future network licence decisions. A decision on granting licences enabling the construction of possible new 6G networks should be made so that the services can be deployed in 2030. The current 700 MHz, 800 MHz, 900 MHz, 1 800 MHz, 2 GHz, 3.5 GHz and 26 GHz licences valid in mainland Finland will expire at the end of 2033. The 2.6 GHz network licences for mainland Finland will expire at the end of 2029. Future licences must be prepared in an anticipatory manner, taking into account new requirements and business opportunities.

3.2 International high-level 6G vision: usage scenarios and overarching aspects

The ITU framework for IMT-2030, which includes 6G technology development targets, is a kind of international high-level vision for the next generation of mobile communications. As a result of Finland's advocacy efforts, the vision also contains

national key objectives for Finland, especially related to security and sustainable development. ITU's 6G vision creates a vision for national 6G work that has comprehensive principles and ambitious usage scenarios.

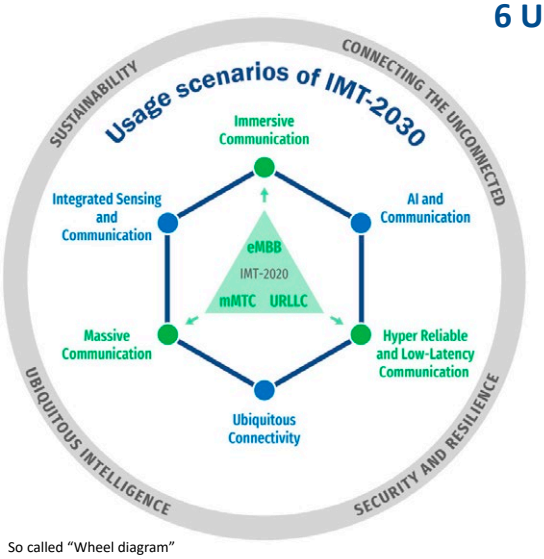
According to ITU, the different 6G usage scenarios have been designed to expand the three usage scenarios of 5G, namely Enhanced Mobile Broadband (eMBB), Ultra-Reliable and Low-Latency Communications (URLLC) and Massive Machine-Type Communications (mMTC), to wider utilisation. These 6G usage scenarios will require advanced and new features. In addition to the extended 5G usage scenarios, 6G will enable new usage scenarios brought about by new features such as artificial intelligence and sensing.

Of the 6G usage scenarios that expand 5G, Immersive Communication will provide users with a rich and interactive video experience, including interaction with machine interfaces. Massive Communication is related to connecting to an extremely large number of IoT devices, including devices with very low power consumption and required bit rate, but with a potentially long connection distance to a base station. Hyper Reliable and Low-Latency Communication enables connections for purposes such as large-scale automation, control and use in industrial environments. Of the new usage scenarios, Ubiquitous Connectivity is expected to enable affordable connections and at least basic broadband services with extended coverage, also in sparsely populated areas. AI and Communication require support for high data transfer capacity and speed, as well as low latency and high reliability. Typical use cases include automated transport, autonomous cooperation between devices and the creation of digital twins and the prediction through them. Integrated Sensing and Communication provides situational awareness of radio equipment connected to the network as well as unconnected objects, and their movements and environment.

In addition to these usage scenarios, the development of 6G is guided in an overarching manner by the principles of sustainable development, connecting the unconnected, security and resilience, and ubiquitous intelligence.

Figure 2. The International Telecommunication Union radio sector's framework for the future development of IMT towards 2030 and beyond, i.e. the International high-level 6G vision. Figure: ITU.

Usage scenarios



So called "Wheel diagram"
Source: Document 5/131 and edited in SG 5

6 Usage scenarios

Extension from IMT-2020 (5G)

- eMBB ➡ Immersive Communication
- mMTC ➡ Massive Communication
- URLLC ➡ HRLLC (Hyper Reliable & Low-Latency Communication)

New

- Ubiquitous Connectivity
- AI and Communication
- Integrated Sensing and Communication

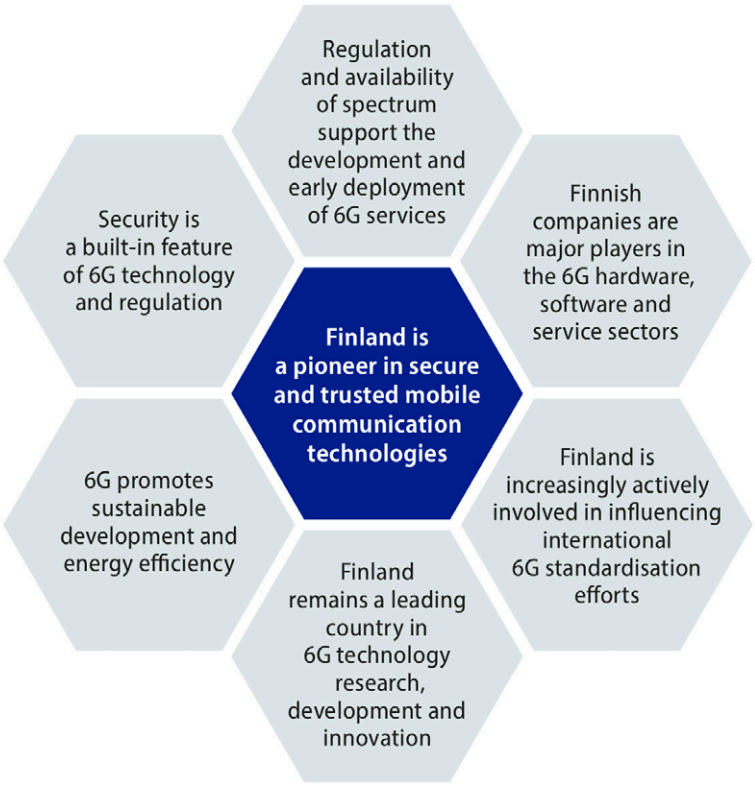
4 Overarching aspects:

act as design principles commonly applicable to all usage scenarios

Sustainability, Connecting the unconnected,
Ubiquitous intelligence, Security/resilience

3.3 Finland's 6G objectives

Figure 3. Finland's 6G vision for the 2030s



Finland aims to be a pioneer in secure and trusted mobile communication technologies. The aim is that 6G will provide highly advanced communications services for the different needs of consumers, business life and society in the 2030s. Finland's advocacy in international forums is crucial, enabling not only the deployment of networks and services evolved at the national level but also the success and leadership of Finnish companies in the international market. This will be facilitated by world-class RDI activities and experts, proactive regulatory and spectrum work and effective national and international cooperation. It is essential to influence the emergence of sustainable and secure 6G solutions, and that 6G will also promote the sustainable development, security and resilience of other sectors of society. The objectives of Finland's 6G roadmap are summarised in the themes presented in Figure 3, whose key steps are described in Chapter 4.

4 Key steps 2025–2030

In order to promote 6G technologies in Finland, the set of tools available to Finland must be examined extensively. Different policy sectors, such as communications policy, RDI policy and foreign and security policy, must steer development in the same direction and be mutually supportive. The work carried out on 6G at the national level has identified regulatory and spectrum work, network security, standardisation, RDI activities and the competitiveness of companies as particularly central areas.

Another key cross-cutting theme is the Sustainable Development Goals. Finland's objectives and measures for promoting sustainable development in the development and deployment of 6G technologies are linked to the UN's Sustainable Development Goals (SDGs). In the development of 6G, this means considering and promoting environmental, economic and social dimensions both nationally and internationally.

The roadmap has the following four priority areas for achieving Finland's national 6G objectives:

- Regulatory and spectrum work
- Network security
- Standardisation
- RDI activities and the competitiveness of businesses

The key steps for the priority areas in the period 2025–2030 are presented below. The implementation of the roadmap will be monitored as part of the TUUTTI project and, with regard to security issues, as part of the work of the Advisory Board for Network Security.

4.1 Regulatory and spectrum work

The focus of the regulatory work carried out by the Ministry of Transport and Communications and the Finnish Transport and Communications Agency Traficom is currently on ensuring adequate frequency resources for new 6G networks and

services, as well as proactive influence on future EU regulation. International advocacy to ensure the achievement of Finland's 6G objectives will continue well into the 2030s.

Finland has a long history in promoting the development and testing of mobile networks, especially by enabling radio licences for research and testing activities in a very flexible manner. Enabling RDI activities has been taken into account in the context of both mobile network licences and flexible national regulation.

This makes it possible for Traficom to grant radio licences for testing activities in different frequency bands, provided that they do not cause harmful interference to other radio frequency use and that the activities are in compliance with Finland's international obligations.

It is important to ensure that international decisions and national spectrum availability support both technological development and investment planning. The introduction of 6G also requires correctly timed policies on future network licence conditions, both for new frequencies suitable for 6G services and for the future use of the frequencies already in use.

Enabling new services will also require new ways of thinking and effective cooperation between the general government and business life. For example, in international cooperation, the convergence of satellite services with terrestrial mobile communications services is a topic of current interest. This development supports important 6G targets related to network coverage and resilience. Many regulatory questions related to this development remain unresolved and it is important to ensure that terrestrial mobile networks are not affected by harmful interference.

Enabling new frequencies suitable for 6G increasingly will require sharing the same frequency bands with other radio services, such as fixed-networks (radio links) and various satellite applications. When frequencies are shared by various applications, sufficient protection of all users can be ensured through means such as geographical separation, indoor and outdoor space separation or different detect and avoid technologies. This will require frequency and application-specific research as well as new regulation, technology and standardisation solutions.

In addition to influencing future EU regulation, it is important to understand and apply the regulation to enable new solutions. For example, in the application of EU network neutrality regulation, Traficom supports telecommunications operators

through engaging in active dialogue. Enabling flexible interpretation will ensure that network neutrality regulation will not result in unnecessary obstacles or delays in 6G use cases.

Key steps

- **Enabling early 6G deployment:** Exerting influence in the EU to harmonise sufficient 6G spectrum resources in time (including the EU's 6G Spectrum Roadmap). Ensuring that international decisions and national spectrum availability support both technological development and investment planning. Outlining the network licence conditions for new mobile communications frequencies sufficiently early to ensure that the planning of 6G network investments will be efficient and enable launching the services in 2030. Outlining the policies on the future use and terms of use of network licences expiring at the end of 2033 and associated frequencies sufficiently early.
- **Spectrum work:** Influencing international 6G spectrum work in accordance with Finland's objectives. Enabling sufficient spectrum resources in the EU's harmonisation efforts and ensuring appropriate technical conditions for mobile networks. Aiming for sufficient frequencies, for example from the upper 6 GHz band (at least 200MHz per operator), for mobile communications under conditions that enable use of macro base stations without unnecessary power limitations. For example, promoting the mobile use of frequencies below the 700 MHz bands. Deploying existing frequency bands to new generations of mobile networks efficiently and flexibly. Promoting the complementary use of satellite communication and their convergence with terrestrial connections. Promoting frequency allocation between different radio communication services and systems and dynamic spectrum use.
- **International regulation:** Continuing to set joint objectives and work to influence EU regulation proposals in cooperation between the public and private sectors. Influencing the EU legislation in the telecommunications sector and related industries, as well as the regulation of EU funding programmes to ensure that the programmes support investments in secure communications networks. Also carrying out advocacy work to prevent that the EU's net neutrality regulation, AI and cloud regulation and its implementation would pose unnecessary barriers to 6G use cases. Fostering closer dialogue with stakeholders through different networks to strengthen the understanding of international regulation. Organising training on regulation and

sharing topical information with researchers and other stakeholders. Increasing students' competence in the importance of regulation and standardisation as part of degree programmes in the field.
- **Needs of vertical sectors:** Using spectrum and licence policy and technical regulation to support the opportunities for deploying local and private networks and other technical solutions (e.g. network parameter customisation). Making sure that 6G development in the EU will not be exclusively focused on a consumer perspective, but that the needs of the business sector and other vertical sectors will also be taken into consideration.

4.2 Network security

In 6G, security requirements should be taken into account in standards based on a so-called "secure-by-design" principle (see 4.3). Security risks are managed according to the steps set forth in Finland's Cyber Security Strategy, including maintaining good cooperation between the authorities and telecommunications sector stakeholders, as well as strengthening the cyber readiness and preparedness of society and the state of cyber security training. The role of trust in technology suppliers becomes increasingly significant. The strategic security risks related to 6G are addressed through up-to-date regulation at the national and EU levels that takes technological developments into account and seeks an appropriate balance between technology-neutral regulation and, if necessary, technology-specific regulation targeting 6G.

The risk management measures at the EU and national levels should be proactive to avoid delaying 6G deployment. The measures must take into account the need to reduce harmful dependencies with third countries and they must be taken to ensure the security of supply chains. The threat landscape of the development of 6G must be examined comprehensively throughout the entire digital infrastructure, from submarine cables to satellites. In managing network security, the opportunities provided by disruptive technologies, such as artificial intelligence and quantum technologies, must be fully exploited and new security threats associated with them must be identified.

Key steps

- **Finnish and EU regulation:** Making sure that regulation is precise, predictable, future-proof and consistent. Ensuring that there is a well-considered relationship between technology-neutral regulation and possible regulation concerning the new special characteristics of 6G. Also assessing the appropriateness of requirements set for the location of critical systems and the services and functions safeguarded with them. The aim is to establish a common level of network security in EU regulation. Effectively influencing the preparation of new EU cybersecurity regulation at an early stage to avoid harmful segregation of Member States' cybersecurity regulation and promoting the utilisation of the EU's cybersecurity certification framework (EU Cybersecurity Regulation (EU) 2019/881). Promoting consistency between the Member States also in the implementation of cybersecurity regulation.
- **Security and reliability:** Technical risks must be managed through comprehensive measures at the EU and domestic levels. Ensuring that the measures taken to strengthen the security of 5G networks will lay a foundation for the deployment of secure 6G. In cooperation between the public and private sectors, monitoring threats related to 6G and the timeliness of network security legislation. Ensuring the security of 6G networks in the implementation of regulation by targeting steering and monitoring efforts to 6G network security. Taking the resilience of 6G technology and networks against radio interference and other disturbances into consideration. Improving the resilience and fault tolerance of telecommunications systems also plays a key role from the perspective of national security. In public procurement and service procurement in critical sectors, giving due consideration to customers' special requirements for the reliability of 6G network services in all circumstances. Combating the threats posed by the increasing number of terminal devices by ensuring the smooth and efficient implementation of the EU Cyber Resilience Act (CRA).
- **Strategic risks associated with hardware, software and (cloud) service providers:** Harmful dependencies will be managed through comprehensive measures at the EU and domestic levels. Ensuring the security of technology supply chains and the security requirements of cloud services and, if necessary, also compliance with sovereignty requirements to the extent required by the use case, as cloud services and edge cloud solutions continue to play an increasingly important role in 6G network solutions. Ensuring that strategic risks and harmful

dependencies related to 6G technology are also taken into account when granting network licences if necessary (see 4.1).

– **New technologies and open interfaces:** Enabling the full and appropriate use of new technologies that improve security and resilience, such as artificial intelligence, quantum and satellite technologies, both at a general level and especially in 6G security solutions. Ensuring that the initiatives related to quantum secure encryption and quantum technologies pay attention to the impacts on 6G network security. Also ensuring security in future radio network technologies based on open interfaces, such as Open RAN, by establishing security standards and certification processes for them equivalent to those used for traditional architectures.

4.3 Standardisation

Finland's key objectives in standardisation include creating global 6G standards and selecting Finnish companies' solutions as technology choices for these standards. For the perspective of companies, regional standards would lead to market fragmentation, the loss of economies of scale and a higher cost of 6G deployment.

Finland's objective is to maintain the current international standardisation system open to all stakeholders and to increase support and coordination instruments to encourage and enable the participation of Finnish and European companies and research organisations in the work of the standardisation organisations essential for 6G (3GPP, ETSI, ITU-R). The work of other standardisation organisations, such as IETF and IEEE, should also be monitored in contexts such as WLAN to identify factors that will affect the security of 6G networks.

Coordinating the participation of different national actors and the desired outcomes of their advocacy will also require governmental stakeholders to play a stronger role and the business sector to be more comprehensively involved. In order to increase impacts, stronger EU coordination and division of responsibilities, for example, within the framework of the ITU, will also help to share the workload. Standardisation organisations that play a key role in 6G, such as 3GPP, are 'contribution-based' and financial inputs may repay themselves as a competitive advantage in the market if the organisations manage to incorporate their own technological solutions in the standards. The best incentive for a stakeholder to participate in standardisation is to have their technology adopted as the basis for a global standard, opening up a broader market for their products. The aim of standardisation is also to increase the inclusion of Finnish companies' patented

technologies or technologies with patents pending in 6G standards. As a result, additional financial investments in standardisation should be examined through the added value it could produce for Finland's competitiveness, such as increasing the Standard-Essential Patent (SEP) portfolio.

Standardisation is also inherently related to network security management. Integrated network security in 6G will be ensured by influencing standardisation work. The aim is to avoid market fragmentation by pursuing global standards, which will enable setting internationally consistent basic requirements for technical security.

Key steps

- **International influence on global 6G standards:** Finland must strengthen its advocacy work in international standardisation to enable achieving the key objective of global 6G standards and technologies sufficiently early to make early deployment possible. Understanding of the link between standardisation and the international competitiveness of Finnish companies must be strengthened at the national level. There is particularly a need to enhance the involvement of Finnish SMEs and research organisations in the standardisation efforts. An international frontier must be established with key partner countries to pursue key objectives such as sustainable development and network security. It is also important to influence the standardisation of telecommunication solutions in vertical sectors that are important for Finland's competitiveness, and taking into account the promotion of the objectives of security authorities and the Defence Forces, especially in 3GPP and the NATO working group focusing on 5G/6G standardisation.
- **Strengthening national coordination and information sharing:** Finland must increase national coordination, prioritisation and support for companies and research organisations in 6G standardisation. Open cooperation and information sharing with public and business sector stakeholders and national standardisation organisations play a key role. For example, an information sharing network for 6G standardisation that would work towards common objectives and contributions would support Finland's active and consistent influence in international 6G standardisation work. The network would coordinate, for example, Finland's participation and influence in 6G in international standardisation processes and would particularly support the participation of SMEs and the third sector.

- **Incentives for participation:** To ensure that Finland will have strong expertise and sufficient resources to influence the standardisation organisations in the industry, the future national standardisation strategy should identify 6G as a national focus area. In this context, there is a need to explore the opportunities for increasing incentives for participation in standardisation related to national and EU-level RDI funding criteria. Research institutes and companies will be encouraged to collaborate to produce research results that can influence standardisation. To strengthen the participation resources, there is a need to raise awareness among Finnish stakeholders of the EU's financial support programmes for participation in 6G standardisation (e.g. StandICT.eu).
- **Sustainable development and security as priorities:** When selecting standardisation forums and allocating resources in Finland, the policy objectives for sustainable development and security must be taken into account nationally. In the technology choices, Finland aims to promote environmentally friendly and energy-efficient solutions to ensure sustainable development in 6G and prepare for the risks of cyberattacks brought by the new 6G capabilities, as well as to facilitate the resilience of networks through the latest available technical solutions and functions. Achieving 6G standardisation at the global level in line with the principle of security by design will require the involvement of security experts in the standardisation of 6G network security with a long-term approach and the allocation of national standardisation resources to the standardisation organisations' working groups on security. In standardisation, there is also a need to pay attention to the requirements set by use by the authorities and functions that support the authorities, and reconcile these with information security and the protection of confidential communications. Network security should also be a priority in a possible national information sharing network for 6G standardisation.

4.4 RDI activities and the competitiveness of businesses

Finland's objective is to be an attractive country for industry to invest in RDI activities related to 6G. This requires investments in 6G research in a multidisciplinary and coordinated manner at the national level, as well as cooperation with key partners in international consortia. In its work in international arenas, Finland's operations must be active and timely to take full advantage of the benefits and resources provided by the EU's research funding instruments,

for instance. In addition, it must be ensured that Finland has sufficiently skilled personnel in terms of both their quantity and quality to develop and study the mobile communications technologies of the next generations. From the perspective of the technology industry, key areas of expertise include both hardware (including microelectronics) and embedded software (including artificial intelligence). In other words, Finland must have a critical number of experts in the field of 6G technologies from the perspective of security of supply, which means top expertise in areas such as telecommunication networks, edge computing, computing, information security and AI, as well as competence related to microelectronics design. Competence must be strengthened by investing in the fields of education linked to network technology, but also by increasing the recruitment of international top experts to Finnish companies and research organisations, for example, through high-quality research and technology infrastructures. The need for R&D personnel is increasing, and in the next few years, we will need tens of thousands of experts.

As a result, there is an emphasis on attracting foreign workforce to Finland. In addition to investments in education and training, key areas include developing the competence of companies' personnel, recruiting highly educated R&D personnel, providing students with internship opportunities and enabling the mobility of experts.

Finland is making significant investments in R&D activities, and the national target is to increase Finland's research and development expenditure to four per cent of GDP by 2030, of which central government R&D funding will correspond to 1.2 per cent of GDP. There are also major investments in RDI related to 6G. Similarly, efforts have been made to support the construction of networks between stakeholders, especially in the whole consisting of the 6G Flagship – 6G Finland – 6G Bridge programmes.

In order for Finnish companies to be competitive on the international market and achieve a higher market share in 6G than previous network generations, the Finnish and EU domestic markets must provide the conditions for research, development, innovation, testing and product development related to products and services.

This means a test environment and regulation that facilitate such activities, taxation that encourages investments, correctly targeted project grants, and cooperation between companies and research organisations. There is particularly an increasing need to develop critical communications systems and services, and consequently, a need to direct development towards flexible and sustainable solutions that support defence.

In the promotion of the exports of mobile technologies, there is a need to lay the groundwork for the utilisation of Finnish expertise in the future 6G transition, for example, by building national and EU-level funding support mechanisms for exports.

Key steps

- **RDI programmes as incentives for innovation:** To remain a leading country in research in mobile communication technologies, Finland needs innovative RDI activities both at the national and EU level. Ongoing programmes such as 6G Bridge and strengthening financing mechanisms for industry, including through EU funding, play a key role. Sufficient basic funding for research organisations can enable the flexible launch of business cooperation. Strengthening national cooperation and coordination will make it possible for Finland to obtain more EU funding for research on network technologies and related technologies in future programme periods. In the context of national cooperation, it would be useful to form a more detailed situational picture of the focus areas of the different stakeholders in Finland's telecommunications cluster and, through this, also identify new opportunities for cooperation between companies and research organisations. At the national level, research programmes should pay attention to technological developments and the priority themes of sustainable development and security. Research investments are needed, for example, to develop AI solutions for 6G systems, to strengthen 6G resilience and to carve a clear path towards the dual use of 6G. RDI resources must also be allocated to the implementation of new open network management and service platforms and the strengthening of integration competence to meet international demand. RDI programmes could also support sustainable development projects and pilots, for example in the industrial and service sectors. The research sector should also promote the recognition of the importance of network security and make sure that both national and EU RDI funding criteria pay attention to the consideration of built-in security in 6G.
- **RDI infrastructure as a competitive advantage:** In addition to research programmes, Finland needs a research and testing infrastructure that will enable research ecosystems and centres of expertise formed around 6G technologies to grow. Finland should have sufficient testing opportunities for 6G infrastructure to attract international companies

and research institutes to Finland to engage in RDI cooperation with Finnish research institutes and companies. Concrete objectives should be set for the testing and product development environments to enable the testing of future data secure, quantum secure and AI native solutions and the integration of satellite technology, also in view of the needs of the Defence Forces and the defence industry. Investing in the development and marketing of 6G testing environments (testing networks and service platforms) will also promote the early deployment of 6G use cases and applications. As the theme of security gains emphasis, the need to establish a test environment for testing the cyber security of 6G networks should be assessed in cooperation between the research and business sector. To strengthen investment incentives, there is a need to examine the suitability of tax deductions for RDI currently in use and under preparation as an incentive for the development of 6G.

- **New business opportunities:** To increase the market share of Finnish companies, technology capabilities must be strengthened throughout the 6G supply chain, including the hardware, software and service sectors. In 6G, AI-native and AI-optimised network management and AI-based services will be key areas of growth. The business opportunities introduced by 6G will largely emerge from the needs of the verticals, including the companies using the technology in their applications. In the area of dual-use technologies, the preconditions for growth can be strengthened by increasing business cooperation with security authorities. To ensure that Finland emerges as a leader in 6G network management and service ecosystem, the use of Open source, Open RAN and Open API concepts in the implementation of new network management and service platforms must be tested and developed. Finland must also strive to move upwards in the value-added chain, from components to systems, by developing and exporting competence in integration to international markets, for example, in the international OpenRAN implementations.
- **Active efforts to promote mobile network exports in international markets:** Active efforts to promote exports in 4G and 5G networks targeting the markets of emerging and developing economies will lay the foundation for the appreciation of Finnish expertise and the market demand for the 6G technologies of Finnish stakeholders in the future. These export promotion efforts will require close, network-like cooperation between key ministries and Finland's embassies to make sure that the embassies in the target countries know the objectives and will be able to build the necessary channels of influence. In international

advocacy – including the promotion of a regulatory framework in third countries in accordance with the 5G toolbox – it is important to ensure the involvement of EU delegations in third countries based on the Team Europe principle as well as embassies from other like-minded countries. It would also be important to develop Finland's and the EU's export subsidy and credit financing solutions to improve telecommunications connections in third countries with European technologies and to establish partnerships with export credit institutions in other countries (e.g. EXIM) to ensure that, once the efforts to export 6G solutions are launched, Finnish companies will have access to export credit arrangements on par with those of their competitors.

Appendix. Finland's key international and EU influence advocacy forums and Finland's representatives

Forum	Finland's representative(s)
Radio Spectrum Policy Group (RSPG) of the European Commission	Ministry of Transport and Communications Finnish Transport and Communications Agency Traficom
Body of European Regulators for Electronic Communications (BEREC)	Finnish Transport and Communications Agency Traficom
Working Party on Telecommunications and Information Society of the Council of the European Union	Finnish Transport and Communications
International Telecommunications Union (ITU)	Ministry of Transport and Communications Finnish Transport and Communications Agency Traficom Companies and research organisations
European Conference of Postal and Telecommunications Administrations CEPT	Ministry of Transport and Communications Finnish Transport and Communications Agency Traficom Companies
Communications Committee (COCOM) of the European Commission	Ministry of Transport and Communications Traficom Finnish Transport and Communications Agency
Radio Spectrum Committee (RSC) of the European Commission	Finnish Transport and Communications Agency Traficom
European Telecommunications Standards Institute ETSI	Finnish Transport and Communications Agency Traficom, companies, research organisations
Third Generation Partnership Project 3GPP	Companies and research organisations

Forum	Finland's representative(s)
Smart Networks and Services Joint Undertaking SNS-JU	Business Finland, VTT Companies and research organisations
European Association of Research and Technology Organizations (EARTO)	VTT Technical Research Centre of Finland
European Association of Space Technology Research (EASTRO)	VTT Technical Research Centre of Finland
European Defence Agency Capability Technology Areas (EDA CapTechs)	VTT Technical Research Centre of Finland
O-RAN Alliance	Companies, VTT
6G Industry Association (6G-IA)	Companies, VTT
ESA Connectivity and Secure Communications – NTN Forum	VTT Technical Research Centre of Finland
Stakeholder cooperation and advocacy organisations, e.g. GSMA, GSA, EBU	Companies

SOURCES AND REFERENCES

Cyber Security Strategy implementation plan 3 December 2024 (VN/36693/2023)
ITU IMT-2030: https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2030/Pages/default.aspx
ITU IMT-2030 framework: https://www.itu.int/rec/R-REC-M.2160/en
Ministry of Transport and Communications project decision: Security and Growth through Information Networks project (TUUTTI-hanke) (LVM007:00/2025): https://valtioneuvosto.fi/hanke?tunnus=LVM007:00/2025
Publications of the Ministry of Transport and Communications 2021:4 – Climate and Environmental Strategy for the ICT Sector: https://julkaisut.valtioneuvosto.fi/handle/10024/162910
Finland's Cyber Security Strategy 2024–2035: https://julkaisut.valtioneuvosto.fi/handle/10024/165860
Government report: Digital Compass 10/2022 vp: https://julkaisut.valtioneuvosto.fi/handle/10024/164429
Cybersecurity of 5G networks: EU Toolbox of risk mitigating measures) 22 January 2020
6G ja Suomi: Taloudellinen, teknologinen ja sovellusnäkymä: https://6gfinland.fi/

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