brief

6/2025

Technological evolution, looming geopolitics

Embarking on 6G standards definition

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PUBLISHED BY THE SWEDISH INSTITUTE OF INTERNATIONAL AFFAIRS | UI.SE

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This UI Brief is based on research within the Europe program, made possible through financial support provided by The Swedish Ministry of Foreign Affairs. The views and opinions expressed in the report are those of the author.

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Language review: Andrew Mash
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Introduction

Wireless networks are the backbone of modern societies. The ubiquity of mobile phones may be the most obvious example, but the mobility and prosperity of societies are increasingly reliant on mobile infrastructure. A rapidly increasing number and diversity of devices, ranging from cars to pacemakers, are or will soon be connected, transforming our urban areas into smart cities and our private spaces into smart homes. The commercial potential of machine-to-machine communication in particular is likely to be decisive for the competitiveness of future economies.[1] All these connected devices require mobile infrastructure with divergent characteristics such as low latency, ultra reliability or massive data throughput.

Given its enormous potential, it is no wonder that wireless network infrastructure is a central area of geopolitical competition. The potential for damage to be caused by espionage through wireless networks is as wide as the broadening applications. Sabotage of such critical infrastructure would have enormous disruptive potential.[2] This only adds to the number of wars in the last 150 years where the outcome was significantly shaped by communication infrastructure,[3] and explains why the rollout of 5G infrastructure became the subject of geopolitical competition some five years ago.

It has become somewhat commonplace for a new generation of mobile network technologies to be standardised and launched approximately every 10 years. Following the first deployment of 5G around 2020, the introduction of 6G is envisaged for 2030. 6G rollout may be some five years away, but the technical standardisation and thereby the technological definition of what 6G will be will begin in the spring of 2025. At this stage, the discussion is largely technological but geopolitical cleavages are looming. One may expect "as usual" this generation will be needed to support the ever-increasing volume of mobile data traffic and enable new and diverse applications. The specific and urgent need for 6G is not that clear at the moment, and many operators in particular might express a rather conservative position on planning 6G deployment when from a business perspective 5G has not yet lived up to the promises.[4] However, a similar situation has existed in the past and it may well be that the value of 6G will become evident on or after the launch of better or novel networking capabilities.

[1] M. Giordani et al., "Toward 6G networks: Use cases and technologies," IEEE Communications Magazine, vol. 58, no. 3, March 2020, pp. 55-61.
[2] European Commission, "Cybersecurity of 5G networks - EU toolbox of risk mitigating measures," 23 January 2020, online at https://digital-strategy.ec.europa.eu/en/library/cybersecurity-5g-networks-eu-toolbox-risk-mitigating-measures, accessed 29 March 2025.
[3] Doshi, R. and McGuiness, K., „Huawei meets history. Great powers and telecommunications risk, 1840-2021," Brookings Institution, March 2021, online at https://www.brookings.edu/wp-content/uploads/2021/03/Huawei-meets-history-v4.pdf, accessed 29 March 2025.
[4] Wooden, A., "The telecom industry's biggest problem? Failure to monetise 5G," telecoms, 14 March 2024, online at https://www.telecoms.com/5g-6g/the-telecoms-industry-s-biggest-problem-failure-to-monetise-5g, accessed 29 March 2025.

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In November 2023, the International Telecommunication Union (ITU) approved the 'Framework and overall objectives of the future development of IMT for 2030 and beyond' (the Framework), which sets the scene for the next generation of mobile networks, or 6G.[5] In addition to defining the scope of this new generation, the Framework clarifies the target timeline for specification and standardisation, and for systems and product development. While the document outlines a growing consensus on what 6G should be, it is too early to name the precise divergences in visions from different political entities around the globe. As far as the technology is concerned, a plethora of options is mentioned. The jury is still out on whether the consensus building in the frame of standardisation, which will gain momentum at the beginning of 2025, will go smoothly or face complications, as was the case with the first releases of 5G. This paper outlines some of the technological requirements and developments (section I) on which geopolitical cleavages could emerge (section II). 6G is currently at a very early stage, which leads us to provide rather broad conclusions on what European policymakers should consider when assessing how to position the EU on 6G (section III).

Defining technological requirements and developments

ITU outlook on 6G use scenarios and timeline

As the United Nations specialised agency for information and communication technologies, the ITU is the main global harmonisation organisation for radio spectrum and systems. In November 2023, the ITU confirmed that the next generation of International Mobile Telecommunication (IMT) will be IMT-2030, also known as 6G. The ITU Framework contains a vision for 'usage scenarios for IMT-2030' (see Figure 1). It shows three main elements that require technological development, which are reviewed further below.

First, 6G should support the further diversification of applications and services. In particular, the new generation should provide better and/or greater support for the application categories along the three axes of the '5G triangle', as shown in the inner part of the wheel,

a. The vertical axis should ensure a conventional increase in mobile network capacity to support the requirements of the expected volume.
b. Highly reliable and low latency connections will be needed for critical applications and, for example, for autonomous robots and digital twins. While 5G enables

[5] International Telecommunication Union, "M.2160 : Framework and overall objectives of the future development of IMT for 2030 and beyond", 13 November 2023, online at https://www.itu.int/rec/R-REC-M.2160-0-202311-I/en, accessed 29 March 2025.

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significantly lower latency compared to previous generations of networks, it has become clear that even more stringent requirements must be met in the future.

c. Massive connectivity is needed to support the Internet-of-Things (IoT), among other things. It is notable that 5G has not brought great progress in this area thus far.

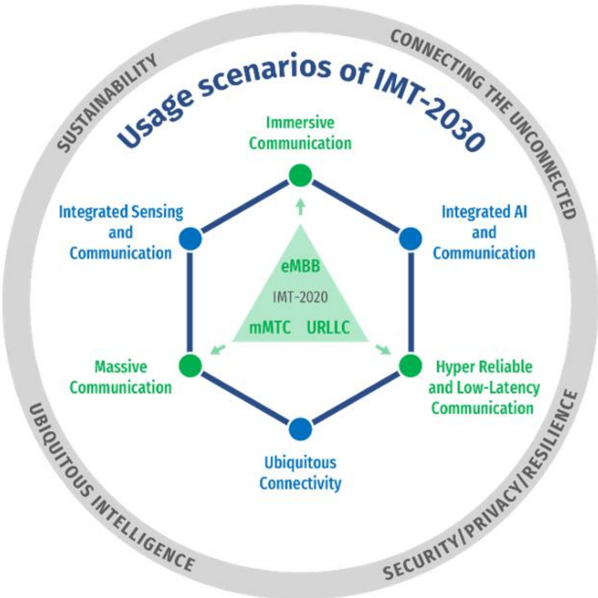

Figure 1: '6G wheel' diagram highlighting usage scenarios and overarching aspects of IMT-2030. Source: International Telecommunication Union, [Recommendation ITU-R M.2160-0 (11/2023), accessed 29 March 2025](#)

Second, the 6G hexagon highlights three extra axes, denoted as new usage scenarios:

a. The AI revolution will have an impact on mobile networks – both as a "customer" of capacity and as a tool for improving the performance and efficiency of networks.
b. A notable criticism is that 4G and 5G have succeeded in boosting peak capacity and throughput in specific locations, but many areas have remained underserviced. If 6G aims for truly ubiquitous connectivity, it should be a major step forward in providing uniformly good coverage, including in remote areas. For the latter, non-terrestrial networks are gaining attention.
c. Location-based and positioning services will be extended, whereby sensing features will allow the network to identify the location and movement of passive (non-transmitting, not actively cooperating) people, devices and animals.

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Third, overarching aspects and evolutions will raise important concerns in all phases and technologies of 6G development:

a. *Sustainability* is a term that can be understood as much broader than mere energy efficiency, which has been an important characteristic in the progress of 4G and 5G. Europe should target both "sustainable 6G" and "6G for sustainability".[6]
b. *Connecting the unconnected* should be seen as increasing attention on the potential for new services and old problems of unequal coverage.
c. *Ubiquitous intelligence*: The evolution of computing capabilities will be embedded in all kinds of devices and distributed throughout the environment, opening up possibilities and challenges for novel wireless networking generations.
d. *Security/privacy/resilience*: This cluster of characteristics relates to the trustworthiness of wireless networks, which have become a crucial resource in personal and professional environments.

6G technologies outlook

Substantial research on candidate 6G technologies began around 2018, through larger pioneering programmes such as the "6G flagship" in Finland.[7] EU-funded projects focused on 6G were included in the most recent phase of the Horizon 2020 programme under the 5G-PPP umbrella.[8] European 6G R&D gained significant momentum under the SNS programme (European Smart Networks and Services Joint Undertaking, SNS JU) supported by the Horizon Europe programme.[9] At the national level, significant investments in 6G R&D are being made in several countries, such as the Netherlands, Germany and, more recently, Sweden.

Many new technologies have been explored as candidates to boost capacity. Some could be evolutions of 5G technologies, while others are more disruptive. At the time of writing, there is a growing consensus on which technologies should be considered prime candidates for standardisation in the first so-called releases of the Third Generation Partnership Project (3GPP), which is the main international mobile standardisation body. The value of other technologies has not yet been proved

[6] Rühlig, T. (ed.), "Reverse dependency: Making - Europe's digital technological strengths - indispensable to China," Digital Power China, 6 May 2024, online at https://dgap.org/en/research/publications/reverse-dependency-making-europes-digital-technological-strengths, accessed 29 March 2025. For example, the SNS SUSTAIN-6G flagship project, which will start on 1 January 2025, will consider both "footprint" and "handprint" aspects. Experts recognise that ecological sustainability should consider full Life Cycle Assessment (LCA) and be aware of rebound effects.

[7] "6G flagship", online at https://www.6gflagship.com/, accessed 29 March 2025.

[8] "5GPPP," online at https://5g-ppp.eu/, accessed 29 March 2025.

[9] European Commission, "The smart networks and services joint undertaking," online at https://digital-strategy.ec.europa.eu/en/policies/smart-networks-and-services-joint-undertaking, accessed 29 March 2025.

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sufficiently and it is unclear whether they will be adopted in 6G standards sooner or later. It is beyond the scope of this paper to provide a full overview of the technologies that are or have been considered relevant for 6G. Instead, we focus on a few examples.

Spectrum: Every new generation of wireless networks needs electromagnetic frequencies, the so-called spectrum, on which to operate. The World Radiocommunication Conference (WRC) 2023 was central to the revision of the Radio Regulations to reserve and/or free up radio-frequency spectrum for 6G. Figure 2 provides a vision of the spectrum that could be allocated, albeit not uniformly in all regions of the world. This confirms that the upper midband in 3GPP referred to as FR3 spectrum (7.125–24.25 GHz) is considered the prime candidate to provide the main capacity upgrade in urban areas.[10] The spectrum that would become available for 6G in the FR3 band is not contiguous and poses challenges in terms of coexistence with other services, which complicates radio hardware implementation.

Many have made somewhat oversimplified statements on the advent of 5G and 6G that the only way to support the anticipated extreme capacity and throughput requirements would be to exploit the very high bandwidth available at millimetre wave (mm wave) frequencies. The deployment of frequencies in the 25–40GHz range for 5G services, however, has not been a success, probably because of inherently complicated radio wave propagation and lack of user devices. In preparation for 6G, even higher frequencies in the sub-THz region are being advocated. Extensive research has focused on communication in these bands, supported by substantial funding in Europe at both the national and the European Union levels. These very high frequencies (>90GHz) are currently identified as a potential solution for niche applications in local hotspots, where the very high bandwidth could also offer unprecedented positioning and sensing performance.

Extreme multiple input multiple output (MIMO) and distributed multiple antenna techniques: Novel technologies for exploiting more antennae for capacity and service enhancement in the <20GHz spectrum are considered key to realizing the use scenarios put forward for 6G. The deployment of very large arrays in the FR3 band is particularly attractive as many more antennae can be fitted into the same physical surface area compared, for example, to the 3.5GHz band used for massive MIMO in 5G.

Integrated sensing and communication (ISAC) could benefit from the very high bandwidth at mmwave and sub-THz frequencies in local environments. Distributed large antenna arrays at lower frequencies would also offer the diversity required to offer these features.

[10] Ericsson, for example, has stated that "the cm frequency range 7–15 GHz holds the promise of combining good coverage with reasonably large bandwidths". Parkvall, S., "Why cmWave spectrum is expected to be a powerful enabler of 6G and future networks," online at https://www.ericsson.com/en/blog/2023/6/cm-wave-spectrum-6g-potent-enabler, accessed 29 March 2025.

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"Native AI" 6G: The term "native AI" is used by many researchers and leading companies in the context of 6G, but has not been defined unambiguously. It is clear that novel data-driven techniques can play a valuable role in many aspects of network roll-out and operation, to cope with the complexity of networks, optimize the allocation of resources and reduce energy consumption, among other things. A more disruptive adoption of AI could involve transmitters and receivers taking autonomous decisions on how to transmit. It is not clear, however, whether it will be possible to open the door for a priori undefined air-interfaces in the first releases of 6G standards.

Non-terrestrial networks: Satellite-based wireless access has received interest as a means of achieving the 5G/6G 'ubiquitous connectivity' ambition.[11] It can also provide redundancy in network infrastructure and increase resilience in geopolitically unstable situations. Low Earth Orbit (LEO) constellations offer lower latency and potentially lower costs compared to the geostationary (GEO) alternatives. The privately owned and US-headquartered Starlink network has launched over 7000 satellites. The global coverage of the network does not mean that services can be provided, however, as providing a licence to operate the frequencies falls within national jurisdiction. Currently, Starlink services are available in more than 90 countries, including many European states. Alternative LEO networks are being considered, not least in the light of regional autonomy considerations. It should be noted that long earth-to-satellite links inevitably require much larger transmission powers and/or larger antennae at the terminal side, and incur longer latency compared to terrestrial cellular networks. There are growing environmental concerns regarding the many mega-constellations of satellites planned to be launched as the amount of space debris is likely to increase drastically.[12]

Customisation of networks/openness of networks: The adoption of OpenRAN and/or standardised application programming interfaces (APIs) could benefit the interoperability of hardware in the Radio Access Network (RAN). The "exposure" of network interfaces and features could engage an ecosystem of developers and providers to offer new applications and services that make use of the wireless network. This could be key to enabling the broad diversity of 6G use scenarios envisaged in the 6G wheel. Enthusiasm for and drivers of such initiatives have increased among some European companies in recent years as they have identified potential commercial interest.

[11] Lagunas, E. et al., "Low-earth orbit satellite constellations for global communication network connectivity," Nature Reviews Electrical Engineering 1, 2024, pp. 656–665.
[12] Pultarova, T., "Pollution from rocket launches and burning satellites could cause the next environmental emergency," Space, 15 October 2024, online at https://www.space.com/rocket-launches-satellite-reentries-air-pollution-concerns, accessed 29 March 2025.

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Political cleavages meet economic and technological realities

The development and deployment of wireless infrastructure will be crucial for states for at least three reasons: First, wireless infrastructure has enormous economic implications. Mobile infrastructure is highly standardised and many of these standards are patented technology. Vendors compete for significant revenues from standard essential patents (SEPs). Both broad and targeted deployment, in turn, will be essential for the competitiveness of modern economies. Operators of public networks strive to reduce the costs of serving their customer base. In many cases, more innovative industrial applications require tailored Mobile Private Networks (MPNs). Thus, national economies can profit significantly from both the development and deployment of wireless infrastructure.

Second, mobile infrastructure has implications for the security of states. Most notably, wireless networks can be used for espionage. Encryption makes the information transmitted through mobile networks more secure from interception. Not all information is encrypted, however, and nor is encryption unbreakable. The expected level of precision of the geolocation data that 6G could generate provides just another type of sensitive information that could be of interest to malign actors. At least as damaging as espionage is the potential for sabotage of mobile networks. A diversity of vendors coupled with network redundancy increase the costs of a malign actor seeking to make mobile communication unavailable. However, the more modern societies rely on mobile networks, the greater the damage that could be caused by a kill switch. In other words, states have a vital interest in technical and vendor trustworthiness as mobile networks are crucial to national security. Hence, states are wary of the influence of threat actors during both the development and the deployment of mobile infrastructure. Third, the political sovereignty of states can be affected by mobile networks. Wireless infrastructure is the backbone of modern societies and some sub-market segments, such as the RAN market, have undergone a process of market consolidation. This creates dependencies on a small number of vendors for any technology that requires regular maintenance by the vendor. In other words, states are concerned that the functioning of their critical infrastructure might become reliant on regular maintenance provided by vendors based in rival states. This would undermine the ability to act against the core interests of that rival state. Thus, such lock-in dependency can limit the political sovereignty of states.

Against this background, it is no wonder that the European Union, the United States and the People’s Republic of China all consider the development of 6G to be strategic for their economic development, their national security and their political sovereignty. All three entities have a vital interest in the success of their own companies, are carefully considering how to regulate their wireless market and are spending significant resources on the development of 6G.

While such geopolitical concerns about the development of 6G are undeniable, it is unclear how precisely they will affect the standardisation and evolution of the next generation of mobile infrastructure

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technology. All sides have an interest in cooperation on the development of a unitary global technical 6G standard. The 6G standardisation due to start in the spring of 2025 will be shaped both by global competition for influence between key stakeholders, including over the underlying SEPs, and by a desire to reach consensus.
3GPP is and remains the main standardisation body. It is in the shared interests of all stakeholders – manufacturers, end-users and operators – to agree on one unitary mobile communication standard. 3GPP has published a timeline for 6G standardisation involving several releases (see Figures 3 and 4). Release 21 is the first to be considered 6G. Starting in March 2025, the stakeholders will present their main technological proposals. This will be followed by intensive work on the first release throughout 2025.

Based purely on the outcomes of technological research, no disruption is foreseen or anticipated. The transition from 5G to 6G could be a gradual and smooth process. However, there are strategic and political interests at stake. It could well be that technological proposals are put on the table for which Europe is not well prepared. Despite various rumours, there are currently no signs that there will be a regional divergence. In particular, three reasons make it unlikely that the world will see the return of divergent standards for 6G.

First, the 6G standard has predominantly been developed by private sector actors that all share an economic self-interest in a unitary standard. Developing and implementing divergent network infrastructure technology is costly. All the major vendors have R&D centres around the globe that are more useful if their technical solutions can be applied globally and not just in their respective regions.

Second, it is a safe assumption that everyone is in favour of one agreed standard for transmission formats and protocols following 3GPP releases. This will enable the seamless operation of end-user devices worldwide, which is a convenient feature that customers around the world have come to expect in recent decades.

Third, while private sector actors have a strong interest in a unitary 6G standard, political actors are not united in their push for a fragmentation of the standard. In Europe, the EU member states have adopted very different approaches to dealing with Chinese vendors. Sweden, for example, has explicitly banned Huawei and ZTE. Other countries, such as France and Italy, have put in place legislation that makes it unattractive to deploy Chinese RAN technology. Hungary and Cyprus are among a group of countries that has not restricted the deployment of Chinese RAN network vendors. Despite misleading headlines, Germany's recent decision will allow a significant market presence for Huawei in its RAN market for the foreseeable future. In the light of such diversity, it is unlikely that Europe will make a political push to exclude China from development of the 6G standard. At first glance, the United States might seem to be a more likely supporter of such a policy. However, while the Trump administration has been the driving force behind pressure on Huawei, the US remains open to cooperation with Chinese entities in the development of Open RAN. The strong

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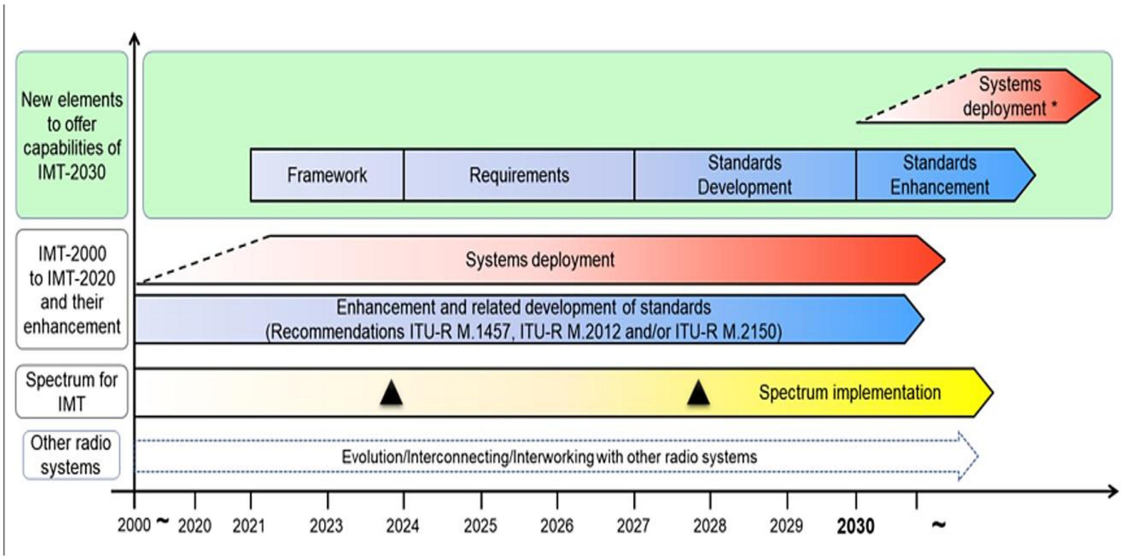

Figure 3: IMT-2030 relationships and timelines. Source: International Telecommunication Union, [Recommendation ITU-R M.2160-0 (11/2023), accessed March 29 2025](#)

presence of Chinese actors in the ORAN Alliance indicates that the US is unlikely to push for the exclusion of China as long as its participation is economically beneficial. Ironically, however, Huawei is not a member of the ORAN Alliance but several other Chinese entities, whose links to the Chinese security apparatus is likelier than that of Huawei.[13] Finally, Huawei's interest in maintaining a global presence that benefits from a single standard is likely to influence the stance of the Chinese party-state.

None of this means that Europe, the US and China will support each other's standard proposals. There has been controversy among leading wireless researchers in different regions regarding technologies that have been intensely studied and promoted as interesting candidates for 6G. This has been the case, for example, with reconfigurable intelligent surfaces (RIS), orbital angular momentum (OAM) and Non-orthogonal Multiple Access (NOMA).[14] Several leading academics, including in Europe, have made strong claims about the value of various acclaimed novel techniques. The ITU recommendation contains statements that do not exclude these from consideration for 6G:[15] 'Techniques such as reconfigurable

[13] Kleinhans, J.-P and Rühlig, T., "The false promise of Open RAN. Why Open RAN does not solve the "5G China challenge"," Digital Power China, online at https://timruhlig.eu/ctf/assets/x93kiko5rt7l/2VmWvuXxKdqdTuwkLSWUSQ/b48a2ffe9e42dc3a3b09d4c35b1c802e/DPC-Open_RAN_-_FULL_REPORT_-_FINAL.pdf, accessed 29 March 2025.

[14] CAICT, "White Paper on 6G vision and candidate technologies", June 2021, online at http://www.caict.ac.cn/english/news/202106/P020210608349616163475.pdf, accessed 29 March 2025.

[15] Weissberger, A., "ITU-R: IMT-2030 (6G). Backgrounder and envisioned capabilities," IEEE, 6 July 2024, online at https://techblog.comsoc.org/2024/07/06/itu-r-

intelligent surfaces (RIS), holographic radio (HR), and orbital angular momentum (OAM) are potential technologies that would improve performance and overcome challenges in traditional beam-space antenna array beamforming’. There’s a clear correlation to the candidate technologies in a main vision document issued by China’s IMT-2030 promotion group.[16] It should be expected that the organisations, or the individuals representing such organisations, putting forward statements in favour of technical solutions might also advocate their incorporation into the standard. In quite a few cases they have significant interests, for example linked to intellectual property. With some creativity, it would be possible to define ‘novel networking components to improve coverage’ in standards without fully specifying what these should be. These could for example be RIS or repeaters. The latter are promoted by Ericsson among others. On the characteristics of the signals that are actually transmitted over the air, such as waveforms or multiple access techniques, there will need to be consensus.

Beyond such competition over a unitary 6G standard, states are likely to protect their interests in tightened regulations that will place conditions on the technology and restrict the vendors involved in its rollout.

Conclusions and policy implications

6G is a highly strategic but still unfolding technology. Research institutions and companies have put much research effort into its development, and standardisation in 3GPP starts in March 2025. This paper provides an overview of the technological candidates to be included in 6G. At this stage, some frictions linked to geographical regions are visible, such as over NOMA technology. However, these are probably only the start of heated geopolitical competition over 6G development. The development of 6G is geopolitically important and will have an impact on economic prosperity, security and political sovereignty.

It is beyond the scope of this paper to provide a comprehensive analysis of all the potentially relevant angles and draw policy conclusions for the EU and its member states. Dedicated studies would be necessary to provide adequate depth to discussion of issues such as the role of AI, non-terrestrial networks, privacy concerns or sustainability beyond energy efficiency, to name just a few examples. Instead of providing a comprehensive set of policy recommendations, a few observations and policy implications are discussed in three areas.

1. **Europe’s preparation for the transition from 5G to 6G:**

The EU and several member states, such as Germany, the Netherlands, Finland and

imt-2030-6g-backgrounder-and-envisioned-capabilities/, accessed 29 March 2025.

[16] “White Paper on 6G vision and candidate technologies” op. cit.

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Sweden, have invested significantly in R&D. However, these four countries have adopted different strategies. Sweden was remarkably late with its funding, leading to short application deadlines. This was clearly suboptimal. Germany and the Netherlands made funding available much earlier but followed rather national approaches with rather limited coordination with EU funding schemes. Our impression is that actors that have received German and Dutch funding have tended to be less interested in EU funding, in an indication that these national funding schemes may have diverted attention from more coordinated efforts. In this regard, Finland has been a role model as an early mover that aligned closely with EU funding schemes – an approach that should be considered best practice. As standardisation is about to begin, further R&D funding should focus on 6G advanced.

Beyond R&D, real-world experimentation by means of deploying the most advanced 5G networks could help the development of 6G. In this context, so-called standalone 5G (5G SA), the deployment of MPNs and the allocation of mid-band spectrum are good proxies for measuring Europe's advances. In all three proxies, however, Europe is far behind other actors, notably China. In Europe, even Germany – the country with the most 5G SA – is well behind China, India, South Korea and the US. China is also outperforming Europe by wide margins on MPNs. By the end of 2022, China had deployed more than 8,000 hybrid private networks and had contracted for another 28,000. While there are no precise numbers for Europe, and industry experts' calculations vary, there are thought to be between slightly less than 100 and a few hundred MPNs in the EU.[17] Europe's mid-band coverage is a meagre 25%, well behind the global average of 40%, whereas China is at 95% and North America 85%. To encourage the deployment of innovative 5G technologies that facilitate the transition to 6G, EU member states should incentivise the deployment of mid-band MPNs, for example by means of tax incentives but also dedicated spectrum.

Other policies that would facilitate Europe's role in the transition to 6G would be support for standardisation efforts (such as through tax incentives), abandonment of new EU SEPs regulation that would only harm EU interests,[18] and active engagement with the inherent trade-offs between the declared goals of 6G development. For example (a) the trend towards non-terrestrial networks will increase waste in space; (b) growing sensing is an inherently privacy-threatening functionality; (c) AI compute power requirements require enormous amounts of energy and thereby undermine sustainability goals; and (d) Europe's leadership in sustainable 6G has been criticised for its risk of overregulation that

[17] 5G Observatory, "5G private networks," online at https://5gobservatory.eu/5g-private-networks/, accessed 29 March 2025.

[18] Erixon, F. and Guinea, O., "Reforming standard essential patents: Trade, specialisation, and international jurisprudence," ECIPE, April 2023, online at https://ecipe.org/wp-content/uploads/2023/04/ECI_23_PolicyBrief_04-2023_LY01.pdf, accessed 29 March 2025.

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could slow down the adoption of new technologies.

2. Spectrum:

The history of spectrum allocation in Europe hints at several challenges. For example, spectrum licensing has often been a lengthy and expensive process, creating uncertainty for European operators. In contrast to China, European states consider spectrum licensing to be an important source of income. This mindset should change. Instead, European states have an interest in quick and cheap allocation of spectrum so that operators have enough resources for fast and innovative deployment.

Another example is the lack of harmonisation of spectrum and licensing across the EU. Coexistence of the FR3 band would pose technological challenges, not only but particularly in border areas. At worst, the unavailability of spectrum and thus the inability to communicate could be disastrous in case of war, as there would be no network close to national borders.

3. Ubiquitous coverage:

A final example is the need for many European states to shift priority from commercially viable deployment of wireless infrastructure to the premise of digital inclusion not only of urban, but also of rural regions. To this end, 6G satellite infrastructure will be particularly crucial. A 6G enabling satellite system will be geopolitically strategic. Europe would be well advised to increase its investment in and efforts to establish such infrastructure in order to reduce its dependency on Starlink, as the EU cannot rely on its availability. It is arguable that the EU's growing R&D budgets in this domain might not result in an alternative network on reasonable terms. However, the speedy deployment of Starlink proves that truly impressive deployment is generally possible, and such infrastructure is too strategic to be neglected by the EU.

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