



White Paper

A Path for EU-US Cooperation in 5G/6G

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Think NEXUS, an EC-funded project, aims at reinforcing EU-US collaboration on NGI-related topics in three focus areas: Science and Technology, Innovation and Entrepreneurship and Policy. The aim is to boost strategic research, industrial partnerships and policy compliances in order to gain socio-economic benefits in both the EU and US regions.

In the framework of this project, we are regularly publishing several short articles aiming at comparing the US and the EU approaches in different topics of NGI. The present document is focusing on Artificial Intelligence.

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A Path for EU-US Cooperation in 5G/6G

The fifth generation of mobile networks, or 5G, is of strategic importance for the global economy. The COVID-19 crisis is only demonstrating this further, as assessed by the Croatian EU Presidency calling the European Commission to put forward a revised Action Plan for 5G and 6G, to “set the right framework to enable operators all stakeholders to invest in the most advanced 5G network and service solutions, in line with competition law principles, and to incentivise European companies to start developing and building technology capacities in 6G” [1].

The EU, in its planned “transition towards climate neutrality and digital leadership in an ever-changing and ever more unpredictable world” [2], considers that **“connectivity is the most fundamental building block of the digital transformation”** and that **“European technological sovereignty starts from ensuring the integrity and resilience of our data infrastructure, networks and communications”** [3]. The US has also recognised that 5G is critical to its technological leadership, placing it at the heart of the EU-China trade war, taking measures to prevent US deployment of network equipment from the Chinese manufacturer Huawei, and even considering buying one of the two leading European 5G equipment manufacturers Nokia or Ericsson¹.

Another major concern is the security and privacy of 5G networks. The main reason for the US Government to ban Huawei network equipment was to declare that there were risks that information circulating on the network via this equipment was being disclosed and sent to the Chinese Government². President Trump signed on March 23, 2020, the “Secure 5G and Beyond Act of 2020”, which is aiming at developing a “strategy to: (1) ensure the security of next generation mobile telecommunications systems and infrastructure in the United States; and (2) assist allies and strategic partners in maximizing the security of next generation mobile telecommunications systems and infrastructure”. According to the US House Energy and Commerce Committee, the bill is **“critical to ensuring that [...] networks are secure and trusted”** [7]. The EU had already launched a couple of months before an **“EU toolbox” to ensure security in 5G networks** [4].

The implementation of GDPR, the General Data Protection Regulation, imposed by the EU as a global standard, has demonstrated if needed that user privacy and data protection in general is considered as a priority in Europe. Besides, “for 5G to succeed on a mass scale, there must be mutual agreement and trust among the various stakeholders such as the end-user, network operators, app developers, and device manufacturers” [5]. Such a feature should be implemented directly in networks, thus ensuring an “end-to-end privacy by design” [6].

1 See for example <https://www.mobileworldlive.com/featured-content/home-banner/us-ag-moots-government-move-for-ericsson-nokia/> and <https://www.lightreading.com/mobile/5g/attorney-general-barr-the-us-allies-should-take-nokia-or-ericsson-stake-for-5g/d/d-id/757341>.

2 Many articles were published on this subject; one of them states that for example that “the US always suspected Huawei of using its technology to spy on other countries for the Chinese government”, cf. <https://marketrealist.com/2019/06/why-the-us-ban-on-huawei-is-probably-here-to-stay/>

The EU and the US both consider 5G to be critical for technological sovereignty. 5G networks shall be secure and trusted and ensure privacy by design.

Based on those commonalities, this note explores opportunities for the EU and the US to cooperate in 5G and 6G.

Where do we stand?

The global market for 5G technology is projected to reach \$667.90 Billion by 2026. By 2035, 5G may contribute up to \$13.2 trillion potential global sales activity across multiple industry sectors enabled by 5G, representing 5% of global real output and 22.3 million jobs generated by the 5G value chain [8].

Today, the largest telecommunications equipment manufacturer is Chinese (Huawei), followed by two European companies (Nokia and Ericsson) and another Chinese company (ZTE). Reports diverge on forecasting who will eventually be leading the 5G infrastructure market, but some see Huawei and therefore China well positioned to see the most economic gains from the 5G roll-out [8]. Recent measures from the US to ban Huawei from selling their equipment in the country and their request to “allied countries” to act in a similar manner, may eventually change the situation, although so far it has only slowed down their pace of share growth [9]. The criticality of 5G, as highlighted above, along with the fact that Huawei is able to offer lower price for 5G equipment than main competitors Nokia and Ericsson because “Huawei [is] a key beneficiary of China subsidies” [10], explains why **5G has become one of the main issues of the US-China trade war**. In EU terms, the transition to the digital economy “will take place in **a time of moving geopolitical plates which affect the nature of competition**” [2].

There has also been growing concerns with China in the EU. In October 2020, a new EU regulation will come into force to strengthen and coordinate defences against foreign direct investment (FDI) that may be unwelcome on national security and public order grounds. This has been drafted specifically with China in mind. According to a close observer of EU-China trade, “5G has been an enormous wake-up call [...] China acquired the technology and rapidly built up a company to exploit it to the point of global near-domination” [11].

Investment in 5G and 6G infrastructures shall and will continue. As rightfully stated in the EU industrial strategy plan, “the successful roll-out of highly secured and state-of-the-art 5G network will be a major enabler for future digital services and be at the heart of the industrial data wave. Europe must now invest if it wants to be a frontrunner in 6G networks” [2]. Besides its “Secure 5G and Beyond Act of 2020”, President Trump also signed the “Broadband Deployment Accuracy and Technological Availability Act” that will help the US get a map of where investment is more needed in terms of infrastructure [7]; and the EU is committed to “invest more in the strategic capacities that allow us to develop and use digital solutions at scale and to strive for interoperability in key digital infrastructures, such as extensive 5G (and future 6G) networks” [3].

There are opportunities ahead

The 5G infrastructure market alone is estimated between \$45 and \$60 Billion by 2026-2027 [13]. Although representing only less than 10% of the whole projected 5G market, it is critical because it will set part of the standards by which the 5G-enabled products and solutions will be developed. But it also means that **more than 90% of the market enabled by the implementation and deployment of 5G lies beyond network infrastructure.**

The telecommunications market has been stable since 2018 and will likely remain stable in the coming years [14]. On the other hand, “a significant trend observed is the penetration of global 5G infrastructure across the range of end-user industries. **The rising demand from various [vertical] applications [...] has been recognized as the major drivers for the 5G infrastructure market growth**” [15].

By 2035, \$13.2 trillion potential global sales activity across multiple industry sectors may be enabled by 5G, representing 5% of global real output and 22.3 million jobs [8]. Besides Information and Communications Technologies (ICT), the sectors most impacted by 5G are likely to be transport and logistics, manufacturing, media and content, smart cities, agriculture, energy, healthcare, and public safety. Automated cars, augmented and virtual reality, and solutions for smart cities are already the most promising domains in terms of 5G trials³. Those are expected to be the first sectors where 5G-enabled solutions will transform the life of business and citizens, but they will be followed by many others. The transformation in some sectors may be drastic, e.g. in manufacturing where the entire manufacturing process may be automated with smart devices, from design to distribution, leading to “smart factories” [12].

There are therefore many opportunities that will open soon in vertical markets, thanks to 5G. This was anticipated by the EU 5G Public-Private Partnership (5G PPP), that has since its inception implemented a strategic plan to involve gradually vertical stakeholders in the projects, along with players from the telecommunications and ICT ecosystem⁴.

Although a large share of those vertical markets is likely to be captured by incumbent players, the progressive arrival of **5G is likely to bring disruption in business models** for incumbent operators and verticals alike. While opportunities will surely arise for large, well-positioned market participants, there should also be opportunities for agile and flexible SMEs who have mastered the key technologies and services that enable the new business models emerging from the deployment of 5G **not only in the telecommunications ecosystem but also in the 5G-enabled vertical sectors**. Besides SMEs well positioned in technology, **SMEs well introduced in vertical sectors shall be the first to find new opportunities** from the introduction of 5G in their business. Large companies could also form dedicated alliances or joint ventures composed e.g. of 5G expertise along with knowledge of a given vertical market, or support spin-offs take advantage of those emerging opportunities. Similarly, universities and research institutes may form spin-offs with a similar objective in mind.

³ Automotive, broadcasting & media and smart cities are among the primary sectors addressed in the EU 5G Public-Private Partnership, cf. <https://5g-ppp.eu/>. 5G for cooperative, connected and automated mobility (CCAM) was even the subject of a specific call for proposals, cf. <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ict-18-2018>

⁴ <https://5g-ppp.eu/>

Whatever the case, **innovation and entrepreneurship have a key role to play in grabbing some of the 5G related opportunities ahead.** This might be leading to large growth and **global leadership for those start-ups, spin-offs or SMEs who will be the first ones to take this path i.e. use 5G technology to develop new and innovative solutions and applications in the vertical markets or to develop disruptive solutions to reach new markets.**

5G is likely to bring disruption in business models in the 5G-enabled vertical sectors. Start-ups, spin-offs, and SMEs have a key role to play in the emergence of innovative solutions for 5G-enabled vertical markets.

Promoting such an industry- and SME-driven approach is consistent with the EU industrial strategy plan that promotes industry to “become the accelerator and enabler of change and innovation” and stresses that the plan is “entrepreneurial in spirit and in action” [2], and by the new EU SME strategy that considers that “Europe’s 25 million small and medium enterprises (SMEs) are the backbone of the EU economy [and are] central to the EU’s twin transitions to a sustainable and digital economy” [16].

Besides, SMEs are very often suppliers of key elements in solutions commercialised by large industry. Focusing on SMEs would then indubitably also benefit those large players. This is highlighted for example by OECD, that stresses that “when the role of SMEs as suppliers of inputs to larger direct exporters is taken into account, the importance of SMEs as exporters increases considerably. [...] The significance of indirect channels is especially important for independent SMEs (i.e. those not owned by a larger domestic firm or foreign firm)” [17].

Case for an EU-US cooperation in 5G and beyond

To summarise the current situation, the emergence of 5G network infrastructures is opening potential opportunities for developing innovative and disruptive solutions for vertical sectors enabled by 5G, e.g. in automotive, media, or smart cities. This is where a cooperation between EU and the US could prove most fruitful.

Addressing and accessing global markets is essential for success, especially when it comes to start-ups, spin-offs, and SMEs. According to OECD, “relative to their share of overall activity and employment, SMEs account for only a small proportion of exports. In most OECD economies SMEs account for 99% of all firms, around two-thirds of total employment and over half of [...] overall exports” [17]. Although this may be leveraged when adding indirect channels i.e. via large companies, this remains **especially true for start-ups and spin-offs, and when SMEs are trying to reach or trigger new markets.**

According to 2018 estimates by the International Monetary Fund, China is the world’s largest economy. The European Union is in second place, and the U.S. is No. 3. The three combined represent 50% of the world economy. No other economy is even close to the top three. According to forecasts, the EU and US economies together would represent 28.5% of the world share in 2024, when China is projected to represent 21.4% [18].

When it comes to 5G, although the largest market is currently the US, forecasts show that Europe is the fastest growing market, due to the large presence of large software providers and the high investment planned in 5G by carriers [19].

The EU and the US represent the two largest 5G markets in the world. Addressing and accessing global markets is essential for success, especially for start-ups and spin-offs, as well as for SMEs trying to reach or trigger new markets.

According to the EU industrial strategy, “the openness of Europe’s economy is at the source of its prosperity and competitiveness. Although EU industry is highly integrated in global value chains and operates globally, the EU should not be naïve to threats to fair competition and trade. [...] This distortion is often coupled with a lack of reciprocal access for European firms to the home country markets of foreign, state-owned companies” [2]. Moreover, EU’s Digital Strategy states that “the EU will remain open to anyone willing to play by European rules and meet European standards, regardless of where they are based”. Such a cooperation shall take place in “a framework that allows [businesses] to start up, scale up, pool and use data, to innovate and compete or cooperate on fair terms” [3]. All of these lay the foundations for a **strengthened cooperation in 5G and 6G between EU and the US.**

Much has been done all over Europe in recent years to support SMEs and encourage entrepreneurship and innovation, both at European level and at national level. Examples include the *Eurostars* programme, focusing on innovative projects led by R&D performing SMEs, the *StartUp Europe* initiative that aims at connecting high tech start-ups, scaleups, investors, accelerators, corporate networks, universities and the media, and the new *Digital Innovation Hubs* that aim to help companies improve their processes, products and services through the use of digital technologies.

The EU industrial strategy plan is looking at putting in place “the right conditions for entrepreneurs to turn their ideas into actions and for companies of all sizes to thrive and grow”, and plans to “step up investment in disruptive and breakthrough research and innovation [and] accept failure along the way” [2]. New initiatives are being started to achieve this, such as the *Enhanced European Innovation Council (EIC) pilot*, that supports top-class innovators, entrepreneurs, small companies and scientists with bright ideas and the ambition to scale up internationally, or the *InvestEU* programme, that will give an additional boost to investment, innovation and job creation in Europe⁵.

Still, Europe, known for its scientific excellence and technological innovation, needs to “shift [EU’s] mind-set from risk averse to failure tolerant” to allow successful start-ups to scale up globally [2]. This, on the other hand, has been for a long time one of the strengths of the US. All the famous FAANGs (Facebook, Amazon, Apple, Netflix and Google) originated as start-ups and found the right environment to scale up and become global leaders. One of the reasons for this success is that “the US provides innovation-friendly framework conditions and its investment climate makes it an attractive place to commercialize innovative products, services and solutions” [20] and has done so for a long time.

The EU and the US will best cooperate in 5G and beyond by building on each other’s strengths and markets.

⁵ <https://www.eurostars-eureka.eu/>, <https://ec.europa.eu/digital-single-market/en/startup-europe>, <https://ec.europa.eu/research/eic/>, https://ec.europa.eu/commission/priorities/jobs-growth-and-investment/investment-plan-europe-juncker-plan/whats-next-investeu-programme-2021-2027_en

The COVID-19 crisis is showing two things: **SMEs** are hit hard and **must be supported in the long term** to restart; and **global cooperation is necessary when the solution can only be global** [21]. These two points can and should be applied to foster the emergence of new industrial leaders enabled by 5G and beyond.

Global cooperation is one of the main elements that should be promoted, and the EU and the US can and should play a key role in this. The US have already initiated such a global cooperation in the 5G domain by supporting the emergence of an “Open RAN Policy Coalition”⁶. Despite the growing presence of China, the EU and US, along with other partner countries such as Japan and Korea, still play an essential role in international bodies related to 5G and 6G such as ITU, GSMA, NGMN and in standardisation organisations such as ETSI (including 3GPP), IEEE and IETF.

“The future is bright and we’re about to see the world change before our very eyes. However, **the 5G revolution will take 10 years to be set up**” [8]. This summarises well the duration of the investment that must be made. **An EU-US cooperation in 5G and beyond would greatly benefit from being built on the long term.**

An EU-US cooperation in 5G and beyond should aim global and be built on the long term.

What next?

In the telecommunications sector, the cooperation between the EU and the US has been mainly focusing on research infrastructures. A long-term cooperation has been going on between the EU FIRE initiative and the US GENI programme. The main running EU-US cooperation in the 5G and beyond domain focuses on advanced wireless infrastructures, with the EU EMPOWER project and the US PAWR initiative⁷.

To pursue the opportunities highlighted in this paper, a renewed cooperation between the EU and the US in 5G and beyond shall primarily address a **shorter time to market and a more industrial ecosystem**. Such a framework would then be used to promote the most relevant issues for an EU-US cooperation in 5G and beyond. Large industry and research organisations could work together e.g. to promote global standards and provide the infrastructures and the platforms required to develop and test 5G/6G-enabled products and applications, and SMEs could then be encouraged and supported to use those infrastructures and platforms to develop innovative and disruptive 5G-enabled solutions in key vertical industrial sectors. Industrial partnerships involving all the pieces of the value chain of a given industrial sector should be encouraged and supported.

The “Roadmap for EU -USA S&T cooperation” signed in August 2017 [20] could be amended to reflect the possibility to define and implement a long-term cooperation allowing for joint short and medium-term industry-oriented actions.

⁶ <https://www.openranpolicy.org/>

⁷ Future Internet Research and Experimentation (FIRE), <https://ec.europa.eu/digital-single-market/en/future-internet-research-and-experimentation>; Global Environment for Networking Innovations (GENI), https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=501055; EU-US joint development of advanced wireless research platform targeting new connectivity frontiers beyond 5G (EMPOWER), <https://www.advancedwireless.eu/>; Platforms for Advanced Wireless Research (PAWR), <https://advancedwireless.org/>

Another option would be to include the possibility for such an action at international level in the coming EU Action Plan for 5G and 6G. **This would provide the framework for designing joint initiatives and projects focusing on the most relevant 5G and 6G issues to be addressed together by the EU and the US.**

This should happen now, so that **implementation can start when Horizon Europe is kicked off**. Indeed, time is of the essence in the global 5G and beyond competition, and more generally in the digital industry, where **“those who move first and move fastest will hold the greater competitive advantage”** [2].

A framework shall be available for designing EU-US joint initiatives and implementing projects focusing on the most relevant 5G and 6G issues to be addressed together by the EU and the US as soon as Horizon Europe kicks off. A shorter time to market and a more industrial partnership ecosystem should be targeted.

Once this framework is available, **implementation shall involve all the relevant stakeholders, i.e. industry** (large companies, mid-sized companies, SMEs, start-ups, spin-offs), **public authorities** (in Europe, the EC and the Member States, including whenever relevant regional authorities especially when they support innovation and entrepreneurship at local level), and the **related SME support and financial ecosystem** (in Europe the European Investment Bank, Venture Capital, local SME support structures e.g. Digital Innovation Hubs, etc.). Such an approach would be consistent with the EU industrial strategy stating that “these efforts should be supported by policies and financial instruments at EU and national level, as well as the private sector” [2]. One of the interesting options to ensure the participation of all relevant stakeholders in the EU would be to involve the upcoming Smart Networks & Services Public-Private Partnership.

The implementation of the 5G and beyond EU-US joint framework shall involve all the relevant stakeholders, i.e. industry, public authorities, and the related SME support and financial ecosystem, at EU and national level.

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