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Acronyms

AI. Artificial Intelligence

ATM. Air Traffic Management

BMR 2024. *Performance of European Partnerships – Biennial Monitoring Report* 2024

EDF. European Defence Fund

EDCTP. European & Developing Countries Clinical Trials Partnership

EIC- European Innovation Council

EIC Pathfinder. European Innovation Council Pathfinder programme

EQCO. European Quantum Coordination Office

EuroHPC JU. European High Performance Computing Joint Undertaking

FP. Framework Programme for Research and Innovation of the European Union

HE. Horizon Europe.

HPC. High Performance Computing

IP. Intellectual Property

JPI. Joint Programming Initiative

JU. Joint Undertaking

MS. Member States

OSA. Open Strategic Autonomy

PAB. Public Authority Board (in JU)

PPP. Public-Private Partnership

PRIMA. Partnership for Research and Innovation in the Mediterranean Area

QuIC. Quantum Industry Consortium

R&I. Research and Innovation

SRIA. Strategic Research and Innovation Agenda

TRL. Technology Readiness Level

TFEU. Treaty on the Functioning of the European Union

Executive Summary

Technological sovereignty has become a strategic priority for the European Union (EU) especially in critical technologies such as quantum computing. European Partnerships and networks under Horizon Europe (HE) have emerged as essential instruments for reinforcing Europe's capacity to innovate, reduce strategic dependencies and secure a stronger position in global value chains.

Developed under the ERA-LEARN project, this policy brief explores the role of European Partnerships in strengthening technological sovereignty. It focuses on the rapidly evolving field of quantum technologies as a strategic case study. These technologies offer a valuable testbed to analyse i) how Europe can balance openness with sovereignty; ii) ensure continuity across Technology Readiness Levels (TRLs) by linking research and industry and iii) consolidate leadership in an emerging domain of intense international competition.

Building on the Biennial Monitoring Report 2024[1] together with expert insights from QuantERA, Chips JU, and EuroHPC JU, the analysis highlights how partnerships and networks complement one another, fostering alignment and interaction across different TRLs, as well as shaping and influencing international collaboration with third countries. The findings of this policy brief can be outlined along three main lines

First, **technological sovereignty should be understood** not only with regards to EU self-sufficiency, rather **as playing a key role (by becoming an indispensable supplier or by ensuring a trustworthy supply partnership) in global value chains.** EU's strength lies in leading selected high-value niches, such as specific quantum modalities, while maintaining selective openness to trusted international partners[2].

Second, **European Partnerships and networks can play a decisive role in aligning research, innovation and industrial capacity** with the EU's sovereignty objectives, particularly in strategic fields such as quantum technologies. Global technological sovereignty is increasingly shaped by structural challenges such as access to critical raw and advanced materials, regulatory barriers, limitations in supply-chain resilience and the absence of harmonised procurement or dual-use transparency frameworks. Addressing these issues is essential to reduce vulnerabilities and reinforce resilience. By enhancing coordination across programmes, safeguarding key technologies, strengthening interfaces between research and industry, and leveraging science diplomacy, the EU can consolidate its leadership while maintaining open strategic autonomy in an increasingly contested technological landscape.

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[1] *Performance of European Partnerships – Biennial Monitoring Report 2024 on Partnerships in Horizon Europe*. Luxembourg: Publications Office of the European Union. Available at: https://op.europa.eu/en/publication-detail/-/publication/8f71dfd0-76fe-11ef-bbbe-01aa75ed71a1 (Accessed: 20 November 2025). Publications Office of the EU+1

[2] https://digital-strategy.ec.europa.eu/en/library/state-digital-decade-2025-report

Third, and final, **more strategic monitoring and evaluation systems** are necessary to assess partnerships' contribution to sovereignty goals and ensure reciprocity in international cooperation, including in access to programmes, intellectual property, and researcher mobility. A growing requirement is also marked to examine how to **bridge civilian and defence innovation in a way that keeps European values at the core**, proposing active exploration of synergies with defence initiatives alongside transparent governance for dual use applications.

In synthesis, **partnerships should explicitly address the main dimensions of technological sovereignty while remaining internationally engaged in a way that is calibrated to risk and maturity**. The proposed logic can be further unpacked: at lower technology readiness levels, the EU should encourage openness and values-based cooperation with trusted partners, whereas at higher readiness levels the cooperation should shift toward stronger reciprocity, clearer safeguards, and a deliberate avoidance of one-sided cooperation with systemic rivals, especially where strategic technologies are at stake.

Internationalisation should become more predictable and less ad hoc through institutionalised, long term framework agreements with trusted partners. The underlying argument is that structured cooperation arrangements can deliver strategic coherence and reciprocity while reducing the volatility that arises when collaborations are shaped primarily by short term geopolitical pressures rather than by a stable, long horizon innovation strategy.

There is a need for **coordination and continuity across Europe's fragmented policy and funding landscape**. Deeper alignment between European Partnerships, networks, and national and regional initiatives, is needed with the aim of linking priorities and investments to major EU level programmes and flagships so that progress toward sovereignty objectives is coherent. In the same vein, it calls for stronger bridges between exploratory research-oriented initiatives and industrially driven programmes so that the full technology readiness spectrum is covered without discontinuities. This continuity is framed as a practical design requirement that should put SME needs, shared roadmaps, pilot projects, and, where relevant, joint calls at the centre, ensuring that promising results can move from early discovery to industrial uptake without falling into gaps between instruments.

Sovereignty is shaped not only by technology programmes but by upstream dependencies, particularly in raw and advanced materials that underpin emerging strategic sectors. This highlights the need to **leverage partners' complementarities to address resource dependencies**. By aligning technology and materials initiatives, Europe can secure essential inputs structurally rather than incidentally.

Protection of strategic interests requires looking beyond formal legal establishment in the EU to the realities of ownership and control, especially in sensitive domains where participation by subsidiaries of non-EU corporations could introduce sovereignty risks. **Therefore, safeguarding eligibility, governance, and market shaping instruments becomes paramount**. This calls for **strengthening regulatory and public procurement frameworks towards sovereignty-oriented criteria**, including European ownership, supply chain resilience, and security considerations, can be legitimately incorporated into decisions for strategic technology areas.

1. Introduction

Technological sovereignty is now a central priority of the European Union driven by geopolitical tensions, rapid technological innovation and global competition. Beyond economic growth, the ability to develop and protect critical technologies is increasingly recognised as a foundation of strategic autonomy, security and resilience. The European Parliament Research Services[3] highlights the need to reduce strategic dependencies in high-stake sectors such as AI, big data, cloud computing, cybersecurity, secure communications, robotics, and microelectronics in order to maintain a competitive and resilient edge in a fractured global market.

The purpose of the policy brief is to analyse how technological sovereignty is addressed in European Partnerships, an important instrument of international collaboration. It focuses on quantum technologies as these represent a disruptive field in which the EU is investing with ambitions to become a global reference and key player. Both the EU and the Member States have developed dedicated strategies and action plans to strengthen their position in this area. The EU has launched a Quantum Flagship with a budget around €1bn and has reoriented two of its main Joint Undertakings (EuroHPC JU and Chips JU) to align priorities and pool national and EU resources. These Joint Undertakings now fund large-scale projects, some worth tens or even over one hundred million euros, reflecting their strategic and industrial scope.

In parallel, QuantERA serves as the main European network supporting smaller, investigator-driven projects, typically below €5m. It provides the scientific community with greater flexibility and an avenue for proposing potentially groundbreaking ideas. As a more agile instrument, it enables early exploration of transformative concepts that may later feed into higher-TRL initiatives. Quantum technologies provide an ideal testbed for this analysis because they combine rapid technological evolution, strong geopolitical competition, the need for continuity from low to high TRLs, and active involvement of several European Partnerships with complementary roles.

Technological sovereignty in this policy brief is examined through three analytical dimensions:

1. **Instrumental**: How each partnership's legal basis, mechanisms and governance influence its capacity to protect strategic interests, manage openness, and shape global competition.
2. **Structural**: How the interaction between partnerships (QuantERA, Chips JU, EuroHPC JU) enables or constrains continuity across TRLs, supply-chain resilience, and strategic autonomy.
3. **Geopolitical**: How partnerships navigate the shift towards a more constrained global environment, including open and selective international cooperation, reciprocity mechanisms, and science diplomacy[4].

[3] European Software and Cyber Dependencies: Dec. 2025 PP 43-48 and 71- 84
https://www.europarl.europa.eu/RegData/etudes/ATAG/2025/767234/EPRS_ATA%282025%29767234_EN.pdf
Also: Strategic dependencies: Threats to EU sovereignty in communication infrastructure. Febr, 2025

[4] "*Science diplomacy is the direct or indirect use of science, scientific evidence, and scientific cooperation to support diplomatic objectives at different levels as well as the deployment of diplomacy to support scientific progress*." The

We apply a combined approach linking a review of relevant documentation, review of websites, elaboration of ERA-LEARN data, some 10 semi-structured interviews with experts involved in Chips JU, QuiC, Quantera, Quantum Flagship, and EuroHPC JU, also integrating written contributions from some of these actors. The analysis helped contextualise interview insights and provided quantitative and qualitative evidence on partnership performance, TRL coverage, international engagement and governance.[5]

In the remainder, we introduce the concept of technological sovereignty and proceed by unpacking what this means for European Partnerships. We then present the analysis of non-EU countries participation in partnerships based on ERA-LEARN data (section 2). In section 3 we then discuss the role of partnerships in the EU`s technological sovereignty and global competition in quantum technologies. This section includes a brief introduction on the importance of quantum technologies for the European strategic autonomy and proceeds with presenting three partnerships (QuantERA, Chips JU and EuroHPC JU), their role in the field drawing on available data and insights from the interviews. In the last section, we present the conclusions from the analysis and recommendations drawing on the analysis conducted on both primary and secondary information. In the Annex we share more detailed information on the Horizon Europe partnerships, the most active third countries and the methodological steps followed in this study.

The target audience of the report is the partnership community as well as national and European officials engaged in the policy discourse on technological sovereignty. Moreover, we reported over some of the basic features of the partnerships in Horizon Europe in section 2.2 and in the annex to address the needs of newcomers in the field because knowledge of these instruments is necessary to fully grasp the analysis of the information and its conclusions.

European Commission adopted on 27 February 2026 the proposal for a Council recommendation on a European Union framework for science diplomacy. The main objective of the EU framework for science diplomacy is to provide a shared vision, common narrative and pragmatic code of conduct in the field of science diplomacy, in particular in support of:

- defending the Union's democratic values, strategic interests and technological & data sovereignty
- strengthening the Union's competitive position as one of the leading global science and technology actors
- maximising the deployment of the Union's R&I potential for the pursuit of peace and a rules-based international order, and
- reinforcing the Union's commitment to managing global goods and commons sustainably, fighting the triple planetary crisis of climate change, biodiversity loss and pollution, and contributing to the achievement of the Sustainable Development Goals
- fostering coherence and optimise resources, both at Union and Member State level.

https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/europe-world/international-cooperation/science-diplomacy_en

[5] The distinct steps of the methodology are presented in Annex 5.3

2. Technological sovereignty and European Partnerships

2.1. Technological sovereignty

European technological sovereignty is **defined as Europe's capacity to develop, provide, protect, and maintain the critical technologies necessary for the well-being of its citizens and the prosperity of its businesses, as well as its ability to act and decide independently in a globalised environment**[6].

This definition implies three interrelated dimensions[7]:

- **Technological**: building R&D capacities, a solid knowledge base, industrial infrastructure, and networks in critical technologies.
- **Economic**: leadership in key enabling technologies[8] such as advanced manufacturing, (nano)materials, life sciences technologies, micro/nanoelectronics and photonics, artificial intelligence, and secure connectivity.
- **Regulatory**: the EU's ability to shape regulation and global standards in line with European values.

The EU's approach to **technological sovereignty** does not envision isolation. Rather, it is framed by the principle of Open Strategic Autonomy (OSA)[9], which seeks to combine leadership in selected strategic niches with openness to trusted international partners. This approach is supported by the Letta Report (Much more than a market)[10] which underlines that technological sovereignty requires global cooperation from a position of strength, ensuring Europe's capacity to shape, rather than merely adapt to, international technology markets. Sovereignty, in this sense, demands the ability to scale innovation and lead in foundational technologies across three dimensions: knowledge, production, and trade. This vision is closely connected with the EU's broader objectives, including:

- The **transition from a consumer to a producer model**, backed by a coherent strategy and an execution plan.

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[6] Chapter 8. Technology Sovereignty of the EU: Needs, Concepts, Pitfalls and Ways Forward https://ec.europa.eu/assets/rtd/srip/2024/ec_rtd_srip-report-2024-chap-08.pdf

[7] Key enabling technologies for Europe's technological sovereignty. Dec 2021. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/697184/EPRS_STU(2021)697184_EN.pdf

[8] Key enabling technologies (KETs) are knowledge-intensive, multidisciplinary technologies with high R&D intensity and rapid innovation cycles. They are crucial for the EU's economic competitiveness and address societal challenges through innovation.

[9] "*Open strategic autonomy emphasises the EU's ability to make its own choices and shape the world around it through leadership and engagement, reflecting its strategic interests and values. (…) . It builds on the importance of openness, recalling the EU's commitment to open and fair trade with well-functioning, diversified and sustainable global value chains*" https://rmis.jrc.ec.europa.eu/autonomy-b2cea8

[10] https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf; page 60 and other references to leadership in strategic niches

- The promotion of Open Strategic Autonomy (OSA) and the twin green and digital transition.
- A renewed emphasis on economic security, particularly in strategic value chains such as advanced semiconductors[11].

The **coexistence of EU and national/regional policies** and strategies in research and innovation **creates a delicate balance** between common directionality of efforts and investments towards key areas of European interest and strengthening national specialisation and competencies or creating new ones with each Member State pursuing its own positioning at the European and global levels.

Regarding the **level of efforts and resources dedicated to jointly addressing certain areas**, the EU's central R&I budget is around one tenth of what the Member States collectively allocate in their national budgets for R&I. In 2023, the EU budget proposal earmarked about €13.6 billion for research and innovation (including €12.3 billion for Horizon Europe)[12]. In the same year, Eurostat reported total government budget allocations for R&D (GBARD) across the EU at €123.684 billion.[13] When considering the full Horizon Europe envelope averaged over 2021–2027 (about €93.5 billion total[14], or roughly €13.4 billion per year), the ratio is similar, around 10–11%. At the same time, the total of the EU gross expenditure in R&D (GERD) as a share of the gross domestic product (GDP) is around 2.26 (2023 values) while that of our peers reaches 3.45 for the US, 3.4 for Japan, 4.85 for South Korea and 2.49 for China (excl. Hong Kong).

The **need to strengthen coordination and alignment of national and regional resources** besides increasing public R&D spending in the EU is paramount. This challenge is further intensified by the regulatory fragmentation among members states and insufficient private investment. To address these challenges, the EU assumes a dual role. On the one hand, it fosters cooperation among European actors to position the Union as a strategic global player, while safeguarding and maximising its own interests. On the other hand, the EU acts as a key enabler working alongside Member States (MS) and other public and private stakeholders, particularly European industry, to design instruments within the Union's broader toolbox.

2.2. European Partnerships in Horizon Europe

Within this context, European Partnerships and related network initiatives **play a crucial role by balancing cooperation and protection, enabling the EU to remain globally connected while safeguarding its strategic interests.** European Partnerships are initiatives that involve Member States (MS), associated countries, private and/or public partners (including industry, universities,

[11] https://www.consilium.europa.eu/media/yxrc05pz/sn02167en24_web.pdf,and https://publications.jrc.ec.europa.eu/repository/bitstream/JRC136359/JRC136359_01.pdf

[12] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3473?utm_source=chatgpt.com

[13] https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240806-1?utm_source=chatgpt.com

[14] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en?utm_source=chatgpt.com

research organisations, public authorities, civil society organisations, NGOs, etc.) [15].The partners commit to jointly support the development and implementation of a programme of Research & Innovation (R&I) activities, including those related to market, regulatory and policy uptake and they serve as collaborative platforms through which their partners can coordinate investments, reduce strategic dependencies, and reinforce Europe's role in global value chains16. By pooling resources across multiple actors (EU, member states, associated countries, industry, etc.), partnerships are conceived as core instruments for delivering Horizon Europe (HE) policy objectives and commitments, playing a decisive role in achieving greater impact and effectiveness than the European Commission (EC) could deliver on its own. There are three types of European Partnerships in HE: co-funded, co-programmed, and institutionalised[17].

Table 1: Brief descriptions of the partnership types under Horizon Europe

CO-FUNDED PARTNERSHIPS	CO-PROGRAMMED PARTNERSHIPS	INSTITUTIONALISED PARTNERSHIPS
Co-funded partnerships fund joint programmes of research and innovation activities between research and innovation funders. They are implemented through Horizon Europe Grant Agreements signed by the Commission and a consortium of partners, generally composed of research and innovation funders and other public authorities but also open to private partners. Partners generally implement joint transnational calls as well as additional activities, with either 30% or 50% co-funding from Horizon Europe.	Co-programmed partnerships are based on joint programming of research and innovation activities and mobilisation of additional activities by partners in line with the objectives of the partnership. They are based on a Memorandum of Understanding, which the Commission signs with industry associations, large industry actors, and public research organisations. The EU contribution is implemented through Horizon Europe work programme calls, while matching contributions from partners are implemented under their responsibility.	Joint Undertakings (JUs) based on Article 187 of the Treaty (TFEU): long-term collaborations with private (sometimes also public) partners. Article 185 initiatives, based on Article 185 TFEU: long-term collaborations with public partners. Both Article 185 and 187 partnerships require the adoption of specific legislation and are implemented by dedicated structures created for that purpose.

[15] REGULATION (EU) 2021/695 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013- Art. 2.36. https://eur-lex.europa.eu/eli/reg/2021/695/oj/eng

[16] ERRIN (2025) *European Partnerships*. Available at: https://errin.eu/RI-Policy/european-partnerships (Accessed: 20 November 2025). errin.eu

[17] Web Site of the European Partnerships in Horizon Europe.

Source: European Partnerships in Horizon Europe

Beyond the formal categories, EU also relies on transnational networks based on other legal instruments, which coordinate national and EU funding to support joint calls, especially in emerging and sensitive research areas. QuantERA is an example of this kind of network that operates as a special Research and Innovation Action and focuses on low- and mid-TRL projects, supporting foundational science, early innovation effort, SME participation and cross-border collaboration.

The way in which each initiative approaches **their relationship with and contribution to the EU's global competition and technological sovereignty rests on**:

- Their legal basis, which gives the partners greater or lesser flexibility in deciding their openness to third countries, including partner countries, depending on their topic and activities, as well as the main recipients and the financial effort devoted by the Union together with the Member States.
- The purpose for which they were created. Some, such as PRIMA or EDCTP2 have a clear international component and play a role in the EU's 'science diplomacy'. Others, such as the Chips Joint Undertaking (Chips JU), seek to protect and promote European industry. The latter are linked to specific sensitive areas and technologies that have implications for the EU's global position. [18]

2.3. Non-EU countries collaborating in partnerships

Ensuring EU competitiveness and technological sovereignty in the context of shifting geopolitical balance means to reflect on the EU position vis-à-vis third countries. Participation by non-EU countries varies significantly across partnership types and governance models. While all partnerships contribute to the green and digital transitions and address global challenges such as climate change, energy security and health resilience, their degree of openness to international cooperation differs substantially. Given that no uniform strategy exists for international cooperation across the different partnerships, each of them applies their own approach based on their focus and aims. For example, the co-funded partnerships tend to offer greater flexibility for third-country participation, whereas institutionalised and co-programmed partnerships often operate within more restricted governance frameworks, limiting external engagement. Participation levels are heavily influenced by the nature and objectives of each partnership, as the strategic choices made by consortia largely determine whether third countries are invited.

The role of Horizon Europe partnerships in strengthening the EU's technological sovereignty must be analysed through the lens of a strategic vision in which Europe becomes an indispensable actor within global value chains with selective openness, strategic alignment, and values-based cooperation, whereby each partnership and network responds according to its objectives, interests, and the regulatory framework governing them. In this regard, Article 22.5 and 22.6 of

[18] For more information on the specific features of partnerships including the legal basis, governance, funding source, etc. see the table in Annex 5.1. For further information on the European Partnerships under Horizon Europe, please visit https://www.era-learn.eu/partnerships-in-a-nutshell/european-partnerships/general-information.

the Horizon Europe Regulation (EU, 2021/695), or Article 12.6 of the Digital Europe Programme[19] encourage case-by-case assessments rather than blanket exclusions of third countries, with the aim of safeguarding both competitiveness and security. These articles allow for:

- Restricting the participation of entities from certain countries in sensitive areas (e.g. quantum, space, critical raw materials)
- Imposing additional conditions on cooperation with countries where a level playing field in R&I does not exist.

These articles were applied in Horizon Europe (including the European Partnerships). As a result, participation was limited in the topics related to quantum research, space, and critical raw materials (49 topics in the 2021-22 work programme - 4% of the work programme budget) and 31 topics in the 2023-24 work programme (3.5% of the work programme budget)[20].[21]

Including third countries presents a mix of potential benefits and challenges. As discussed in the Partnership Stakeholder Forum 2024, experience gained outside Europe across numerous fields is highly valuable, and the EU should draw on the expertise of diverse actors, such as the United States or China. At the same time, it must safeguard its own strategic interests. Mutual learning exercises and training exchanges in competitive areas, such as hydrogen, should concentrate on topics that are genuinely mutually beneficial. China was highlighted as a key partner in scientific and technological collaboration, but such cooperation should rest on long-term, balanced advantages for both sides. In the aerospace sector, partnerships often align with shared interests yet remain inherently competitive with other regions, adding further complexity. This complexity is also illustrated by cases such as the United Kingdom's full participation in certain EU initiatives despite no longer being a Member State. In short, while the inclusion of both European and non-European industrial actors offers added value through broader participation and increased critical mass, the involvement of subsidiaries of third-country corporations raises specific concerns. Without appropriate safeguards, the objectives of partnerships may be undermined by the risks inherent in such dynamics.[22]

Based on the ERA-LEARN data, Türkiye, is the most active non-EU country in partnerships across both H2020 and Horizon Europe, followed by Switzerland, Israel and Canada, South Africa and Iceland. Indeed, the most appealing instrument for non-EU country participation has been the ERA-NET Cofund actions in H2020 followed by the co-funded partnerships in Horizon Europe. Switzerland, Canada, South Africa and Taiwan have been the most active non-EU countries since the Sixth Framework Programme (see Annex 5.2). Overall, participation by third countries remains limited, often involving fewer than three non-European partners per initiative.

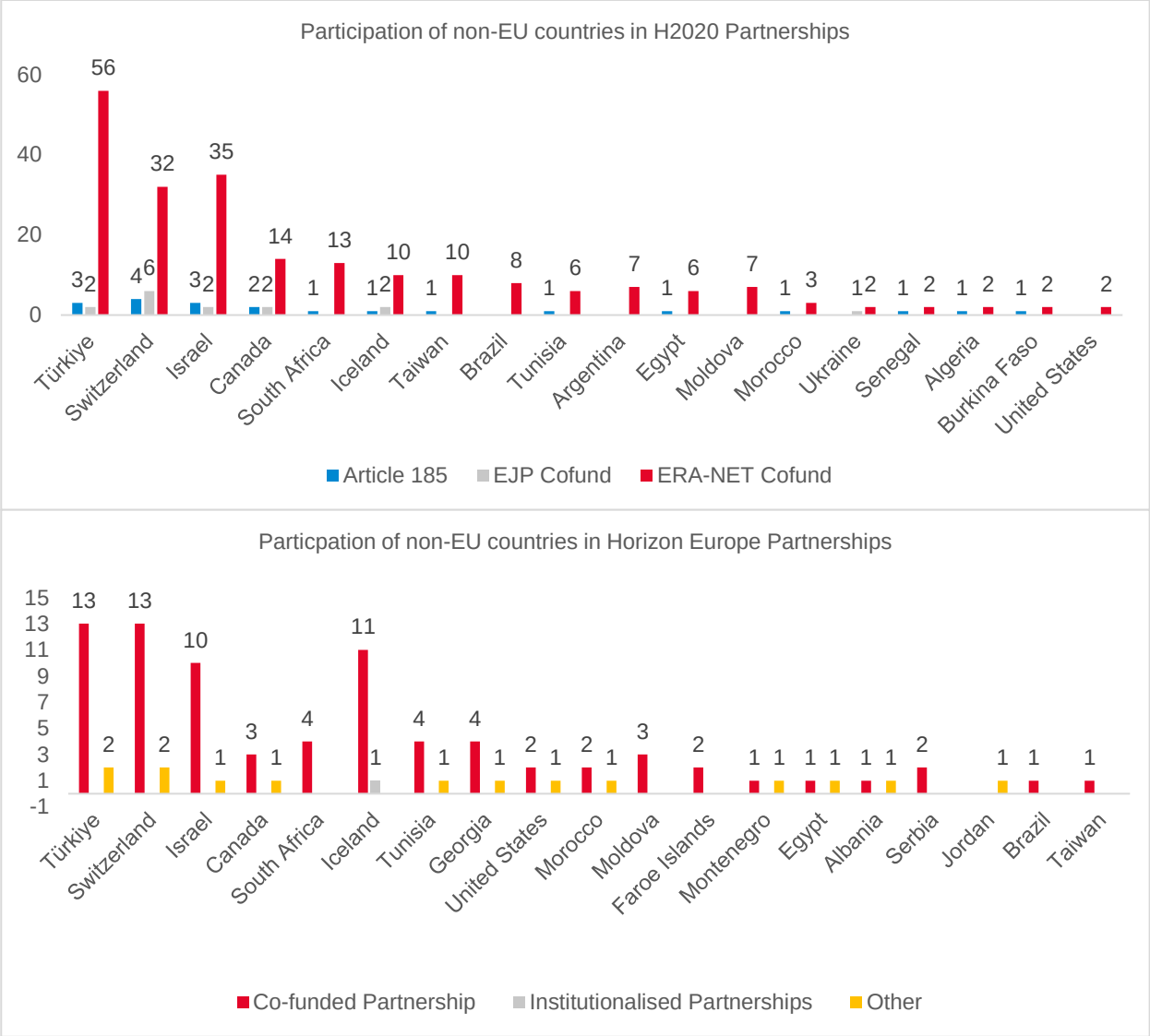
[19] Art. 12.6 If duly justified for security reasons, the work programme may also provide that legal entities established in associated countries and legal entities that are established in the Union but are controlled from third countries may be eligible to participate in all or some actions under Specific Objectives 1 and 2 only if they comply with the requirements to be fulfilled by those legal entities to guarantee the protection of the essential security interests of the Union and the Member States and to ensure the protection of classified documents information. Those requirements shall be set out in the work programme. https://eur-lex.europa.eu/eli/reg/2021/694/oj/eng

[20] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0356

[21] Biennial Monitoring Report 2024.

[22] https://www.era-learn.eu/documents/era-learn-partnership-stakeholder-forum-report-final-4feb2025.pdf

Figure 1: participation of non-EU countries in H2020 and Horizon Europe Partnerships



Source: ERA-LEARN

The analysis performed by the Biennial Monitoring Report (BMR) 2024[23] and the Interim Evaluation of Horizon Europe of the participation of third countries[24] along the three types of Partnerships reveals distinct patterns as shown below.

Co-funded partnerships

Once the Grant Agreement is signed, co-funded partnerships benefit from a high degree of autonomy to involve third-country partners in their calls. The calls launched under these partnerships are generally focused on low- to mid-TRL projects, which tend to facilitate the participation of third countries. At these stages of research and innovation, collaboration is often

[23] European Commission: Directorate-General for Research and Innovation, *Performance of European partnerships – Biennial monitoring report 2024 on partnerships in Horizon Europe*, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2777/991766

[24] https://research-and-innovation.ec.europa.eu/strategy/support-policy-making/shaping-eu-research-and-innovation-policy/evaluation-impact-assessment-and-monitoring/horizon-europe-programme-analysis_en

less constrained by strategic or commercial sensitivities, allowing for more open scientific exchange and the joint exploration of emerging technologies. This makes co-funded partnerships particularly suitable frameworks for fostering international cooperation and building trust with like-minded partners.

Institutionalised partnerships

Institutionalised partnerships play a strategic role for EU technological sovereignty, particularly initiatives such as EuroHPC JU and Chips JU, whose primary objective is to reinforce Europe's industrial capacity and technological competitiveness.

Based on additional analysis that was done for the purpose of the present report, out of the eleven partnerships examined[25], nearly all include entities whose parent organisations are headquartered in third countries. Participation may be direct, as in the case of the Clean Hydrogen Partnership, which includes members from the US, India, and South Africa through the Hydrogen Power Industrial Association. Alternatively, participation may be indirect, as in the SNS JU, Chips JU, or the Innovative Health Initiative (IHI), where involvement takes place via European industrial associations that include companies legally established in Europe, some of which, however, are owned by non-European corporations. For instance, in SNS JU the 6G Smart Networks and Services Industry Association includes third country firms such as Huawei, Apple and Mitsubishi. In Chips JU, the industrial associations of Chips JU, AENEAS, includes members such as Intel Research and Development Ireland Ltd, Intel Deutschland GmbH, Global Foundries, HCL Technologie, Huawei Technologies R&D Belgium NV, LAM Research International BV, LAM Research Belgium BVBA, Nvidia- Mellanox Technologies Ltd, or Murata Electronics Europe BV. This raises additional risks, requiring adequate safeguard measures to ensure that Europe's strategic autonomy is not undermined.

Table 2: Partners and participants in institutionalised partnerships[26]

Partnership	Legal Basis	Collaborating Countries (outside EU/Associated)
IHI – Innovative Health Initiative	Art. 187 TFEU	Collaborates with C-Path. Participation of third country companies based in EU
Global Health EDCTP3	Art. 187 TFEU	Extensive African participation; South Africa explicitly mentioned
Chips JU[27]	Art. 187 TFEU	Launching joint call with KR
EuroHPC JU (European High-Performance Computing JU)	Art. 187 TFEU	Cooperation with Japan and India

[25] This assessment was carried out by consulting the official websites of each of the industrial associations that are part of the institutionalised partnerships and verifying the entities that make up these associations.

[27] The Key Digital Technologies (KDT JU), precedent JU to Chips JU, also launched a cooperation with US, Japan, KR

SNS JU (Smart Networks and Services)	Art. 187 TFEU	Cooperation with US, JP, KR and via associated to the 6G-IA
Clean Hydrogen JU	Art. 187 TFEU	International cooperation not detailed; open to global R&I partners
Clean Aviation JU	Art. 187 TFEU	Global aerospace cooperation expected; US participate as observer, CA, GE, TR, UK
SESAR 3 JU (Single European Sky ATM Research)	Art. 187 TFEU	Cooperation with several institutions from America, Asia etc.
EU-RAIL (Europe's Rail JU)	Art. 187 TFEU	Cooperation with several institutions from America, Asia
Circular Bio-based Europe (CBE JU)	Art. 187 TFEU	No explicit non-EU partners listed. + Bio-based Industries Consortium (BIC)
Metrology (EMPIR successor)	Art. 185 TFEU	Broad global links in metrology; countries
PRIMA (Partnership for Research and Innovation in the Mediterranean Area)	Art. 185 TFEU	Mediterranean non-EU partners

Source: own elaboration based on the information in the websites

Co-programmed partnerships

In co-programmed partnerships, the European Commission funds R&I projects through dedicated Horizon Europe calls, ensuring transparency, open competition, and control over eligibility conditions, including the participation of third countries. Industrial and sectoral associations, for their part, contribute "in-kind" contribution[28], and play a key role in shaping and aligning the Strategic Research and Innovation Agenda (SRIA) while mobilising industry.

The thematic scope of co-programmed partnerships is closely linked to the EU's objectives in technological sovereignty and open strategic autonomy. They operate in strategic domains such as artificial intelligence, data and robotics (ADRA), smart networks and services (SNS JU), photonics, advanced manufacturing (Made in Europe), the sustainable process industry (Processes4Planet), batteries, and sustainable construction systems (Built4People). Based on the analysis of the information available on the websites, these partnerships are not disconnected from the global landscape. Depending on their thematic area, many maintain selective international cooperation with third countries that share strategic interests. Some co-programmed partnerships therefore stand out for their international linkages, as shown below.

Table 3: European co-programmed partnerships with major international collaborations

Partnership	Collaborating Countries (non-EU / Associated or Third countries)
AI, Data and Robotics (Adra)	United States, Canada, South Korea
Smart Networks and Services (SNS)	United States, Japan, South Korea
Photonics	Japan, Canada, South Korea (also engaged with US, Taiwan, Switzerland via IOA)

[28] Such as staff time, access to infrastructures, technical and administrative coordination, and commitments for private investment

Processes4Planet (P4Planet)	56 non-EU partners including Israel, Iceland, Thailand, Colombia, United States, South Africa

Source: own elaboration based on the information in the websites

3. The role of partnerships in the EU`s technological sovereignty and global competition in Quantum Technologies.

3.1. Quantum Technologies

Quantum technologies provide a particularly clear testbed for observing Europe's approach to technological sovereignty in practice. They are rapidly evolving within a strategic domain where science, industry and diplomacy intersect, and they mobilise multiple HE instruments that collectively span the entire research and innovation spectrum, from basic research to industrial deployment. In a context of intense global competition, quantum technologies illustrate how Europe can balance openness with security, ensure continuity across technology readiness levels, and consolidate leadership in critical technology domains that are essential to its digital and industrial sovereignty.

Major powers including the United States, China, Japan, and South Korea are scaling up their investments, reshaping alliances and increasing competitive pressure. For instance, the AUKUS Quantum agreement (Australia, the United Kingdom, and the United States) seeks joint investment in quantum positioning, navigation, and timing technologies. Similarly, the Quad alliance (United States, Australia, India, and Japan) explicitly includes collaboration on advanced and emerging technologies. These initiatives underscore the strategic competition among global powers, within which the EU seeks to position itself as a key actor.

The recent document The Quantum Europe Strategy (COM(2025) 363 final) identifies a set of pressing challenges that Europe must urgently address to secure technological sovereignty and global competitiveness in quantum technologies. These challenges reflect structural, industrial, and geopolitical gaps that could undermine Europe's capacity to lead the next quantum revolution:

- Fragmentation and lack of coordination.
- Gap between scientific excellence and market uptake.
- Fragile industrial and financial ecosystem.
- Technological dependencies and supply chain vulnerabilities
- Intensifying global competition and geopolitical pressure
- Dual-use potential and security dimension
- Talent shortages and skills gaps
- Fragmented governance and implementation.

At the same time, the European Quantum Industry Consortium (QuIC) proposes a **"*Quantum for Good*" diplomacy agenda**, highlighting the societal value of quantum applications and their role in European science diplomacy. The idea is to demonstrate that Europe's quantum research and industry can contribute to the global common good (*for good)* rather than serving exclusively security or strategic competition. This includes applications such as quantum sensors for groundwater monitoring, advanced medical diagnostics, and the development of pan-European standards and fast-track visa schemes to attract talent. Politically, the agenda aims to project

Europe as a responsible leader in emerging technologies, differentiate its approach from that of global powers like the US or China, and strengthen multilateralism by fostering international cooperation at lower TRLs. In short, “Quantum for Good” positions Europe as combining innovation with social responsibility and sustainability while advancing its technological sovereignty.

3.2. Partnerships in Quantum Technologies

QuantERA

QuantERA is an example on how the EU can respond swiftly and effectively to the challenges posed by intensifying global competition in emerging and disruptive technologies, combining imagination with pragmatism through a Research and Innovation Action, implemented through an “cascading grant” instrument with Financial Support To Third Parties (FSTP)[29] evolved from ERA-NET scheme implementation under Horizon 2020 to become a special type of network, different but complementary to the European Partnership. This network pools resources from the EU, MS, and Associated Countries in an ad hoc instrument that supports research-driven projects, serving as a launchpad for new ideas that frequently lead to future applications. By supporting research, QuantERA expands the European quantum ecosystem and provides a flexible mechanism for MS to jointly foster scientific innovation.

QuantERA also supports SMEs, which provide both funding and collaboration opportunities with academic institutions. This enables SMEs to build competencies, co-develop technologies, and increase their visibility within the European quantum community. In doing so, QuantERA contributes indirectly to scaling up by creating a pipeline of ideas and prototypes that can subsequently be advanced through other funding instruments.

Table 4: Funded QuantERA Projects (Call 2021 and 2023)

	Funded Projects	Budget (M€)
Quantum Phenomena and Resources	40	42
Applied Quantum Science	23	31

Alongside QuantERA, it is worth highlighting CHIST-ERA, initially an ERA-NET that funds calls in the same areas “to lead to significant technology breakthroughs in the long term” and where Taiwan is a stable participant. Its very first call in 2010 identified quantum technologies as a key theme. Since then, CHIST-ERA has funded 116 low-TRL projects.

QuantERA can play a distinctive role in reinforcing technological sovereignty at the level of foundational knowledge. By focusing on low and medium TRLs and maintaining flexible governance, it supports Europe’s scientific leadership while enabling cooperation with like-minded

[29] Cascading grant with FSTP (Financial Support to Third Parties) is a mechanism used in EU funding to allow beneficiaries to redistribute funds to third parties, such as startups and SMEs, to support the selected transnational projects.

partners. In this way, QuantERA is particularly well positioned to act as an instrument of science diplomacy fostering foundational research that enables international cooperation while defending European values in quantum technologies and promoting the "Quantum for Good" diplomacy agenda which illustrates how sovereignty can be strengthened through value-driven, socially beneficial applications.

Chips JU

At higher TRLs, and in the context of Europe's declining global market share in semiconductors, the tripartite governance model of Chips JU (EU, MS, and European industry) has proven highly effective in accelerating innovation. Since 2008, the EC has strongly supported 5 joint undertakings also including the predecessors of the Chips JU (ENIAC, ARTEMIS, ECSEL, and KDT) funding more than 200 projects with over € 10 billion in the areas of semiconductors and chips.

Table 5: Funded projects, participants and total cost of the Chips JU and predecessors

Period	Joint Undertaking	Projects funded	Total grants	Participants
2008-2013	ENIAC [1]	63	1.525	1.384
2008-2013	ARTEMIS[1]	56	1.155	1.420
2014-2020	ECSEL[1]	111	2.600 (*)	3.775 (*)
2021-2023	KDT	30 (**)	4.175 (***)	Pending
2023- 2027	Chips[1]			

(*) Data aprox / no final figures
(**) Only KDT projects no final figures, early stages, room to grow
(***) Expected total contribution (EU 2.275 M€+ Member States 1.450 M€)

The EU's share of global chip revenues has fallen from around 20% in the 1990s to just 10% today. This downward trend poses a serious risk to the EU's competitiveness and technological autonomy. According to experts interviewed, Chips JU and its predecessors have delivered tangible industrial impact, particularly in EUV lithography and related equipment, metrology and precision tools, advanced materials, component manufacturing, automotive electronics, and reliability and they conclude that without this public-private investment, EU would have struggled to maintain its leadership in the field. Chips JU should therefore serve as a reference model for other strategic technology domains, including quantum technologies as suggested by Horizon Europe interim evaluation [30] and different experts interviewed for this policy brief.

While its predecessor Joint Undertakings supported some quantum technology projects, the current Chips JU has made a clear commitment to quantum technologies. It has allocated €145 million to six projects in its 2024 call. This represents a significant leap compared to QuantERA, which since 2014 has funded 101 projects with a total of €117 million[31]. This marks a significant step forward in Europe's efforts to advance quantum chip technology.

[30] https://research-and-innovation.ec.europa.eu/document/download/a3aa9b90-15c0-4ea7-b25e-9f4e29cfa740_en?filename=ec_rtd_he-evaluation-swd.pdf

[31] As the JUs' calls to fund quantum technology projects are relatively recent, it is too early to compare the results of projects funded by joint initiatives and QuantERA.

Chips JU supports the establishment of advanced industrial infrastructure, including pilot lines, some for Quantum Technologies,[32] and competence centres. It is expected that its contributions to innovation, training, and industrial competitiveness should be particularly noteworthy. Regarding collaboration with third countries, Chips JU has progressively incorporated calls related to quantum technologies and collaboration with third country into its portfolio. The 2024 joint call with South Korea includes research on neuromorphic computing and heterogeneous integration, both of which are closely linked to enabling future quantum and post-quantum systems. Preparatory work for a similar call with Japan confirms that quantum technologies are increasingly seen as a strategic area where Europe must remain both competitive and connected to global developments.

These efforts reflect a growing awareness that international cooperation is essential for advancing Europe's technological strategy. First, collaboration with external partners is not only desirable but necessary for the EU's own long-term innovation and competitiveness objectives. Second, given the globalised nature of critical technologies and value chains, Europe cannot realistically pursue these ambitions in isolation. However, interviewees also warn against partnerships driven primarily by short-term geopolitical imperatives rather than by stable, long-term strategies. Instead, they stress that international must be strategically designed. Partners—and the specific form of their involvement—should be carefully selected according to criteria such as trust, reciprocity, technological complementarity, and alignment with European values and regulatory frameworks. The scope of cooperation should also vary across stages of technological development: broader collaboration may be appropriate in early-stage research, while more advanced phases involving sensitive technologies or industrial scale-up require greater selectivity and safeguards. In this context, interviewees highlight the value of cooperation with trusted partners such as Japan, South Korea and Canada, while cautioning against excessive dependence on major global powers in strategically sensitive domains.

EuroHPC JU

With a budget of €6.9 billion, provided jointly by EU programmes and MS contributions, alongside an additional €900 million expected from European industry, EuroHPC JU deploy world-class HPC infrastructure, such as the JUPITER exascale computer in Germany and a second exascale system in France, EuroHPC JU's activities in quantum technologies are relatively new. EuroHPC JU is spearheading the integration of quantum technologies through the EuroQCS initiative, which involves installing quantum computers in several European sites to work in hybrid mode with HPC systems[33] (e.g., in France, Germany, Italy, Spain, Czechia, Poland). This hybrid approach enables researchers and industry to experiment with diverse quantum technologies, accelerating use cases ranging from optimisation to new material design[34].

[32] https://qt.eu/news/2024/2024-09-11_chips-ju-first-calls-for-quantum-chip-pilot-lines-announced

[33] In high-performance computing (HPC) for quantum technologies, "hybrid mode" usually refers to combining classical high-performance computers with quantum processors to solve a problem together. Instead of running everything purely on a quantum computer or purely on a classical supercomputer, the computation is split between both systems, each doing the part it is best at.

[34] BMR 2024, pp. 350–353 and EuroHPC JU: https://eurohpc.eu/

These initiatives aim to place EU at the forefront of quantum-HPC convergence, a domain with strong implications for future industrial and scientific competitiveness. EuroHPC JU supports programs as higher TRL R&I than QuantERA through competitive calls. In this way, it fosters the integration of quantum computing into HPC (e.g. quantum simulators and quantum-classical hybrids) and, together with the Chips JU, contributes to the European quantum value chain, ranging from fundamental research (QuantERA, Quantum Flagship) to HPC applications and industrial prototyping.

To date, EuroHPC JU has funded the HPCQS quantum project[35] , with a budget of €12 million, which aims to integrate two quantum simulators, each controlling more than 100 qubits, and has launched calls to fund projects with Japan[36] and India[37] in HPC and quantum, illustrating that selected partnerships with trusted countries can strengthen, rather than undermine, Europe's strategic autonomy. In addition, EuroHPC JU considers that the impact of the international collaborations normally goes well beyond the call objectives.

Strategic co-existence of the three partnerships

From the above analysis it becomes evident that each type of initiative contributes to technological sovereignty according to its specialism and in a complementary manner. QuantERA fosters scientific excellence, generates novel concepts, and builds foundational knowledge. Its value lies in their agility, openness to academic leadership, and ability to take research risks that industrial programmes typically cannot afford. Yet, small fraction of early-stage projects achieves commercial viability. Chips JU, on the other hand, is perceived to maintain its focus on higher-TRL activities. Regarding EuroHPC JU, SMEs and start-ups are almost always involved in its calls, and the current EU Quantum Computing infrastructure under EuroHPC JU is largely based on procurement processes in which European SMEs play a key role. Furthermore, as described in the "COM/2025/414 final", EuroHPC JU promotes Europe's technological sovereignty, by reinforcing capabilities in quantum enabling components and reducing dependencies in critical areas and this JU also implements part of the Quantum European Strategy. Both Chips JU and EuroHPC JU fall under the framework of Open Strategic Autonomy (OSA), with the shared objective of reducing EU's dependence on external actors in critical technologies.

The examples of Chips JU, EuroHPC JU and QuantERA illustrate the **value of moving beyond participation in individual calls towards embedding European Partnerships within a stronger and more strategic international dimension.** This would entail a gradual shift from stand-alone calls or ad hoc collaborations to long-term framework agreements with trusted partners, providing greater predictability, strategic coherence and reciprocity.

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[35] https://www.hpcqs.eu/

[36]2024 Call to Strengthen EU-Japan Partnership in Quantum Computing. https://www.eurohpc-ju.europa.eu/new-call-strengthen-eu-japan-partnership-quantum-computing-2024-11-19_en#:~:text=The%20objective%20of%20this%20call,Japan%27s%20ABCI%2DQ%20hybrid%20infrastructure%20. This call on Quantum Computing, with a total budget of €8 million, has recently closed.

[37] GANANA Project. New EuroHPC Project Strengthening EU-India Ties: the GANANA Project - EuroHPC JU

The coexistence of these three initiatives highlights the structural challenge to **establish clearer and better-coordinated transition pathways across the TRL spectrum, to reduce fragmentation and ensure effective scaling and deployment of promising results.** As interviewees proposed, a closer alignment between QuantERA and the Quantum Flagship would also enable smoother transitions from early-stage research to applied development. While EuroHPC JU and Chips JU primarily focus on infrastructure and higher-TRL innovation, QuantERA and the Flagship complement these instruments by supporting foundational scientific research. This requires mechanisms that enable promising results to progress from low-TRL research environments to higher-TRL industrial ecosystems. These mechanisms are, for instance, Chips JU, EuroHPC JU, or EIC Transition, and address existing governance gaps between partnerships. Together with harmonised export control and IP frameworks, and stronger support for SMEs, such an integrated approach is critical to achieving strategic objectives, including the target of reaching 100 logical qubits by 2030.

Achieving this continuity does not imply institutional integration, but rather the **creation of effective interfaces and bridging mechanisms,** including joint calls, shared roadmaps and pilot projects, ensuring progression without undermining the core mission of each instrument. Strengthening these transition pathways would allow promising outcomes to advance more systematically along the innovation chain, thereby reinforcing Europe's technological sovereignty.

This resonates with the position of the European Quantum Industry Consortium (QuIC) that stresses that Europe already possesses the pillars of a sovereign quantum ecosystem (exploratory science "QuantERA", industrial fabrication "Chips JU" and demand-driven procurement "EuroHPC JU"), but that greater continuity and coordination are still required.

Expert interviewees agree on the **importance of maintaining a functional division of labour between research-oriented and industry-oriented programmes**. This dual structure strengthens both innovation capacity and strategic coherence. By preserving distinct roles while enhancing coordination, European Partnerships can maximise the return on public investment, accelerate the market uptake of disruptive technologies, and align more effectively with EU objectives on technological sovereignty and global competitiveness. Interviewees also underlined that:

- **Better coordination between HE partnerships, networks and MSs initiatives** is critical to avoid overlap and maximise resources, and
- **Aligning national investments with EU-level programmes** such as Chips JU, EuroHPC JU, and the Quantum initiatives (Flagships, QuantERA…) would ensure more coherent progress towards sovereignty goals, while also enabling regional ecosystems to integrate more effectively into European value chains.

3.3. Understanding and addressing technological sovereignty

The EU must address core challenges, specifically supply chain security, technological sovereignty, and regulatory alignment, to capitalise on emerging global opportunities and

strengthen its global standing. The approaches to technological sovereignty are diverse within the interviewees:

Some interviewees stress the need to **reinforce sovereignty** by fostering novel concepts and protocols, while others explicitly call for prioritising European companies (rather than subsidiaries of multinationals) in public tenders. Another group emphasises the importance of European control over fabrication, intellectual property, and supply chains, highlighting both the need for transparency in dual-use components and the strategic value of diversification. From this perspective, sovereignty is inseparable from openness, rules-based trade, and stable multilateral frameworks, which underpin Europe's innovation capacity. Indeed, trade disruptions have already negatively affected the EU's microelectronics sector, as demonstrated by the surge in semiconductor demand from several European industries, including automotive, healthcare, and consumer electronics, during the second half of 2020 and 2021[38], also the more recent announcement by China on a tighter export control on essential materials such as rare earth, which may constrain global chips supply chain.

Interviewees linked to European partnerships emphasise that technological sovereignty can be interpreted in different ways depending on policy priorities and the position of actors within the innovation ecosystem. For some, it refers to Europe's capacity to develop and control key technologies and infrastructures. Others stress the importance of resilient supply chains and reduced strategic dependencies. These perspectives suggest a differentiated approach to sovereignty across technologies and stages of the innovation cycle. However, most experts reject a narrow or protectionist interpretation, instead advocating a model in which Europe strengthens its leadership in selected strategic niches and acts as an essential player in global value chains, particularly in semiconductors and quantum technologies.

In this context, understanding **technological sovereignty as complete self-sufficiency is neither realistic nor desirable for microelectronics**. Instead, according to a relevant interviewee, Europe should focus on becoming indispensable in high-value segments such as EUV lithography, photonics, and advanced metrology, where it already holds a comparative advantage. The same principle applies to quantum technologies: rather than aiming to dominate the entire field, Europe should seek leadership in strategic niches, such as specific qubit modalities or quantum control electronics.

This approach, supported by most of the interviewees, consistently **rejects a narrow or protectionist vision of EU technological sovereignty**. Instead, they support an approach in which Europe becomes an essential player in global value chains, particularly in semiconductors and quantum technologies. Nevertheless, interpretations of technological sovereignty, and its implications for EU's global competitiveness, vary across interlocutors depending on thematic scope and proximity to market.

In line with these approaches, another expert proposed a risk-based typology to reflect this approach: full reciprocity with peers (e.g., US, Japan), escrowed IP arrangements with emerging democracies (e.g., India, Brazil), and low-TRL cooperation only with systemic rivals (e.g., China).

[38] https://www.reuters.com/world/china/china-tightens-rare-earth-export-controls-2025-10-09/

A **differentiated approach** was also documented in the Biennial Monitoring Report 2024, which highlighted that more than 90% of stakeholders of Cluster 4 regard these partnerships as crucial instruments for achieving strategic autonomy. The report noted that partnerships and networks generally acknowledge that collaboration with third countries is highly relevant and necessary to remain competitive, yet this approach must be carefully assessed to ensure mutual benefits and safeguard strategic interests. This is reflected in differentiated approaches to international cooperation, which vary according to sectoral sensitivity and technology readiness levels (TRLs). Collaboration at low TRLs (1–3) is generally regarded as the most suitable stage for engaging with third countries, as it maximises while limiting strategic risks mutual benefits through basic research. At higher TRLs (6–9), where commercialisation, scale-up and security considerations become more prominent, cooperation tends to be approached with caution and only with partners that ensure long-term trust and alignment of interests. [39]

This approach is also suggested in the recent "QuIC Position Paper on the Quantum Europe Strategy", which includes the following paragraph:

> "*In addition, the Strategy emphasises procurement of EU-made technologies. While this approach supports domestic capacity-building, it may reduce access to globally leading solutions. In contrast, initiatives in the US (e.g. DARPA QBI) and the UK have adopted more open procurement frameworks that allow for participation from global vendors, including those based in Europe. Adopting a similarly flexible approach, where appropriate, could support innovation and accelerate progress. We recommend giving priority to EU suppliers but to allow for procurement of technology from like-minded countries if this demonstrably improves the quality of our QT products*."[40]

Regarding legal measures to implement possible changes to **European regulations** aimed at boosting the EU's technological sovereignty and global competitiveness, interviewees agree that the framework regulation should be conceived as a living instrument, one that provides stability to the European research and innovation system while also remaining flexible enough to respond and adapt dynamically to evolving global circumstances and emerging EU needs. In this regards, the expert for EuroHPC JU considers that the current proposal for a COUNCIL REGULATION on amending Council Regulation (EU) 2021/1173 of 13 July 2021 on establishing the European High Performance Computing Joint Undertaking and repealing Regulation (EU) 2018/1488 is reflecting all the needed EU regulation changes in order to take into account – inter alia - the Quantum European Strategy and the AI Continent Action Plan.

3.4. The dual-use nature of quantum research and strategic autonomy

Until recently, most partnerships and networks, such as QuantERA, Chips JU and EuroHPC JU, have largely avoided explicit engagement with defence or dual-use applications, particularly in

[39] BMR 2024, pp. 91–93

[40] https://www.euroquic.org/wp-content/uploads/2025/08/Position-Paper-on-the-Quantum-Europe-Strategy.pdf

low-TRL calls. This reflects both the civilian nature of the research supported and concerns about premature alignment with defence programmes.

However, some interviewees acknowledged that, as technologies mature and their strategic relevance grows, **stronger coordination between civilian and defence-oriented programmes may become appropriate.** Quantum and advanced digital technologies are now widely recognised as dual-use by nature, with implications for both economic competitiveness and security. From this perspective, technological sovereignty also entails the ability to manage the civil-military interface in a structured and value-consistent manner.

Proposals emerging from interviews include **closer cooperation with the European Defence Fund (EDF), the exploration of civil–military dual-licensing systems for intellectual property, and improved governance coordination across EU instruments.** The European Quantum Industry Consortium (QuIC) has identified the lack of structured defence alignment as a cross-cutting gap and has called for an EU-wide dual-use licensing framework and coordinated oversight, potentially through bodies such as the European Quantum Coordination Office (EQCO). These measures are seen as ways to reinforce strategic capabilities without undermining openness, academic freedom or European values.

4. Conclusions and policy recommendations

Taken together, these findings confirm that **European partnerships play a decisive role and are key instruments for advancing technological sovereignty in the global economy**. They enable the EU to avoid a purely defensive or isolationist stance by combining internal capacity-building with selective international engagement. At the same time, they highlight the need for more structured governance, improved safeguard mechanisms and clearer strategic coordination across civilian, industrial and security-related programmes.

Through their **complementary roles and links with other initiatives** (e.g. QuantERA in foundational research, Chips JU in industrial leadership, and EuroHPC JU in quantum–HPC integration) they **collectively span the TRL spectrum and reinforce Europe's presence in critical segments of global value chains.** The three partnerships exemplify how the EU seeks to balance sovereignty with global competitiveness, reinforcing domestic innovation while remaining an active and credible player in global R&I ecosystems. They also show the need to **strength the strategic international dimension** of European Partnerships. Rather than relying solely on case-by-case cooperation, the EU should establish **structured mechanisms to ensure reciprocity and mutual benefits,** including high-TRL areas, building upon some existing established by the partnerships. Monitoring systems for access to programmes, intellectual property ownership, and researcher mobility would support a more balanced and sustainable model of cooperation, ensuring that openness does not undermine Europe's sovereignty goals.

Qualitative evidence confirms that **sovereignty should not be approached as complete self-sufficiency but with a focus more in becoming essential in selected niches** such as EUV lithography, or specific quantum modalities while upholding Europe's position as a trusted global actor. Nevertheless, several strategic gaps remain. Attention should be paid to avoiding overlaps between initiatives. Ensuring **continuity across the TRL spectrum** is essential, so that promising results from low-TRL initiatives can transition smoothly to higher-TRL programmes without fragmentation.

In addition, partnerships should incorporate mechanisms to systematically reinforce SME participation, thereby sustaining Europe's innovation ecosystem and accelerating market uptake. They must also address the growing structural **challenge of securing access to critical and advanced raw materials,** which requires coordinated action across dedicated partnerships. Finally, it is essential to fully exploit the potential of partnerships as instruments of the EU's external action. As such, they should be **regarded not only as funding tools, but also as instruments of EU science diplomacy, capable of projecting European values and standards at global level.** Building on this last idea, the lessons for international cooperation are clear: collaboration at lower TRLs fosters scientific creativity and diplomacy, while higher-TRL engagement requires stronger safeguards, reciprocity, and trust.

Looking ahead, **reinforcing cross-program alignment, embedding resilience criteria into public procurement processes, and exploring the potential for establishing synergies with**

defence-oriented initiatives in selected thematic areas was also highlighted by sone interviewees.

By **aligning partnerships with regulatory safeguards and long-term strategic funding**, the EU can embed sovereignty principles into its R&I ecosystem. In this way, partnerships can help enable Europe to act as a global leader in quantum and semiconductor technologies, while upholding open strategic autonomy, advancing science diplomacy, and fostering values-based cooperation.

Building on the interviewees' insights and the bibliographic sources consulted, the following recommendations are proposed to strengthen the contribution of European Partnerships to technological sovereignty and global competitiveness:

- **Partnerships should address the key strategic dimensions of technological sovereignty while ensuring that the EU maintains a relevant role in an increasingly competitive global arena.** A differentiated approach should be applied, promoting openness and values-based cooperation with like-minded countries at lower TRLs, while requiring stronger reciprocity and robust safeguards at higher TRLs, and avoiding one-sided partnerships with systemic (countries) rivals.
- **More structured international cooperation frameworks should be created** via institutionalised and long-term framework agreements with trusted international partners that would provide greater predictability, strategic coherence and reciprocity, while reducing the risk that cooperation is driven primarily by short-term geopolitical considerations.
- **The coordination should be deepened between European Partnerships, networks, national and regional initiatives to align priorities/investments with EU-level programmes** such as Chips JU, EuroHPC JU, QuantERA, the Quantum Flagship, to ensure more coherent progress towards technological sovereignty goals, while also enabling regional ecosystems to integrate more effectively into European value chains.
- **The links between "more exploratory initiatives" (e.g. QuantERA) and industrial driven programmes (e.g. Chips JU, EIC Transition) should be strengthened** to create mutual synergies and ensure continuity across the full TRL spectrum and type of funded projects. SME needs, shared roadmaps, pilot projects, and, where relevant, joint calls should placed at the core of this process.
- **The complementarities should be leveraged between partnerships and initiatives to address the challenge of critical resources dependencies in emerging raw and advanced materials.** In the case of quantum technologies, this means aligning quantum-related initiatives (QuantERA, Chips JU, EuroHPC JU) with dedicated materials initiatives (e.g. ERA-MIN, M-ERANET, RAMP and other coming partnerships), ensuring a structural approach to securing critical inputs. It is recommended to embed resilience criteria, such as dual sourcing and the requirement for EU-based suppliers, into procurement frameworks to strengthen Europe's strategic autonomy.
- **Eligibility and governance safeguards should be introduced based on ownership and control.** To protect strategic interests, eligibility and governance criteria should consider not only the legal establishment of participating entities within the EU, but also their effective ownership and control. This is particularly relevant for partnerships operating in sensitive technological domains, where participation by subsidiaries of non-EU corporations may pose risks to technological sovereignty.

- **Regulatory and procurement frameworks should be strengthened in support of technological sovereignty.** Regulatory and public procurement frameworks should be reviewed to allow the incorporation of sovereignty-oriented criteria, such as European ownership, supply-chain resilience and security considerations, in strategic technology areas. This would enable public authorities to better align procurement decisions with EU technological sovereignty objectives.
- **Strategic monitoring and evaluation mechanisms should be developed** to assess the strategic impact of partnerships on technological sovereignty. Across all partnership types, monitoring mechanisms should be reinforced to ensure reciprocity in international cooperation, (access to programmes, intellectual property and researcher mobility).
- **There is a growing need to assess the potential for facilitating the bridge between civilian and defence innovation**, in line with global technological developments while keeping European values at the core of guiding strategies. In this context, synergies between quantum-related partnerships and EU defence initiatives should be actively explored, with particular attention to transparency in civil–military dual-use applications and to the development of common standards for intellectual property, export controls and security-sensitive technologies. To support this, the QuiC proposes to establish a EQCO with a mandate to ensure coherence, prevent duplication, and strengthen the interface between civilian innovation and strategic security objectives.

5. Annex

5.1. Specific features of the different types of partnerships in Horizon Europe

Table 6: Types of partnerships networks in Horizon Europe

Aspect	**Co-programmed**	**Co-funded**	**Institutionalised**
What makes it stand out?	Reflects primarily **industry priorities**, easy to start and flexible to run, and focused on industry stakeholders.	An interplay of **EU and national priorities**, with EC oversight and focus on public authorities.	**Long-term strategic focus** with dedicated implementing structures and large funding commitments.
How is it set up?	The EC and mostly private partners sign a Memorandum of Understanding (MoU).	Grant Agreement (GA) between the EC and partners, based on a proposal to a WP call.	Established under Articles 185 and 187 TFEU or within the European Institute of Innovation and Technology (EIT) framework.
Who joins?	Industry associations, large industry actors, and public research organisations.	Public funders, ministries, and public research organisations.	Article 185: Member States; Article 187 and EIT KICs: private and public actors.
How does the EU contribute financially?	Horizon Europe (HE) Work Programme (WP) calls implement the Union contribution.	EU covers 30 –50 % of the total eligible costs.	Based on dedicated regulations adopted under Articles 185 and 187 of the Treaty on the Functioning of the European Union (TFEU), or on Partnership Agreements established under the EIT Regulation.

For further information on the European Partnerships under Horizon Europe, please visit https://www.era-learn.eu/partnerships-in-a-nutshell/european-partnerships/general-information.

5.2. Most active third countries in partnerships/networks since FP6

Country	Networks	Networks Coordinating	Organisations	Calls	Projects
Switzerland	136	4	45	302	1160
Canada	39	0	19	152	338
South Africa	21	0	6	61	144
Taiwan	16	0	4	61	59
Egypt	14	0	6	55	120
Russia	14	0	18	64	36
Brazil	13	0	6	58	90
Miscellaneous	10	3	7	4	0
United States	10	0	7	23	175
Argentina	9	0	7	23	58

Source: Data from https://www.era-learn.eu/network-information/countries/list-countries Consulted 7 September 2025

5.3. Methodological steps

1. **Review and analysis** of key documents, giving insight and information on European Partnerships and their strategic role in technological sovereignty. The documents analysed include:
   - The Performance of European Partnerships – Biennial Monitoring Report 2024 (BMR 2024)
   - The Interim Evaluation of Horizon Europe
   - Regulations, calls and Strategy/Implementation documents of QuantERA, Chips JU and EuroHPC JU
   - The Quantum Europe Strategy (COM(2025) 363 final)
2. Review of the information on the official websites of each of the industrial associations that are part of the institutionalised partnerships that are examined in the report.
3. **Elaboration of ERA-LEARN data** on partnership participation, governance and third-country involvement.
4. **12 Semi-structured interviews** with experts involved in QuantERA, Chips JU, EuroHPC JU, and the wider European quantum community. Across all interviews, the questionnaire was organised around two thematic blocks, with additional questions tailored to the specific interviewee:

- Block 1. The role of partnerships. Exploring how QuantERA, Chips JU and EuroHPC JU contribute to EU technological sovereignty and shape Europe's position in global competition.
- Block 2. Impacts and challenges. Assessing perceived impacts of these initiatives and identifying structural gaps, risks, and opportunities.

5. In advance of the celebration of the interviews, a sample of the questionnaire was shared with the interviewees to serve as a basis for a flexible, dialogue-driven exchange. The process began with personal contacts and progressively expanded to other experts directly or indirectly involved in:

- Chips JU – including an initial interview with the Chair of the Public Authorities Board, followed by additional exchanges once the draft analysis was shared.
- EuroHPC JU – one consolidated input was provided as the official position of the organisation; no live interview could be conducted.
- QuantERA and the European quantum community – interviews and exchanges with programme managers, scientific coordinators, and experts involved in quantum networks and the broader Flagship ecosystem.

The selection prioritized interviewees with hands-on knowledge of governance, international collaboration, TRL progression, and strategic positioning.

In addition, once the interviews were done and the replies dully structured for the policy brief purposes, they were shared again with the interviewees to gather further validation of the initiatives involved and offer the opportunity to add new data or nuances on the topic.

6. **Analysis and synthesis** by the authors, comparing insights across partnerships and identifying common patterns, divergences, and implications for EU technological sovereignty and global competition.

6. Acknowledgements

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