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ARTIFICIAL INTELLIGENCE • QUANTUM TECHNOLOGIES • HPC

# UK–Italy Critical Technologies Cooperation

A strategy for structured partnership across AI, quantum technologies and high-performance computing — turning political ambition into shared critical-tech capacity.

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# UK-ITALY CRITICAL TECHNOLOGIES COOPERATION

Artificial Intelligence | Quantum Technologies | High-Performance Computing

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# EXECUTIVE SUMMARY

This strategy highlights the opportunities in AI, quantum technologies (QT) and high-performance computing (HPC) as a structured area of strategic partnership between the UK and Italy. The UK brings depth in AI research and commercialisation, quantum science and applications, and emerging exascale plans; Italy contributes world-class supercomputers, converged AI–HPC–QT infrastructures, and strong domain expertise in energy, climate and materials. Yet collaboration levels across these fields, though meaningful, are often ad-hoc and small-scale, and constrained by factors including post-Brexit friction, including tuition fees for international students, and limited bilateral instruments.

Based on in-depth mixed methods research, the report recommends a focused set of actions: reciprocal access to flagship UK and Italian HPC and quantum platforms; co-branded “AI–QT–HPC” testbeds in priority sectors such as health, energy and security; scaled early-career mobility and targeted scholarships to rebuild people-to-people networks; pump-priming and Horizon-oriented seed funding to form competitive binational consortia; and a joint steering group to set 2–3-year priorities and monitor delivery. Implemented over the next 2–3 years, these measures provide an actionable plan for shifting political declarations and research community ambitions into shared critical-tech capacity, strengthening Europe’s wider resilience, and positioning the UK–Italy axis as a visible leader in shaping AI, quantum and HPC governance and deployment.

# GLOSSARY

**Artificial intelligence (AI):** A machine-based system that infers from data how to produce outputs such as predictions, content, recommendations, or decisions. AI is often described as a general-purpose technology because it can be deployed across many sectors, improves over time, and unlocks complementary innovation in other technologies, services, and organisations.

**Critical technologies:** Under the UK Government's Science and Technology Framework (April 2025), the technologies designated as most critical to the UK's future prosperity, security, and global leadership. Five are named: advanced connectivity technologies, artificial intelligence, engineering biology, quantum technologies, and semiconductors. HPC is not formally designated a critical technology under the Framework but can be treated as an enabling infrastructure underpinning both AI and quantum capability.

**High-performance computing (HPC):** Advanced computing infrastructure, architectures, and software used to solve problems that exceed the capacity of standard computing systems, including large-scale simulation, data analysis, and AI workloads.

**Hybrid Quantum–HPC Infrastructure:** The integration of quantum systems with classical supercomputing environments to support hybrid quantum–classical computation and workflows.

**Post-Quantum Cryptography (PQC):** Cryptographic algorithms designed to remain secure against attacks from future quantum computers and deployable on conventional digital infrastructure.

**Quantum Computing:** The development of computing systems and algorithms that use quantum mechanical effects to perform certain calculations differently from classical computers, especially in optimisation, simulation, and other specialised problem classes.

**Quantum Communication:** Technologies that use quantum mechanical principles to transmit information or distribute cryptographic keys with security properties rooted in physics.

**Quantum Sensing and Metrology:** Technologies that use quantum effects to detect or measure physical quantities with very high sensitivity and precision, including in timing, gravity, magnetic, and inertial applications.

**Quantum Technologies (QT):** A broad family of technologies that exploit quantum mechanical effects to process, transmit, or measure information in ways not achievable with classical approaches.

**Supercomputing / supercomputer:** Computing at performance levels that require the massive integration of computing elements to solve problems that standard systems cannot handle; in practice, the term usually refers to the most powerful HPC systems.

# LIST OF ACRONYMS

## National Policy & Governance Bodies

- **AIRR (AI Research Resource):** A suite of advanced supercomputers (including Dawn and Isambard-AI) providing specialised compute capacity to UK researchers and SMEs.
- **ARIA (Advanced Research + Invention Agency):** UK R&D funding agency built to unlock Speculative, high-impact scientific and technological breakthroughs.
- **CDEI (Centre for Data Ethics and Innovation):** Former UK advisory body, now transitioned into the Responsible Technology Adoption (RTA) unit within DSIT.
- **CiTD (Comitato Interministeriale per la Transizione Digitale):** The Italian Interministerial Committee responsible for coordinating digital transition policies and implementing the national digital agenda.
- **CEN**: European Committee for Standardization
- **CENELEC**: European Committee for Electrotechnical Standardization
- **CEN-CLC/JTC 22** : CEN and CENELEC Joint Technical Committee 22 on Quantum Technologies.
- **DSIT (Department for Science, Innovation and Technology):** The UK government department leading on the growth of the digital economy and critical technologies.
- **FCDO (Foreign, Commonwealth & Development Office):** The UK department responsible for foreign policy, including science diplomacy and international R&D collaborations.
- **MIMIT (Ministero delle Imprese e del Made in Italy):** The Italian Ministry of Enterprises and Made in Italy, focused on industrial policy and technological innovation.
- **MoD / Dstl (Ministry of Defence / Defence Science and Technology Laboratory):** The UK government bodies responsible for defense research and the protection of sovereign critical technologies.
- **MUR (Ministero dell'Università e della Ricerca):** The Italian Ministry of University and Research, which supervises the national research programme and university systems.
- **STN (Science and Technology Network):** The UK diplomatic network of scientific officers formerly known as the Science and Innovation Network (SIN), operating internationally to facilitate research partnerships.
- **UKRI (UK Research and Innovation):** The UK's primary funding body for research and innovation across all academic disciplines.

## Research Institutions & Strategic Infrastructures

- **AI4I (Istituto Italiano per l'Intelligenza Artificiale dell'Industria):** The Italian Institute of Artificial Intelligence for Industry, a strategic hub for application-oriented research and industrial deployment.
- **CINECA (Consorzio Interuniversitario):** Italy's primary non-profit inter-university computing consortium, hosting the Leonardo and LISA supercomputers.
- **CNR (Consiglio Nazionale delle Ricerche):** Italy's National Research Council, the largest public research institution in the country.
- **EPCC (Edinburgh Parallel Computing Centre):** A leading supercomputing center at the University of Edinburgh and a core partner in UK exascale computing, and a UK National Supercomputing Centre.

- **ICSC (Centro Nazionale di Ricerca in HPC, Big Data e Quantum Computing):** Italy's National Research Center for High-Performance Computing and Quantum technologies.
- **INFN (Istituto Nazionale di Fisica Nucleare):** Italy's National Institute for Nuclear Physics, focused on high-energy and subnuclear physics.
- **INRiM (Istituto Nazionale di Ricerca Metrologica):** Italy's National Metrology Research Institute, leading on measurement science and standards.
- **IT4LIA (Italy for Artificial Intelligence):** The strategic project to build the Italian AI Factory hub at the Bologna Tecnopolo.
- **NPL (National Physical Laboratory):** The UK's national measurement standards laboratory, developing world-class standards for quantum and digital infrastructure.
- **NPL / QMI (National Physical Laboratory / Quantum Metrology Institute)**: The UK's lead center for quantum metrology, test, evaluation, and international standards in quantum technology.
- **NQCC (National Quantum Computing Centre):** A joint initiative by UKRI to build a sovereign UK quantum computing ecosystem.
- **NQSTI (National Quantum Science and Technology Institute):** A consortium of Italian entities dedicated to advancing quantum science and stimulating industrial innovation.

## Technical & Funding Terminology

- **EIC / ERC (European Innovation Council / European Research Council):** Major European Union funding programmes for breakthrough innovation and basic research.
- **EuroHPC JU (European High Performance Computing Joint Undertaking):** A pan-European partnership to develop world-class supercomputing infrastructure.
- **FPR (Fondo per la programmazione della ricerca):** A new Italian structural fund established for stable multi-year research planning.
- **MSCA (Marie Skłodowska-Curie Actions):** EU funding for the mobility and training of research personnel.
- **NQTP (National Quantum Technologies Programme):** The UK's strategic framework for developing quantum capabilities.
- **NRRP (Piano Nazionale di Ripresa e Resilienza):** The Italian component of the EU's Next Generation EU recovery fund.
- **PRIN (Progetti di Rilevante Interesse Nazionale):** Italy's primary grant scheme for national scientific research projects.
- **QBI (Quantum Benchmarking Initiative):** A standard measurement framework for evaluating quantum computer performance.
- **QKD (Quantum Key Distribution):** A secure communication method that uses quantum mechanics to encrypt data.
- **QPU (Quantum Processing Unit):** The physical hardware architecture utilised by quantum computers.
- **QT (Quantum Technologies):** The broad field of technology leveraging quantum mechanics for sensing, computing, and communications.

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# 1. INTRODUCTION AND STRATEGIC AIMS OF COOPERATION

**Overview**

**New UK–Italy bilateral frameworks explicitly prioritise cooperation in science and technology. This cooperation agenda provides an opportunity to galvanise and strengthen partnerships in critical technologies, including Artificial Intelligence (AI), Quantum Technologies (QT), and High-Performance Computing (HPC).** These three technologies form the core infrastructure for future competitiveness, security, and technological sovereignty, and align closely with UK and Italian strengths: Italy's world-class supercomputers and growing AI/quantum infrastructure, and the UK's leadership in frontier AI, quantum R&D, and sectoral applications.

- **Focusing on AI, QT, and HPC targets the general-purpose technologies behind key areas essential to national resilience** including advanced simulation, drug discovery, climate modelling, and secure communications, while offering immediate opportunities for shared infrastructure, standards, and joint demonstrator projects.

- **These technologies have political value for UK–Italy cooperation: they sit at the intersection of economic security, defence, and industrial policy, making collaboration a way to deepen the broader strategic partnership** and shape European and transatlantic norms together rather than in isolation.

- **The three fields are converging into hybrid systems** where HPC provides the backbone, quantum accelerates specific optimisation and simulation tasks, and AI orchestrates models and workflows—making cross-stack collaboration more valuable than siloed initiatives.

- **Italy is already piloting this convergence through EuroHPC-backed hybrid quantum–HPC systems and initiatives such as ICSC and IT4LIA, while the UK brings strong AI-for-science, genomics, drug discovery, and finance capabilities**; pairing these assets can generate high-impact, cross-technology collaborations rather than narrow, subfield-specific programmes.

The UK-Italy science and technology relationship is deepening, with the Prime Ministers' Joint Statement in September 2024; the launch of the UK-Italy Science and Technology Dialogue in June 2025; and work underway towards the signing of a Science and Technology MoU. The emphasis on cooperation across three strategic technologies—Artificial Intelligence (AI), Quantum technologies (QT), and High-Performance Computing (HPC)—sits within these frameworks. It speaks to the clear, strategic possibilities surrounding UK cooperation with Italy—a country with an extensive scientific community and home to two of the fastest supercomputers globally (see Vis.). Both countries are investing in science and technology, with clear public funding signals for coming years (see Table 1.), Similarly, both Italy and the UK have recognised the importance of economic growth as a national priority, and understand the outsized possibilities of science, technology, and innovation in unlocking growth (see, for example, the UK Digital and Technologies Sector Plan and Italy's NRPRand Strategy for Artificial Intelligence).

Enhancing UK-Italy cooperation across these three strategic technologies also supports a range of broader, critical objectives for the UK Government, including deepening and diversifying trade relations, meeting objectives of the Strategic Defence Review, and creating greater economic and regional resilience for the UK and Europe. With this, there is need not only for the foundational research requisite for research leadership, but also to get the technologies out of the lab and into settings and sectors where they can contribute to national and European resilience.

> *"Quantum technologies are no longer just a field of advanced research reserved for a few specialists... but are already a specific lever of national security, as they impact information protection, the resilience of critical infrastructure, deterrence capacity, and ultimately a nation's technological sovereignty"*
> **Guido Crosetto, Minister of Defence, Italy**

There is a lot of valuable UK-Italy technology co-operation already happening, and it is delivering impact. Built on a clear appetite among the research community in both countries for further collaborative opportunities, this work aims to provide improved clarity on where the greatest payback can be for the UK, for research institutions, and for individuals, across critical technologies.

### Why AI, Quantum, and HPC

Focusing UK–Italy collaboration on AI, quantum, and HPC brings together the core technological foundations for future economic competitiveness, security, and digital sovereignty. Both countries already have complementary strengths and sunk investments across these domains (from EuroHPC/ICSC and IT4LIA on the Italian side to the UK's frontier compute, quantum programmes, and Horizon-linked R&D access), bringing in-depth expertise to cooperation and potentially leading to higher impact. The three technology fields are at different levels of advancement, also providing a range of opportunities across the research and innovation lifecycle.

### Technological Convergence

**Quantum, AI, and HPC—the trio of technological fields on which this analysis focuses—are increasingly converging around the premise that no single compute paradigm can tackle the hardest problems alone.** The emerging standard is heterogeneous systems that route workloads to whichever mechanism—whether classical CPU/GPU clusters, AI accelerators, or quantum processors—handles them most efficiently. Quantum handles discrete optimisation and simulation tasks that are intractable classically; HPC provides the classical backbone for data handling and pre/post-processing; and AI manages workflow orchestration, error mitigation, and algorithm design across the stack. This convergence unlocks the possibility of greater efficiencies, through tightly interconnected hybrid systems rather than separate machines. It is also the most probable route to immediate impact, given the limited capacity of standalone quantum computer systems in the near-term.

**Both the UK and Italy recognise, and are spearheading, this convergence.** A clear example is CINECA's Leonardo supercomputer complex in Bologna. In February 2026, Pasqal delivered a 140-qubit neutral atom quantum computer directly integrated with Leonardo—one of the world's top pre-exascale HPC systems—under the EuroHPC Joint Undertaking with co-funding from MUR. The hybrid architecture lets researchers offload optimisation, materials simulation, and machine learning workloads to the QPU while Leonardo handles classical data processing. An IQM 54-qubit system is also being installed at CINECA alongside this. The overarching institution, ICSC (National Center for Research on HPC, Big Data, and Quantum Computing), explicitly frames its mission around all three domains in conjunction. The EU-funded IT4LIA factory, funded by the EU Gigafactory competition, has an explicit joint mandate around supercomputing and Advanced AI, including services to industry.

**The UK has some explicit advantage in terms of this "quantum-classical" convergence** because of the strength of its applied AI research labs, and domain expertise in areas including genomics and drug discovery (through the Edinburgh genomics cluster, the UK Biobank, and Google Deepmind);

AI-for-Science (through, for example, Isomorphic Labs, other related startups, and UKRI's AI for Science Strategy) and financial services innovation, with London's historical FinTech strengths and expertise. Particular value can be derived in pairing this domain expertise with quantum computational power. **As a result of this critical convergence and the strong positioning of the UK making advances in quantum-classical convergence when combined with domain expertise, the report aims primarily to present recommendations that can be deployed across technologies and at their intersection, rather than "picking winners" to support within each technological subfield.**

*Box 1.*

**Landmark Italian funding of UK-Italy Photonic Circuits Development**

The recently announced €211 million Italian state-aid package for CamGraPhIC, a University of Cambridge spinout, underlines how UK–Italy collaboration can unlock scale and strategic advantage in frontier technologies. The deal, in the form of a direct grant to CamGraPhIC, channels large, EU-approved public funding into a UK-origin university spinout firm (CamGraPhIC has an Italian registered entity) to industrialise graphene-based photonic transceivers in Italian sites, creating a shared manufacturing base for energy-efficient, high-bandwidth optical interconnects that are critical to AI and HPC. The grant will unlock collaborative projects in the UK and Italy. It demonstrates that when UK research excellence connects with Italian industrial policy, semiconductor capacity and EU instruments, both countries stand to gain: in this instance, the UK strengthens its research and spin-out pipeline and access to advanced fabrication, while Italy anchors cutting-edge production and skills on its territory, jointly shaping the UK and Europe's next-generation chip and AI infrastructure.

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# 2. NATIONAL POLICIES AND PUBLIC INVESTMENT

### Overview

**The UK and Italy are increasingly aligned in policy terms on AI, quantum technologies (QT) and high-performance computing (HPC)**, with complementary strengths that create concrete opportunities for joint action.

- **On AI, both countries now prioritise sovereign capability, diffusion into the real economy and responsible governance**: the UK via large-scale industrialisation tools (Sovereign AI Unit, AI Growth Zones, AI for Science) and Italy via SME-oriented AI ecosystems (Competence Centres, AI4I) and a pioneering national AI law, creating scope for joint work on AI for science and regulation that bridges EU and UK approaches.

- **In QT, the UK's long-run, mission-driven investment and recent procurement-led Quantum Leap package complements Italy's newer strategy, which focuses on coordinating a fragmented research base and closing funding and hardware gaps**; together, this suggests opportunities for shared testbeds, joint industrial pilots and knowledge transfer on scaling quantum firms within a European market.

- **In HPC, the UK is committing to an integrated exascale and AI-oriented compute roadmap, while Italy already operates world-class EuroHPC-class systems (Leonardo, HPC6) but has structural limits on commercial use**; this asymmetry points to collaboration around shared access, joint demonstrators for industry, and co-designed "supercomputing for science" programmes that couple UK research depth with Italian capacity.

- **Strategically, both governments are converging on AI–QT–HPC as a unified infrastructure stack and explicitly elevating AI for science as a cross-cutting mission**, opening space for bilateral initiatives that: pool infrastructure investments, align funding calls around common sectors (climate and energy, life sciences, aerospace, manufacturing), and advance interoperable standards and governance frameworks across the UK, EU and wider partnerships.

The analysis in this chapter aims to map areas of policy convergence and complementarity between the UK and Italy. Comparative analysis of national strategies and public investment trajectories across AI, QT, and HPC reveals meaningful, though asymmetric, ambition. The UK has a relatively robust and long-run set of technology policies focused on UK research leadership and economic growth across sectors, and Italy embeds its priorities within European frameworks while developing leading research infrastructure. Together, these complementaries create a foundation upon which deeper collaboration can be built.

The analysis also acknowledges that the policy agenda surrounding each of the three technological fields is increasingly blurring, in line with the innovation and economic potential of developing all three technologies together. In the UK, at the policy level, for example, the US-UK Quantum Technology Pact (September 2025), part of a broader MoU, specifically designates AI and HPC as tools to accelerate quantum algorithm development —treating the three as a unified stack rather than parallel programmes.

*Table 1. Summary of Italian and UK Critical Technology Policies*

| | UNITED KINGDOM | ITALY |
|---|---|---|
| AI | National AI activity across multiple programmes. Up to £500m for the Sovereign AI Unit. £2bn for compute expansion to 2030, aiming to increase public-sector AI compute capacity twentyfold. £137m for the AI for Science Strategy. | 2024–2026 AI Strategy introduces a multi-year budget (€50–100m/year) for research, public administration, enterprise support and skills. National AI Investment Fund capitalised at around €1bn, aiming to crowd in further private investment. |
| Quantum | National Quantum Strategy allocates £2.5bn for quantum R&D from 2024–2034, aiming to crowd in £1bn private investment. £2bn Quantum Leap package (March 2026) launches ProQure for dedicated public procurement and industry internships to boost quantum skills. | Funding primarily via EU programmes and national contributions, estimated at about €229m in 2021–2024. National Strategy recommends €200m/year over five years; National Quantum Hub to aggregate excellence. |
| HPC | AI strategy links to £2bn compute expansion to 2030. £36m DAWN supercomputer upgrade. Quantum funding covers the National Quantum Computing Centre. | Access and investments largely mediated through EuroHPC JU and EU funds, plus national co-financing. Total HPC-relevant spend plausibly into the low-single-digit billions, including NRRP cloud and data-centre funding. |

*Source: StateUp, based on Italian and UK national AI, Quantum, and Compute strategies.*

## 2.1 Artificial Intelligence

### United Kingdom

The UK has sustained a leading position in AI research and commercialisation since the mid-2010s, when it became one of the first countries globally to adopt a national AI strategy—alongside Canada, Finland, France, Germany, and Japan—ahead of a broader wave of later adopters (OECD, 2021). That early mover advantage remains visible: the UK holds the third-highest number of AI companies in the world after the United States and China. The current government is now focused on translating this research excellence into economic growth at scale.

The policy architecture rests on two interlocking pillars. The AI Opportunities Action Plan (January 2025) sets out 50 recommendations to make the UK an 'AI maker, not an AI taker', prioritising compute infrastructure, talent, data access, and sovereign capability in frontier AI. In early 2026 the UK government published the AI Opportunities Action Plan: One Year On announcing that it had met 38 of its 50 key commitments within twelve months — covering compute infrastructure, public sector AI deployment, and skills. Underpinning this is UKRI's £1.6 billion AI Research and Innovation Strategic Framework (2026–2030)—the organisation's single largest investment area—which funds the full innovation cycle from discovery to scale-up. A newly established Sovereign AI Unit, backed by approximately £500 million, is tasked with prioritising scaling AI companies and managing strategic datasets. Furthermore, central to this is the designation of five AI Growth Zones, which provide "fast-track" planning consent and priority grid access for data centres

Up to £137 million is directed specifically at the AI for Science Strategy (November 2025), targeting AI-enabled breakthroughs in engineering biology, fusion energy, materials science, medical research, and—notably—quantum technologies. Governance is coordinated through DSIT, with advisory oversight from the Centre for Data Ethics and Innovation (CDEI). In February 2025, the UK released an AI Playbook to guide safe and ethical AI deployment across government departments.

### Italy

Italy's approach is shaped by a core concern with the risk of digital and technological dependency as presented in its Italian Strategy for Artificial Intelligence 2024–2026. The strategy is structured around four macro-areas—Research, Public Administration, Enterprises, and Training. A notable priority is building decentralised networks of Competence Centres and Houses of Emerging Technologies (CTE) to help Italy's large ecosystem of Small and Medium Enterprises (SMEs) adopt AI - SMEs account for 99.9% of the total number of active companies in the country (4.4 million SMEs) and circa 80% of employment, with micro-enterprises (fewer than 10 employees and less than €2 million of turnover) the largest segment (94.9% of all SMEs) and employment (43.7%).

The operational delivery of Italy's AI strategy may increasingly be anchored in AI4I, the Italian Institute of Artificial Intelligence for Industry, publicly launched in Turin in May 2024 by the Ministers of Economy, Enterprises, and University and Research. It is expected to serve as a Research and Technology Organisation (RTO) with R&D units structured to grow by securing industrial contracts and competitive grants, and a sectoral focus on manufacturing, automotive, and aerospace. AI4I operates from the OGR innovation hub in Turin. It benefits from a strategic partnership with the Italian Institute of Technology, and accesses compute through both an on-premise AI cluster and preferential access to the Leonardo supercomputer at CINECA. Its Scientific Advisory Board draws on senior international researchers, including, from the UK, Professor Sabine Hauert (University of Bristol).

In **September 2025 Italy became the first EU Member State to adopt a comprehensive national AI law (Law No. 132/2025)**, explicitly designed to complement the EU AI Act. This positions Italy as a regulatory pioneer within Europe. By October 2026, the government is mandated to issue a series of implementing decrees that will operationalise key provisions of Law.

## 2.2 Quantum Technologies

### United Kingdom

The National Quantum Technologies Programme (NQTP), established in 2014, was the first initiative of its kind globally, sustained by more than £1 billion of public investment across its first decade. The National Quantum Strategy (March 2023) — published by the then Conservative government — built on this foundation, committing £2.5 billion over ten years from 2024 and establishing the ambition of making the UK a "quantum-enabled economy by 2033." It is structured around five time-bound Quantum Missions (announced November 2023) covering quantum computing, quantum networks, sensing and timing, navigation, and quantum-enabled positioning. Following the general election of July 2024, the Labour government confirmed delivery of the third phase of NQTP Research Hubs.

The Office for Quantum, a dedicated body within DSIT established under the strategy, currently coordinates national policy. The £670 million quantum computing commitment in the Digital and Technologies Sector Plan (June 2025) and the£2 billion Quantum Leap package (March 2026) are anchored in the NQTP's institutional architecture and the Missions' sectoral priorities, but with a greater emphasis on procurement, sovereign scale-up, and industrial deployment.

Delivery is multi-institutional. The NQTP Programme Board coordinates across DSIT, EPSRC and STFC (fundamental research and doctoral training), Innovate UK (commercialisation), the National Physical Laboratory's Quantum Metrology Institute (NPL/QMI)(test, evaluation and international standards), and Dstl/MoD (defence quantum R&D).

The UK faces a gap between its strength in fundamental research and its capacity to retain and scale homegrown quantum companies. The March 2026 £2 billion “Quantum Leap” package is a response to this challenge, bringing R&D, manufacturing, hardware, software, and procurement into a single integrated programme. It entails:

- The £1 billion ProQure advanced procurement programme, designed to position the UK as the first country to deploy large-scale quantum computers by the early 2030s. Companies are invited to propose and deliver state-of-the-art prototypes, and the most promising suppliers are then expected to progress to larger-scale systems for use by researchers, businesses and the public sector as part of national infrastructure.
- £200 million reserved exclusively for UK-based companies, to support domestic scale-up and mitigate the risk of homegrown deep-tech firms migrating or being acquired abroad.
- A Quantum Translational Research Group charged with closing the engineering gap between laboratory and market.
- More than £1 billion over four years for technology development, skills and facilities, including over £500 million for quantum computing, over £400 million for sensing and navigation, £125 million for networking, and further support for infrastructure and commercialisation.

### Italy

Italy published its National Strategy for Quantum Technologies in September 2025, adopted by the Interministerial Committee for the Digital Transition (CITD). The strategy is firmly aligned with the European Quantum Communications Infrastructure (EuroQCI) and the EU Quantum Flagship, reflecting a national ambition to pursue technological sovereignty within the European frameworks.

The strategy acknowledges three key challenges:

- A fragmented ecosystem: Italy's quantum research community is distributed across numerous universities, national research centres (CNR, INFN, INRIM) without a unified coordination structure or a consistent pathway from research to commercial application. The National Quantum Science and Technology Institute (NQSTI)—established under the NRRP to address this—has acknowledged structural weaknesses including "fragmentation of research lines and organizations" and "lack of exploitation of the existing facilities/laboratories" (NQSTI, Quantum for Italy 2025).
- A lack of domestic specialised foundries for quantum hardware—resulting in dependence on foreign supply chains.
- A significant funding gap relative to leading nations: Between 2021 and 2024, Italy invested approximately €228.9 million in quantum technologies, predominantly through the NRRP. This is substantially below leading European peers like France at €1.8 billion, Germany at €3.03 billion, and the United Kingdom at €4.12 billion in cumulative public quantum funding to 2024 (Italian National Strategy for Quantum Technologies).

Italy's private investment has been particularly weak: venture capital in Italian quantum start-ups totalled just €12.5 million between 2023 and 2024. The strategy recommends a sustained public investment of €200 million per year over five years to begin to close this gap—a volume that would represent approximately 0.01% of GDP, in line with France and Germany's proportional commitments. The strategy also prioritises overcoming bottlenecks in deep-tech venture capital to prevent the flight of Italian quantum scale-ups to foreign markets.

The strategy proposes to address these challenges through a combination of public-private partnership mechanisms, government guarantees designed to de-risk institutional investment in deep-tech VC funds, and the establishment of growth funds with longer return horizons than conventional venture capital. Large Italian enterprises, particularly in finance, energy, and aerospace and defence, which together accounted for the majority of demand-side interest in the Ministry of Enterprises and Made in Italy (MIMIT) industry consultation, are identified as key early adopters whose engagement is seen as essential to maturing the national quantum ecosystem.

## 2.3 High-Performance Computing

*Table 2. Supercomputers by Speed*

| Rank | Name | Country | Rmax (PFlop/s) |
|---|---|---|---|
| 1 | El Capitan | USA | 1,809.00 |
| 2 | Frontier | USA | 1,353.00 |
| 3 | Aurora | USA | 1,012.00 |
| 4 | JUPITER Booster | Germany | 1,000.00 |
| 5 | Eagle | USA | 561.20 |
| 6 | **HPC6** | **Italy** | 477.90 |
| 7 | Supercomputer Fugaku | Japan | 442.01 |
| 8 | Alps | Switzerland | 434.90 |
| 9 | LUMI | Finland | 379.70 |
| 10 | **Leonardo** | **Italy** | 241.20 |
| 11 | **Isambard-AI phase 2** | **UK** | 216.50 |
| 12 | Tuolumne | USA | 208.10 |
| 13 | ISEG2 | Netherlands | 202.4 |
| 14 | MareNostrum 5 ACC | Spain | 175.30 |
| 15 | Discovery 6 | USA | 164.20 |

Source: The TOP500, ranks the world's fastest supercomputers by Linpack performance

### United Kingdom

The UK Compute Roadmap (DSIT/UKRI, July 2025), outlines a comprehensive investment of up to £2 billion in national compute infrastructure to 2030. The Roadmap's centrepiece commitments include:

- Over £1 billion to expand the AI Research Resource (AIRR) twenty-fold—from 21 to 420 AI ExaFLOPs by 2030
- Upto £750 million for a new national supercomputer at the Edinburgh Parallel Computing Centre (EPCC), set to come online in 2027 and replace the current ARCHER2 system.
- Dedicated compute allocations guaranteed for the Sovereign AI Unit and the AI Security Institute.
- A plan to designate AI Growth Zones—mega-infrastructure hubs capable of exceeding 1 GW of capacity, potentially powered by advanced nuclear energy—to integrate energy infrastructure with large-scale data centres for frontier AI training.

From 2027, the Roadmap envisages the integration of novel computing technologies, including quantum, neuromorphic, and AI-hybrid systems, into public infrastructure, directly bridging the HPC and quantum domains.

### Italy

Italy is, paradoxically, a world leader in HPC infrastructure while lacking a dedicated national HPC strategy comparable to its frameworks for AI and Quantum. Italy hosts two of the most powerful supercomputers globally: HPC6 (owned by the energy company Eni), currently ranked 6th globally, and Leonardo (owned by the university consortium CINECA), ranked 10th globally by peak computing power (see table 2).

The most substantial public investments in HPC originate at the European level—principally through the EuroHPC Joint Undertaking (EuroHPC JU) and the NRRP, which financed a nationwide network of HPC and quantum infrastructures through the National Centre in HPC, Big Data and Quantum Computing (ICSC) in Bologna. Domestic national funding from the Ministry for Enterprises focuses predominantly on energy aspects, not hardware manufacturing or large-scale procurement, a gap that leaves Italy's HPC leadership structurally dependent on European institutional support.

A significant institutional constraint is the legal status of CINECA as a public 'in-house' entity: under EU state aid rules, CINECA cannot offer commercial HPC services beyond 20% of its total activity, limiting its ability to serve private-sector clients even where demand exists.

The European Commission is preparing an AI Gigafactory funding call (2026) designed to encourage private investment in large-scale HPC centres for industrial users; Italy is expected to participate through an industrial consortium supported by CINECA's expertise. Italy's HPC infrastructure spending is also embedded in the MUR's 2026–2028 Research Plan, which allocates over €1.25 billion through the new Research Programming Fund (FPR), with specific instruments—the PRIN Hybrid and Synergy Grant schemes—explicitly targeting HPC, AI, and quantum as national strategic priorities.

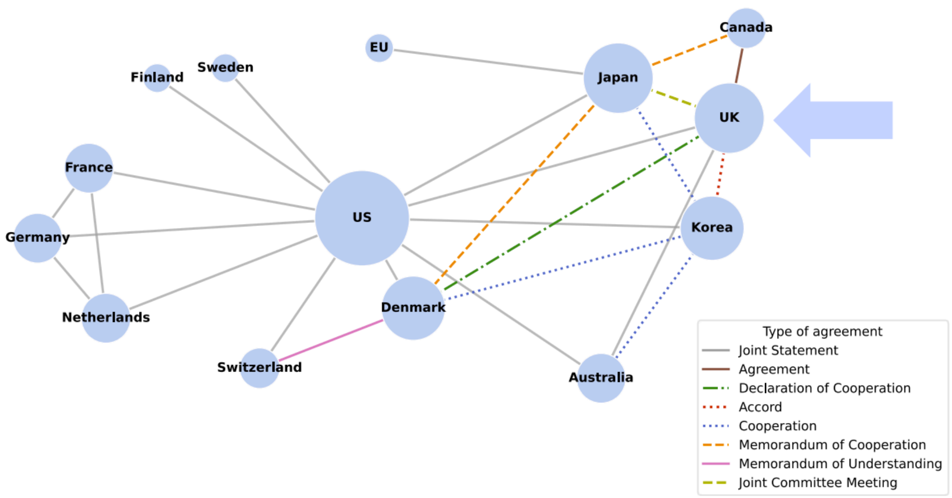
## 2.4 UK Bilateral Policies

The UK has pursued formalised bilateral and multilateral technology cooperation across all three domains covered by this report. In AI, the UK concluded the first government-to-government AI safety agreement with the United States in April 2024, and in September 2024 signed the Council of Europe's Framework Convention on Artificial Intelligence—the first legally binding international AI treaty—alongside the United States, Australia, and Council of Europe member states.

In quantum, the UK has concluded bilateral science and innovation agreements with at least six countries—including the United States, Canada, Australia, and the Netherlands—and participates in European quantum standards-setting through the CEN/CENELEC Joint Technical Committee. The UK is a relatively prolific signatory of bilateral agreements in QT when compared to other countries (see figure 1). In HPC, the UK rejoined the EuroHPC Joint Undertaking in May 2024, restoring UK researcher access to European supercomputing infrastructure including Italy's Leonardo.

The UK is also a founding signatory of Pax Silica (signed 2025). The US-led minilateral initiative is designed to bring together nations with significant AI and semiconductor industries to strengthen supply chains and secure AI infrastructure.

*Figure 1. Bilateral agreements related to quantum science and technology*




*Source: OECD (2025), "An overview of national strategies and policies for quantum technologies", OECD Digital Economy Papers, No. 379, OECD Publishing, Paris,*

## 2.5 Italian Bilateral and Multilateral Technology Cooperation

Italy has pursued international technology cooperation across AI, QT, and HPC, largely through European and wider multilateral frameworks, while also expanding selected bilateral research partnerships. In AI, Italy was one of the 28 countries, alongside the EU, that endorsed the Bletchley Declaration, and it used its 2024 G7 Presidency to advance work on AI in the public sector, the Hiroshima AI Process, and AI and emerging technologies in industry. Italy's 2026–2028 Three-Year Research Plan also provides for bilateral calls under existing or planned MoUs with partners including Morocco, Kenya, Switzerland, Serbia, Algeria, Tunisia, and Uzbekistan, with particular emphasis on African cooperation in line with the Piano Mattei and the AU–EU Innovation Agenda.

Italy is also further developing arge-scale technology cooperation with the United States, with AI, quantum computing, 6G, biotechnology and space innovation serving as priority areas for enhanced partnership. At the 15th U.S.–Italy Joint Commission Meeting on Science and Technology Cooperation (April, 2026) both sides committed to deepening cooperation in quantum sciences, HPC and AI, fusion and fission energy, biotechnology and advanced materials. Italy announced its intention to significantly increase funding for joint research projects. On an industry level, US investment in AI computing and cloud services, announced in 2025 as part of a broader strategic agenda, could enhance the position of Italy as a regional data hub for the Mediterranean and North Africa.

In QT, Italy participates in European standardisation work through CEN/CENELEC JTC 22 and has taken a more active role in shaping the agenda, including through Italy's leadership of a 2024 High-Level Forum workstream on quantum standardisation. Italy was also among the original signatories of the 2019 EuroQCI Declaration. In HPC, Italy's international strategy is closely tied to EuroHPC.

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## 2.6 Conclusion: UK–Italy Policy Convergence and Complementarity

A comparative review of national technology policies indicates that, despite operating through different institutional architectures, the UK and Italy do exhibit convergence in strategic orientation and offer complementary strengths that together create a solid foundation for deeper bilateral cooperation.

**Conceptual and regulatory alignment**: Italy became the first EU Member State to adopt a comprehensive national AI law (Law No. 132/2025), explicitly designed to complement the EU AI Act. The UK, though outside the EU regulatory perimeter, has developed its own governance architecture—including the AI Playbook and the AI Security Institute—that reflects compatible principles of safe, ethical deployment. **This creates space for regulatory dialogue, including knowledge transfer and co-learning in relation to regulatory innovations pertaining to emerging technological developments, without requiring formal harmonisation.**

**Research infrastructure as a basis for collaboration:** The UK's research excellence in AI and quantum (through UKRI, NQTP, NPL, and the Research Hubs) and Italy's world-class HPC infrastructure (Leonardo at CINECA, HPC6 at Eni) are structurally complementary. The UK has deep quantum and AI research depth, while Italy has compute scale. There are already industry partners contributing and benefitting from both ecosystems. IonQ participates in Italy's National Quantum Hub as a founding industry anchor of the new "Q-Alliance" hub in Lombardy, and has signed a major long-term research and infrastructure partnership with the University of Cambridge. **This provides the basis for far greater research collaboration organised around joint infrastructure usage.**

**SME and start-up ecosystems:** Italy's national AI strategy explicitly cites the UK university enterprise-lab model as a benchmark for developing AI spin-offs and accelerating start-up formation. Italy currently lags European peers on AI start-up density (0.68 per million inhabitants versus 2.05 in France). R&D expenditure as a share of GDP also falls significantly below the OECD average, constraining Italy's ability to unlock its innovation potential. As the OECD identifies in its recent Foundations for Growth and Competitiveness Report 2026: Italy, "Many medium-sized firms are productive in international comparison, but their size limits their resources for research and development, while there are fewer large firms than in comparable economies. The private financing for innovative activities that is common in other OECD countries, such as venture capital firms, is less developed in Italy."

The UK has developed comparatively mature mechanisms for commercialisation through Innovate UK, university-industry partnerships, and UKRI's full innovation cycle funding. In Quantum specifically, the NQCC drives connections with industry. The UK does, nonetheless, continue to navigate the challenge of support for scaling "homegrown" deep tech companies. **As Italy seeks to bolster its collaboration between research and industry and grow the innovative capacity of its companies, there is a clear opportunity for 1) practical knowledge transfer regarding spin-offs and start-up formation and 2) co-learning in relation to scale-ups and innovation-led company growth.**

**Converging infrastructure:** Both countries are moving toward treating AI, quantum, and HPC as an integrated infrastructure stack. The UK Compute Roadmap explicitly plans to integrate quantum, neuromorphic, and AI-hybrid systems into public infrastructure from 2027. Italy's MUR Research Plan 2026–2028 and the PRIN schemes bundle all three technologies as a unified strategic priority. **This convergence may provide a natural entry point for shared access arrangements, and coordinated R&D investment—which may prove particularly valuable as both countries navigate the European AI Gigafactory funding landscape.**

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# 3. THE CURRENT UK-ITALY COLLABORATION LANDSCAPE

### Overview

**UK–Italy collaboration in AI, quantum technologies (QT), and high-performance computing (HPC) is broad and long-standing, but also frequently fragmented and under-structured.** These technologies already form part of wider UK–Italy scientific ties, and provide a strong base for more intentional cooperation aligned with industrial and societal priorities. Key findings include:

- **Collaboration is strongest in AI**, where joint publications and Horizon Europe projects indicate dense networks, especially around human-centred and socially impactful applications such as healthcare, education, and AI governance.

- **In QT, UK–Italy co-authorships and shared Horizon projects are smaller in volume but strategically significant**, reflecting complementary profiles: Italy's strengths in foundational physics and theory and the UK's emphasis on engineering, applications, and experimental platforms.

- **HPC collaboration builds on Italy's deep heritage in computational science and the UK's applied strengths in engineering and data infrastructure**. Joint work tends to be problem-driven in domains such as meteorology, materials, fusion, and climate, pointing to clear opportunities if structural constraints (notably Italy's energy costs for HPC) can be managed.

- **Experts in both countries, but especially Italy, underline the need to link technology development more tightly to industrial strategy and priority sectors.** The UK has started to move in this direction (for example, through sector-oriented AI initiatives), while Italy is building converged infrastructures (ICSC, IT4LIA) that explicitly connect AI, HPC and emerging quantum capabilities to application domains, creating clear opportunity areas for targeted bilateral programmes.

- **AI for science is an increasingly important shared priority**: the UK's leadership in AI-driven scientific discovery (e.g. drug discovery, materials, biology) and Italy's emerging strengths in AI tightly coupled to HPC and domain science (via ICSC and IT4LIA) create natural ground for joint "AI for science" programmes in areas such as climate, energy, and life sciences.

This chapter examines the current cooperation landscape between the UK and Italy across AI, QT, and HPC, through an analysis of jointly authored publications and Horizon grants including both UK and Italian partners. We conclude the chapter through considering key opportunity areas that emerge from the findings.

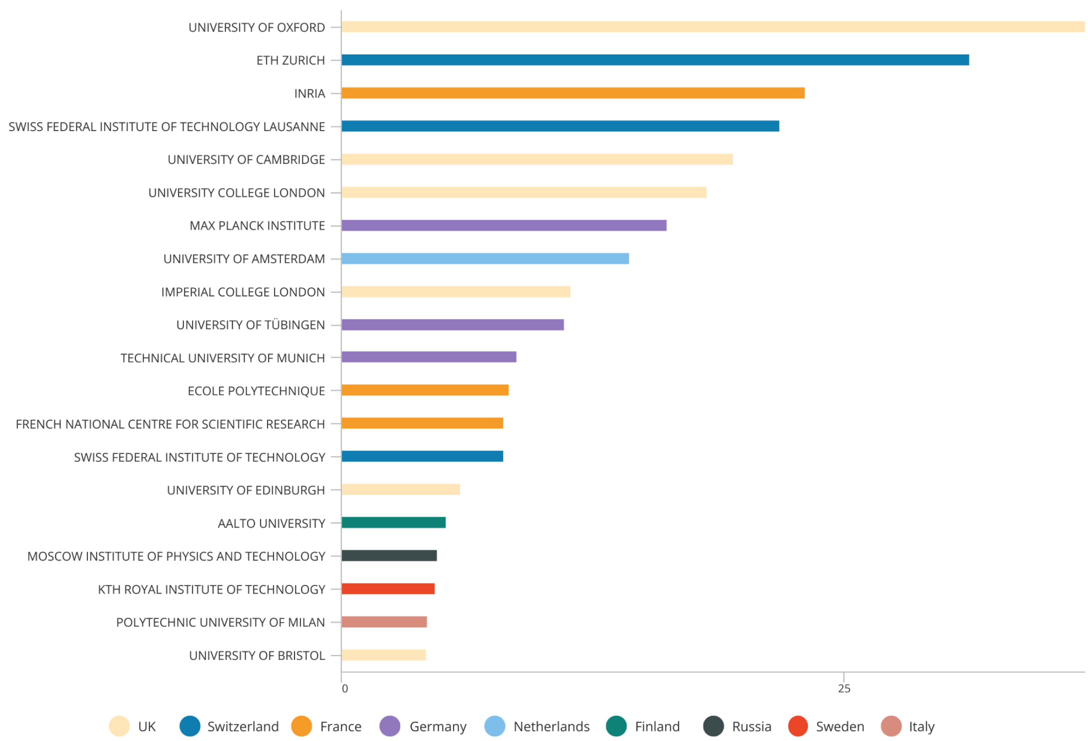
Across AI, QT, and HPC, the two countries maintain complementary research strengths and long-standing academic networks that underpin both bilateral and European cooperation. These collaborations are not only measurable in co-authored scientific output but also indicative of converging policy and innovation agendas aimed at fostering technological sovereignty, responsible innovation, and cross-border research excellence.

**In AI, collaboration volumes reveal particularly dense networks and a shared focus on human-centred and socially impactful applications—areas such as healthcare and education stand out. QT research, though earlier in its maturity curve, demonstrates growing strategic importance** and a robust base of joint publications that signal readiness for deeper engagement as both nations ramp up funding in quantum science and innovation. UK–Italy collaboration in HPC builds on Italy's deep technical heritage in computational science and the UK's applied strengths in engineering and data infrastructure. **While HPC remains a smaller field than AI or QT, existing partnerships discussed by roundtable participants and evident in the bibliometric research often focused on applied, problem-driven domains like meteorology, materials, and climate research. These focuses highlight complementary expertise and early foundations for expanded cooperation.**

A coordination problem is particularly acute in Italy, but also felt to some degree among the UK scientific community. Interview participants noted that **despite frequent interaction across organisations, collaboration is often insufficiently structured, which can lead to duplication, weak prioritisation, and dispersion of resources.** Some Italian researchers also indicated that research resources are not strategically concentrated, but rather spread thinly across multiple initiatives, making it difficult to achieve a critical mass. In both countries, policy and research experts also observed a clear need to connect technology development more closely to industrial strategy, so that scientific and technological trajectories reinforce priority sectors and application areas, though the UK has made significant efforts in this regard—for example by prioritising target frontier sectors within the AI Opportunities Action Plan.

## 3.1 Artificial Intelligence

*Figure 2. Top AI institutions in Europe*

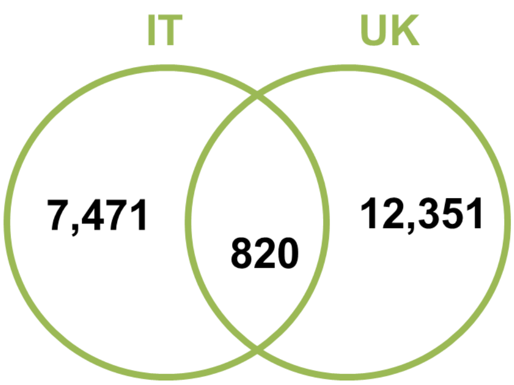



*Note: Rankings based on fractional count of authors. Source: MacroPolo, "Regional Dives: Europe, Asia-Pacific, and Middle East," The Global AI Talent Tracker 2.0 (March 2024).*

Across the three technologies, the highest number of scientific publications focus on AI, indicating the breadth and long-standing interest of the scientific community, as well as the status of AI as a "general-purpose technology" with applications and research in a wide variety of domains, from STEM to social sciences and ethical considerations.

Over the past 5 years, joint journal article publications between Italy and the UK have represented about 11% and 7% of Italian and UK AI research output respectively (820 co-authored articles; out of 7,471 Italian and 12,351 UK articles see figure 3), suggesting a significant embeddedness of British research in Italy, and a strong network of bilateral relationships (the specific nature of collaborations to date is explored under “case studies”). The propensity of Italians to cooperate with British researchers in AI is unsurprising, with the UK boasting, by some measures, more than 25% of Europe’s 20 highest ranking universities for AI (see figure 2).

*Figure 3. Number of UK, Italian, and joint published articles in AI (2021-2025).*




*Source: StateUp, Data: OpenAlex*

## Topical Focuses

Italian AI research focuses strongly on healthcare-related applications (e.g., AI in healthcare; Medical imaging; COVID-19; AI in cancer detection), aligned with societal needs. There is also substantial focus on explainable AI, digital transformation, and industry-oriented technologies (IoT, edge computing).

**The UK shows a similar prioritisation of AI for healthcare innovation, with high publication volumes, especially in AI for healthcare and education.** Guided in part by early policy priorities and an active research system in these domains, the UK also has particular research strengths in the ethics and social impacts of AI. Similarly to Italy, a focus on AI in business intelligence, service interactions and online learning showcases active thinking on applications and sectoral integration of the technology.

**Across the two countries, joint research is most prominent in areas of societal impact, including healthcare and education, ethics and social impacts, radiomics and medical imaging, and Explainable AI (XAI).**

*Table 3.*

**Top 10 journal article topics in AI, 2021-2025**

| IT | | UK | | IT & UK co-authored | |
|---|---|---|---|---|---|
| **Artificial Intelligence in Healthcare and Education** | **411** | **Artificial Intelligence in Healthcare and Education** | **909** | **Artificial Intelligence in Healthcare and Education** | **49** |
| **Ethics and Social Impacts of AI** | **205** | **Ethics and Social Impacts of AI** | **493** | **Ethics and Social Impacts of AI** | **33** |
| **Radiomics and Machine Learning in Medical Imaging** | **167** | **Radiomics and Machine Learning in Medical Imaging** | **182** | **Radiomics and Machine Learning in Medical Imaging** | **27** |
| **Explainable Artificial Intelligence (XAI)** | **146** | **Explainable Artificial Intelligence (XAI)** | **158** | **Explainable Artificial Intelligence (XAI)** | **20** |
| Digital Transformation in Industry | 117 | Big Data and Business Intelligence | 156 | Colorectal Cancer Screening and Detection | 17 |
| COVID-19 diagnosis using AI | 84 | AI in Service Interactions | 147 | Inflammatory Bowel Disease | 14 |
| Colorectal Cancer Screening and Detection | 83 | AI in cancer detection | 145 | COVID-19 diagnosis using AI | 13 |
| Big Data and Business Intelligence | 82 | Digital Transformation in Industry | 143 | Big Data and Business Intelligence | 12 |
| IoT and Edge/Fog Computing | 71 | Online Learning and Analytics | 125 | Digital Transformation in Industry | 12 |
| AI in cancer detection | 68 | COVID-19 diagnosis using AI | 120 | AI in cancer detection | 9 |

*Source: StateUp, Data: OpenAlex*

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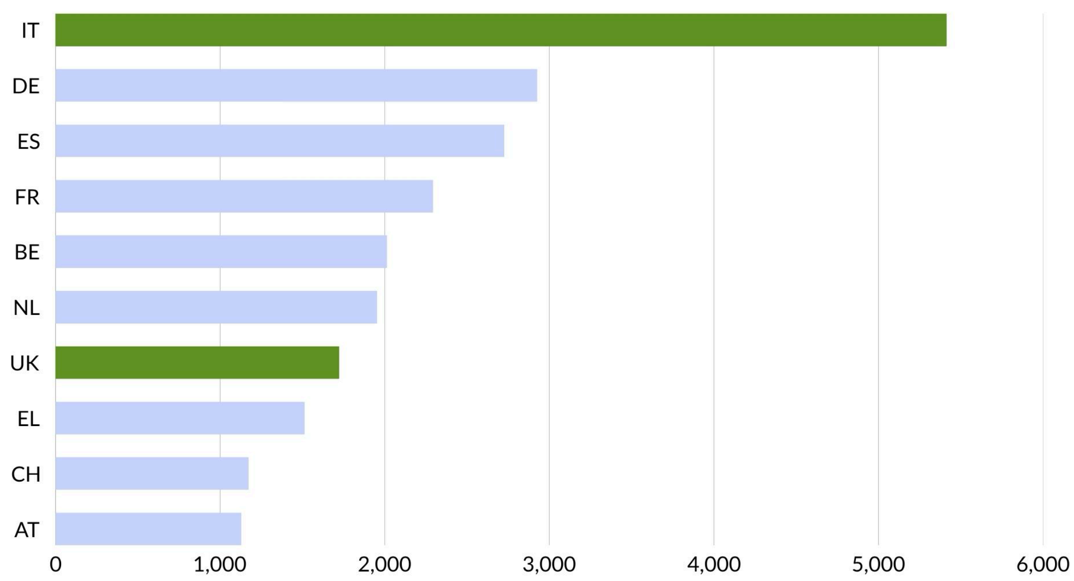
## Horizon Europe Grants

Under Horizon Europe (2021–2027), Italy participates in 5,414 AI projects involving 2,558 Italian organisations across all roles. Around 1,724 of these (32%) include both Italy and the UK, making the UK Italy's sixth most significant AI collaborator in the programme, with Germany ranking first (see figure 4). 939 UK organisations are involved, mostly as associated partners.

Unlike in QT and HPC, where UK partners are predominantly universities, almost 60% of UK collaborators in AI are private for-profit organisations (540), followed by other organisations (128), higher or secondary education institutions (113), and research organisations (89). Joint projects cluster in fields such as governance, ecology, oncology, sensors, energy and fuels, and software, reflecting bilateral strengths in AI governance, software and emerging hardware, as well as applications in life sciences, environment and energy, and industry (see figure 5).

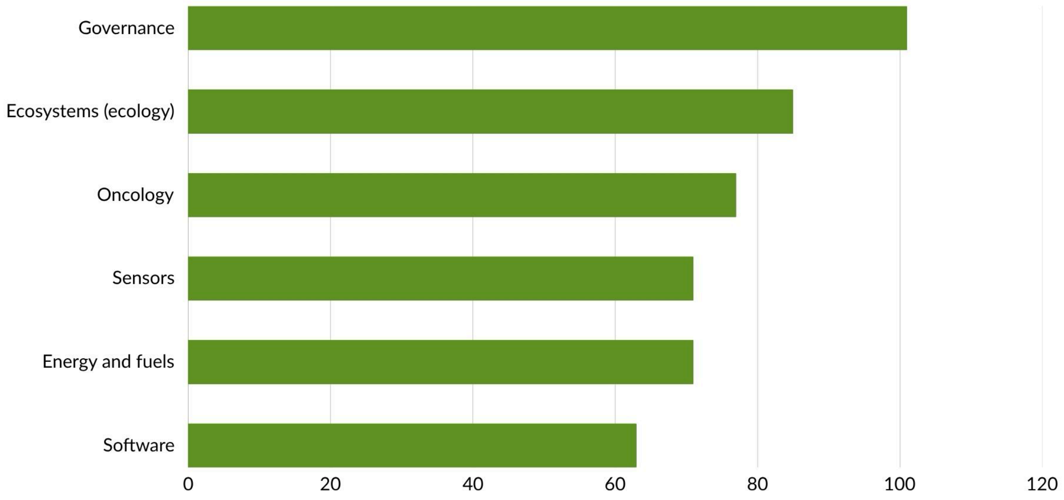
Most collaboration occurs through key Horizon Europe instruments: Research and Innovation Actions (about 43%), Marie Sklodowska-Curie Actions (about 20%), Innovation Actions (about 15%), Coordination and Support Actions (about 8%), Joint Undertaking RIAs (about 6%), with the remainder spread across smaller schemes.

*Figure 4. Number of AI projects with Italian partners on AI, by country (top 10)*




*Source: StateUp, Data: CORDIS*

*Figure 5. Number of IT-UK projects collaboration on AI, by top scientific field*

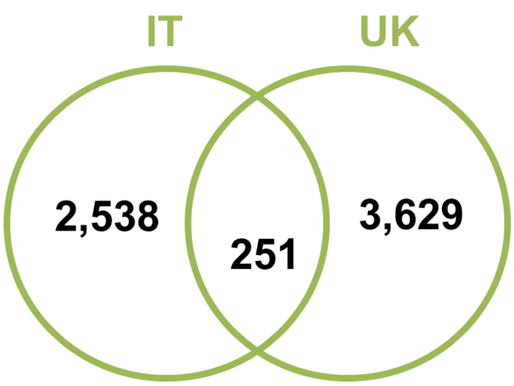



*Source: StateUp, Data: CORDIS*

## 3.2 Quantum Technologies

QTs are mostly at an early stage of development, but highly promising in terms of their potential impact on different sectors and applications. They have become a key area of academic focus in both countries. Between 2021 and 2025, approximately 2,500 QT journal articles were published with at least one Italian author, and about 3,600 QT journal articles with at least one UK author. **251 QT-focused journal articles were published with UK and Italy co-authorship, representing about 10% and 7% of Italy and UK QT-focused research output respectively (see figure 6). This level of interaction presents a promising basis for further cooperation as greater levels of funding are assigned to QT in both countries.**

*Figure 6. Number of articles in QT (2021-2025).*




*Source: StateUp, Data: OpenAlex*

### Topical Focuses

In terms of publication topics, both countries' have the most research outputs in quantum computing algorithms & architecture; and quantum information & cryptography. Combined, these subfields comprise about 41% and 38% of Italy's and the UK's quantum output respectively (Table 4). They also lead in terms of IT-UK joint publications, indicating shared national priorities in theory- and software-driven quantum research. However, the UK further complements this specialism with a broader research focus in QT applications and engineering.

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*Table 4.*

| Top 10 journal article topics in quantum technologies, 2021-2025 | | | | | |
|---|---|---|---|---|---|
| IT | | UK | | IT & UK co-authored | |
| **Quantum Computing Algorithms and Architecture** | **526** | **Quantum Computing Algorithms and Architecture** | **821** | **Quantum Information and Cryptography** | **56** |
| **Quantum Information and Cryptography** | **507** | **Quantum Information and Cryptography** | **574** | **Quantum Computing Algorithms and Architecture** | **30** |
| Quantum many-body systems | 102 | Quantum Mechanics and Applications | 148 | Quantum many-body systems | 13 |
| Quantum Mechanics and Applications | 83 | Quantum many-body systems | 134 | Neural Networks and Reservoir Computing | 9 |
| Quantum and electron transport phenomena | 75 | Quantum and electron transport phenomena | 133 | Photonic and Optical Devices | 8 |
| Cold Atom Physics and Bose-Einstein Condensates | 56 | Diamond and Carbon-based Materials Research | 91 | Cold Atom Physics and Bose-Einstein Condensates | 8 |
| Neural Networks and Reservoir Computing | 43 | Cold Atom Physics and Bose-Einstein Condensates | 89 | Diamond and Carbon-based Materials Research | 8 |
| **Advanced Thermodynamics and Statistical Mechanics** | 42 | Photonic and Optical Devices | 61 | Particle physics theoretical and experimental studies | 7 |
| Diamond and Carbon-based Materials Research | 41 | Neural Networks and Reservoir Computing | 55 | Orbital Angular Momentum in Optics | 6 |
| Photonic and Optical Devices | 36 | **Random lasers and scattering media** | 44 | Advanced Thermodynamics and Statistical Mechanics | 6 |

*Source: StateUp, Data: OpenAlex*

The UK's research focus has a broader coverage in applied and engineering aspects compared to that of Italy, which focuses slightly more on the underpinning science of QT. Italy's strong legacy in theoretical and material physics may be a factor in this divergence.

It is valuable to note that EU-wide analyses of quantum publications and projects show that, across Europe, the densest activity is in quantum computing/software (algorithms, architectures) and quantum information/communications/cryptography, with sensing and metrology somewhat smaller but growing. OECD mapping of the global quantum ecosystem also finds that, for most major countries, specialisation indices are highest or near highest in computing and communication/information subfields. Thus, the UK and Italy concentrations in these areas track with concentrations in the field more globally, and are not distinctive focuses.

UK-based researchers have an outsized share of highly cited quantum papers. The UK is "particularly well placed to lead on quantum software and algorithms," leveraging strong academic talent and a robust spin-out pipeline. In quantum communications and cryptography, the UK has specialised hubs (e.g. Quantum Communications Hub) and early national testbeds and networks, giving it practical advantages in protocol development and applied crypto/communications work. The Italian Quantum strategy, meanwhile, frames its comparative opportunity in combining strong theoretical/computational work (algorithms, information, cryptography) with national strengths in sectors like finance, manufacturing, and aerospace, where algorithms and crypto can be applied. In the Opportunity Areas, we outline natural *joint* advantage areas based on the positioning of both countries.

## Horizon Europe Grants

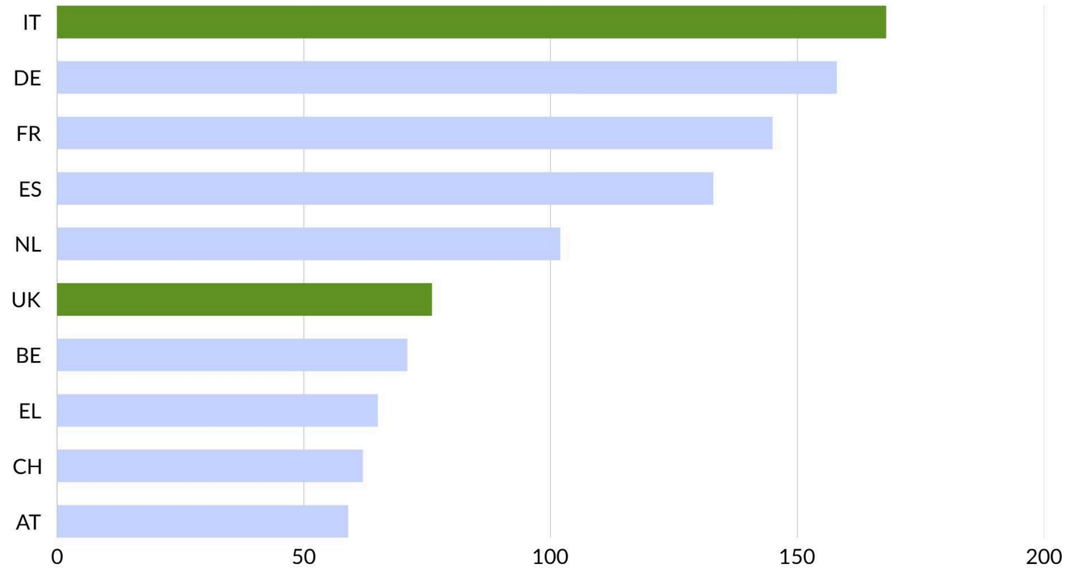
Under Horizon Europe (2021-2027), Italy has so far either participated or agreed to participate in 339 quantum technology projects, with participation from 248 Italian organisations (see figure 8). Of these projects, 76 projects also include a UK collaborator, with the UK being the 5th highest collaborator with Italy on quantum projects under Horizon Europe, and Germany ranking first.

Top scientific project fields involving researchers from the UK and Italy all correspond with the academic publication strengths of the two countries, and include laser physics, nanomaterials, software, and cryptography (see figure 9).

74 UK partner organisations are involved in projects shared between the UK and Italy, the majority taking the form of an associated partner group (see figure 7). Roughly half of these organisations are higher or secondary education establishments, approximately 30% are private for-profit organisations, and 12% are research organisations.

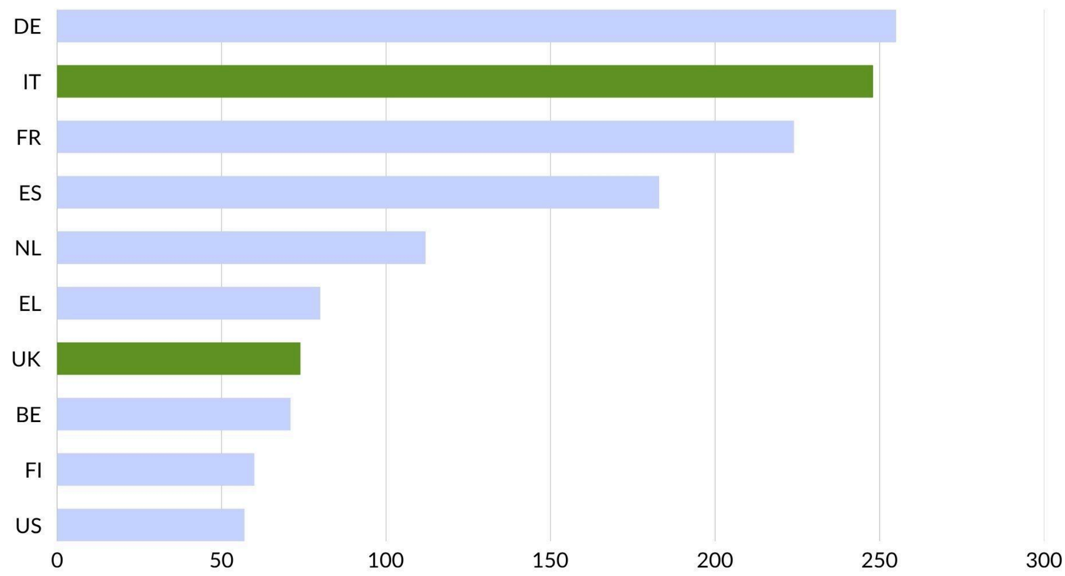
Most collaboration takes place under key Horizon EU programmes: the Marie Sklodowska-Curie Actions, accounting for almost 30% of the activity, followed by Horizon Europe Cluster 4: Digital, Industry & Space at c. 21%, and the European Innovation Council at roughly 20%. The relatively high proportion of collaborations under Marie Sklodowska-Curie Actions suggests strong interest in early-career researcher mobility, career development, and network building.

*Figure 7. Number of QT projects with Italian partners, by country (top 10)*




*Source: StateUp, Data: CORDIS*

*Figure 8. Number of organisations collaborating with Italian partners on QT, by country (more than 10 organisations)*




*Source: StateUp, Data: CORDIS*

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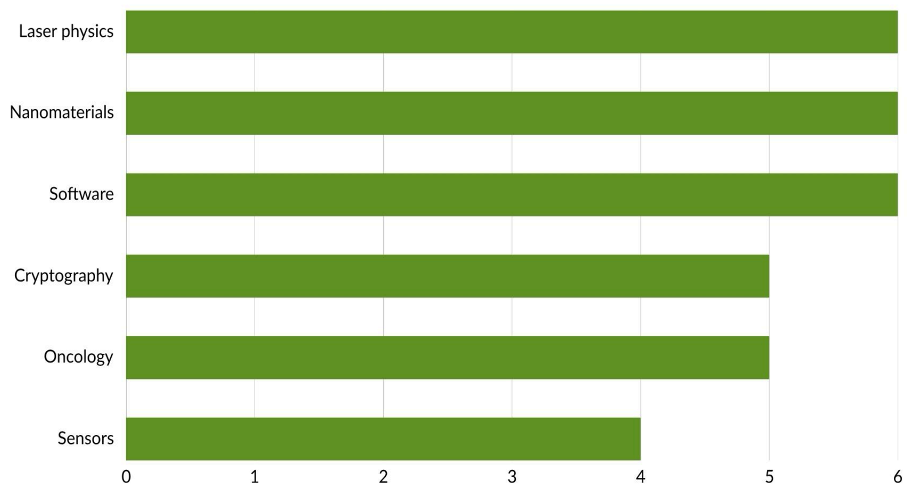
*Figure 9. Number of IT-UK projects collaboration on QT, by top scientific field*




*Source: StateUp, Data: CORDIS*

Besides Horizon grants (and other types of formal grants), interviewees noted that most collaborations with the UK (mostly with the University of Oxford, Cambridge and Manchester) are based on spontaneous and informal initiatives in which the parties 'bring' resources from individually obtained grants.

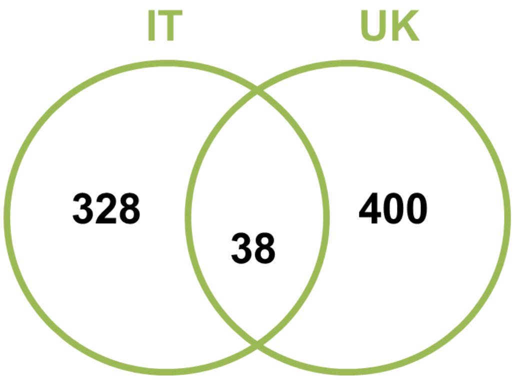
## 3.3 High-Performance Computing (HPC)

Italy displays global leadership in HPC infrastructure, with HPC6 (owned by the energy company Eni, see box 2) and Leonardo (owned by the university consortium CINECA) ranking the sixth and the tenth fastest supercomputers globally (see table 2)

Italy has a long-standing depth of technical expertise built far in advance of the current AI-driven interest in computational infrastructure. This strength, particularly in physics, materials science and computational fluid dynamics, have played a key role in the emergence of national HPC capabilities. Italian researchers' need for HPC long before its recent 'hype' created an early demand and a strong community capable of designing, operating and scaling HPC systems. This tradition is one of the country's clearest competitive strengths, distinguishing Italy from many other European partners whose HPC ecosystems developed later and more unevenly.

Despite these developments, HPC is currently a narrower technological field globally when compared to QT and AI. In terms of scientific publications, between 2021 and 2025, 328 Italian HPC journal articles and 400 UK HPC journal articles were published. **Joint journal article publications between IT-UK in HPC represent about 12% and 10% of Italian and UK output respectively (38 co-authored articles, see figure 10)—providing an early indication that researchers in each country recognise the strengths of the research community and infrastructure that the other country has to offer.**

*Figure 10. Number of articles in HPC (2021-2025).*




*Source: StateUp, Data: OpenAlex.*

## Topical Focuses

Key observations drawn from bibliometric research and high-level interviews regarding this more nascent field include:

- Italian research has a strong focus on algorithmic and numerical and physics-driven methods (including numerical simulation)
- The UK covers more applied domains and data infrastructure, emphasising engineering and applied sciences (engineering, materials, environmental) closely coupled to HPC operations, indicating an emerging strength in translating methods to large-scale applications and facility practice.
- Despite these differences, a number of joint research topics recur, typically skewed towards applied science domains (e.g. meteorology, materials, fusion, atmospheric ozone/climate, see table 5 ), suggesting collaborations are often problem-driven (e.g. based on shared datasets, instruments, or programmes).

*Table 5.*

**Top 10 journal article topics in high performance computing, 2021-2025**

| IT | | UK | | IT & UK co-authored | |
|---|---|---|---|---|---|
| Parallel Computing and Optimization Techniques | 20 | Parallel Computing and Optimization Techniques | 22 | Meteorological Phenomena and Simulations | 3 |
| Distributed and Parallel Computing Systems | 16 | Scientific Computing and Data Management | 17 | Distributed and Parallel Computing Systems | 3 |
| Cloud Computing and Resource Management | 15 | Cloud Computing and Resource Management | 15 | Machine Learning in Materials Science | 3 |
| Radiation Effects in Electronics | 12 | Distributed and Parallel Computing Systems | 9 | Cloud Computing and Resource Management | 2 |
| Scientific Computing and Data Management | 10 | Meteorological Phenomena and Simulations | 7 | Magnetic confinement fusion research | 2 |
| Meteorological Phenomena and Simulations | 7 | Seismic Imaging and Inversion Techniques | 6 | Atmospheric Ozone and Climate | 2 |
| Lattice Boltzmann Simulation Studies | 7 | Advanced Data Storage Technologies | 6 | Graph Theory and Algorithms | 2 |
| Machine Learning in Materials Science | 7 | Machine Learning in Materials Science | 6 | | |
| Advanced Data Storage Technologies | 5 | Radio Astronomy Observations and Technology | 6 | | |
| Computational Drug Discovery Methods | 5 | | | | |

*Source: StateUp, Data: OpenAlex*

Despite the expanding collaboration landscape in HPC, researchers note a potential future hurdle. A major challenge identified through the interviews concerns the high cost of energy in Italy, which has become particularly significant for HPC infrastructure, given its energy intensity. The recent rise in electricity prices increases the operating costs of HPC centres, with implications for long-term competitiveness and scalability. Although CINECA is trying to mitigate this pressure through the integration of renewable energy sources, the structural cost disadvantage remains significant in comparison with other countries and may constrain the expansion of national HPC capacity over time, conditioning opportunities for collaboration in the long run.

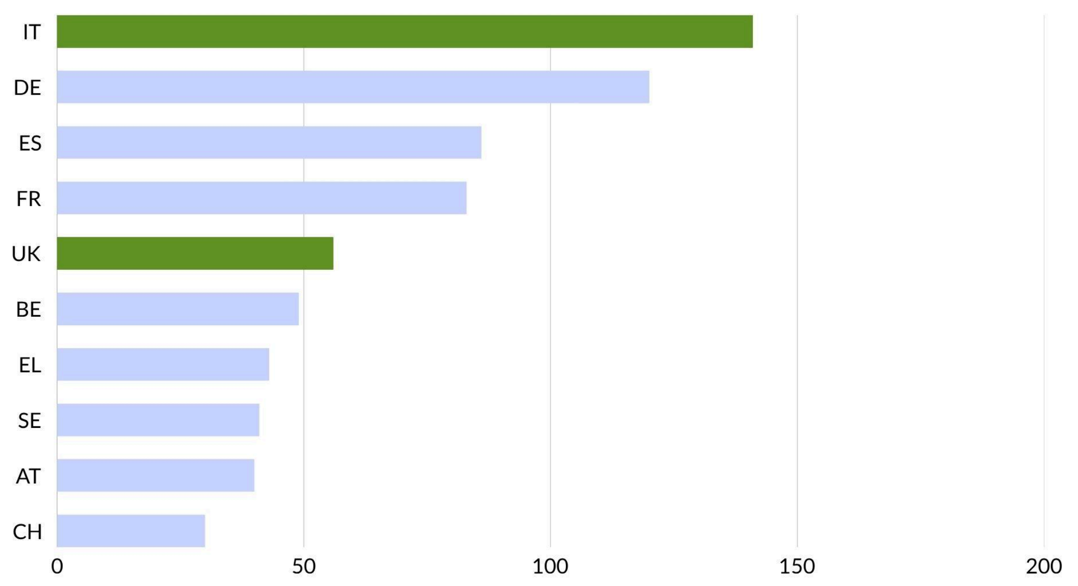
### Horizon Europe Grants

Under Horizon Europe (2021–2027), Italy has participated in (or committed to) 141 HPC projects involving 207 Italian organisations in all roles (coordinators, participants, third parties, associated partners). Of these, 56 projects include both Italy and the UK, making the UK Italy's fifth most significant HPC collaborator in the programme (see figure 11). Around 57 UK organisations take part in these shared projects, mostly as associated partners (see figure 12). Roughly half are higher or secondary education institutions (27), about 37% are private for-profit organisations (21), and around 11% are research organisations (6), mirroring the profile of UK–Italy collaboration in quantum technologies.

Although absolute project numbers are modest, the main shared scientific areas span supercomputers, ecology, oncology, software, enzymes, aircraft, AI, coatings and films, and energy and fuels, pointing to joint strengths in enabling software and infrastructure with applications in climate and energy, life sciences, and aerospace.

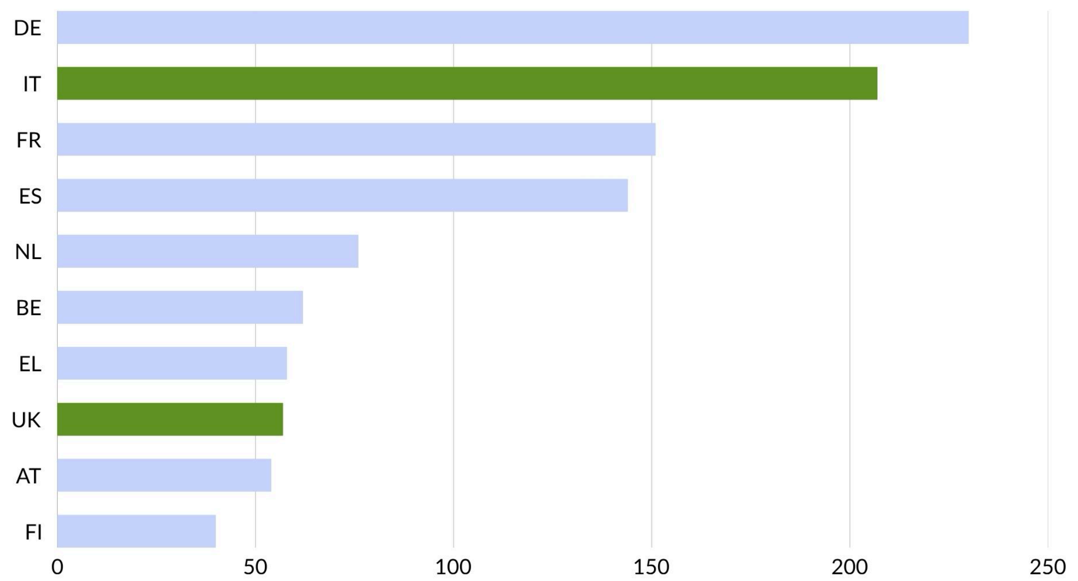
Collaboration is concentrated in a small set of Horizon Europe instruments, led by the Marie Sklodowska-Curie Actions, followed by Cluster 4 (Digital, Industry & Space), Cluster 5 (Climate, Energy & Mobility), the European Innovation Council, Research Infrastructures, and the EuroHPC Joint Undertaking.

*Figure 11. Number of HPC projects with Italian partners, by country (top 10)*




*Source: StateUp, Data: CORDIS*

*Figure 12. Number of organisations collaborating with Italian partners on HPC, by country (more than 10 organisations)*




*Source: StateUp, Data: CORDIS*

*Box 2.*

**CINECA**

CINECA is Italy's non-profit university consortium founded in 1969, made up of 69 universities and 27 national public research, the Italian Ministry of University and Research and the Ministry of Education. CINECA is the most powerful supercomputing centre for scientific research in Italy (and one of the most powerful in Europe), and it hosts one of the top five fastest supercomputers in the world, the Leonardo supercomputer. Over several decades, CINECA has managed the national supercomputing platform, ensuring continuity, expertise and technological growth. This long institutional history is not only unique in Europe, but has also enabled Italy to maintain a sustained presence among the global top supercomputing nations.

A recent major new development is the EU-funded AI Factory initiative, which has selected Italy, with CINECA as national lead, as one of only two European hubs for next-generation AI compute capabilities. This will include a new machine four times more powerful than Leonardo, currently in procurement. When it comes to applications, CINECA HPC Leonardo has been recently used for drug design, proof of concepts and by companies in the packaging sector, materials and sensors. Physics remains the largest user community, followed by materials science and engineering. Increasingly, however, HPC is used for AI and LLM training, which require significant compute capacity; this trend is rapidly accelerating. Industrial demand exists primarily in the energy sector (Eni) and pharmaceuticals. Interestingly, new fields such as cultural heritage and digital humanities are beginning to use HPC resources for cataloguing artefacts, manuscript digitisation and large-scale data processing. CINECA remains sector-agnostic, supporting all academic disciplines.

As a public "in-house" entity, CINECA cannot offer commercial HPC services beyond 20% of its total activity, to avoid state-aid violations. This limits the consortium's ability to serve private companies, even when there is demand, and restricts the development of a domestic HPC market. This is not a lack-of-demand issue: Italian and European companies increasingly need compute capacity for AI, simulation and optimisation, but the current legal and financial ecosystem does not yet support the emergence of large private HPC providers. The European Commission appears aware of this and is preparing the Gigafactory funding call (February 2026), designed to encourage private investment in large-scale HPC centres specifically targeted at industrial users. Italy is expected to participate through an industrial consortium supported by CINECA's expertise.

*Box 3.*

**HPC6 Eni**

HPC6 is the latest version of a series of high-performance supercomputers installed and operated by the energy company Eni. Completed in 2024 at Eni's Green Data Centre in Ferrera Erbognone, HPC6 delivers a computing power of about 606 petaflops, making it among the top global supercomputers (6th in the world) and the most powerful one dedicated to industrial use. Its architecture combines CPUs and GPUs, enabling both large-scale numerical computation and advanced graphical data processing, which are essential for complex scientific simulations.

The development of HPC6 builds on a long tradition of supercomputing at Eni. Since the 1980s, the company has used advanced computing to process geophysical data for energy exploration. A major step forward occurred in 2013 with the introduction of the first High Performance Computing Cluster (HPCC1), which had a capacity of around 0.5 petaflops. Over the following decade, successive upgrades progressively increased computing capabilities, culminating in HPC6's scale. This technological trajectory reflects the strategic importance of computational modelling in Eni's operations. Today, HPC6 is primarily used to support subsurface modelling and exploration activities. By processing large volumes of seismic data and running advanced simulations, HPC6 helps estimate the probability of discovering hydrocarbon reservoirs before physical drilling occurs. This significantly reduces exploration risk and costs while improving accuracy in identifying new gas and oil fields.

In addition to upstream applications, the use of HPC6 has expanded into broader scientific and industrial applications, beyond traditional oil and gas exploration. The system is increasingly used to accelerate research in energy transition technologies, including magnetic-confinement fusion, carbon capture materials, green chemistry, and advanced solar technologies. Through recent initiatives such as the Call4Innovators programme, Eni has also opened HPC6 to external startups, SMEs, and research institutions to test models related to decarbonisation. In this sense, HPC6 represents a critical technological infrastructure in Italy, supporting both industrial competitiveness and the development of next-generation energy technologies.

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# 4. OPPORTUNITY AREAS

Several key opportunities for UK-Italy research cooperation were identified by research and policy leaders and innovators across the fields of HPC, Quantum, and AI. These opportunities are often tied to existing relationships, specific technological strengths and areas of complementary, and a strong interest in increased personnel exchange. While this report does not aim to pick "winning" subfields to fund, a notable breadth of opportunities was mentioned within interviews and expert roundtable discussions.

**Artificial intelligence presents a robust basis for future bilateral collaboration.** Italy holds substantive capabilities in data infrastructure, data preparation, and model training, alongside strong sectoral application areas such as mobility, health, and the social sciences. These are domains in which the UK also has significant expertise and strategic interest. In addition, both Italy and the UK are investing in areas such as AI fairness, explainability, and trustworthiness, which are increasingly central to international AI policy and governance debates. **There is thus an opportunity not only for technical cooperation but also for research collaboration on key societal 'grand' challenges and joint leadership in responsible AI. Implementation could take the form of collaborative projects in selected sectors, combining shared data resources, co-developed models, and common frameworks for ethical and trustworthy deployment.**

**One of the clearest opportunities for collaboration is in quantum technologies, where Italy and the UK possess complementary research profiles.** Italy is generally perceived as having strong capabilities in foundational physics and theoretical frameworks, while the UK shows particular strength in more engineering-oriented and experimental areas, including materials, chemistry, optics, photonics, and applied engineering. This complementarity could create substantial added value by enabling joint programmes that connect underpinning scientific research with application-focused technological development. **A practical next step would be to identify a limited number of priority themes, such as quantum computing architectures, quantum sensing, or quantum information, around which bilateral collaborations could be more systematically organised.**

The MUR notes that basic quantum science is still evolving, and "constitutes the knowledge basis from which future quantum technologies will emerge. Today's discoveries guarantee tomorrow's applications." The potential for cooperation on basic quantum science was emphasised by participants at the high-level roundtables, with UK participants strongly supporting the need to retain and further develop a strong basic quantum science foundation.

**One clear priority theme that emerged from the research is quantum sensing and metrology.** Opportunities for UK–Italy cooperation in quantum sensing are strong because both countries treat sensing and metrology as early, but near-market parts of their quantum strategies and have complementary assets and use-cases. The UK is putting substantial new funding into quantum sensing and navigation for security, underground imaging and resilient infrastructure monitoring, framing these as mission areas within its wider £2.5 billion quantum programme and recent "Quantum Leap" package. Italy's strategy similarly highlights sensing and metrology as nearer-term commercial opportunities (e.g. precision timing, secure positioning, and industrial monitoring), creating obvious scope for both research collaboration, and, at the application-stage, shared testbeds or demonstrators in defence, energy grids, transport, and critical infrastructure.

Italy's strong position in optical clocks and atomic gravimeters offers a clear basis for collaboration with UK institutions like the National Physical Laboratory (NPL). Building on shared expertise, Italian institutes active in metrology such as the National Metrology Institute of Italy (INRiM) and the UK's Quantum Hubs and Quantum Application Hubs focusing on metrology, positioning, navigation and sensing (PNT) could jointly develop standards and infrastructure, which could potentially provide first mover advantage in emerging technology domains. Creating a partnership between a UK sensing hub with Italian labs and Q-Alliance could enable shared testbeds (e.g. for gravity gradiometry, inertial navigation, timing).

**A further priority area could be hybrid pipelines to evaluate QT algorithms/computers.** Such benchmarks remain highly contested, and both countries lack the expertise and frameworks to develop a system as robust as the United States Quantum Benchmarking Initiative (QBI). The QT ecosystems in both countries noted that a collaboration in this area presents a stand-out opportunity for both countries to benefit from pooled resourcing.

**In HPC, there exists a promising opportunity to link Italy's strengths in algorithmic and mathematical foundational models with UK strengths in application domains and operational expertise.** There is also scope to combine Italian capabilities in system-level optimisation and performance with UK experience in centre-scale operations, including energy-aware scheduling, thermal and cooling management, and operating system or runtime co-design. **The value of this approach lies in building collaboration across the full HPC stack rather than in isolated technical niches. A useful implementation mechanism would be to establish small joint demonstrator projects, supported by reciprocal facility access, shared benchmarks, and common validation frameworks.**

A consistent interest in **technology applications for science** was evident among interviewees and roundtable participants. The UK, home to AlphaFold and The OpenBind consortium data-driven AI drug discovery programme (funded by DSIT), has a particular strength in AI for Science, and supercomputing for science also represents a growing need. ARIA, the UK Advanced Research and Innovation Agency, has called for activation partners to apply advanced AI capabilities to the R&D that it funds. Italy has several emerging strengths in AI for science, rooted in the way it is coupling AI with HPC, domain science and application-driven infrastructures. For example, Italy's ICSC and EuroHPC-class systems in Bologna are explicitly organised around using AI plus supercomputing for climate, particle physics, health and industrial research. **Specific AI/QT/HPC for science-focused bilateral programming may thus unlock a shared area of research leadership and innovation.**

Industrial UK–Italy cooperation already extends into adjacent sectors that require all three technologies. Space is a key example, and increasingly prioritised as a "frontier" industry for future security that is contingent on advanced AI, quantum, and supercomputing capabilities. Telespazio UK and Serco UK deliver Earth-observation data-quality and calibration services for the European Space Agency from Italy's ESRIN centre in Frascati, while Serco Italia contributes alongside Leonardo, Telespazio and e-GEOS to Italy's IRIDE Earth-observation constellation. Drawing on this track record, UK-Italy bilateral instruments could integrate space-related downstream services, data exploitation, and sector-specific skills development.

> *"There is a difference between supercomputing and supercomputing for science. When funding collaborations we need to be clear which one we are funding—we need both."*
> **Prof. Marc Parsons, EPCC, University of Edinburgh**

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# 5. GRANT FUNDING AND SCHOLARSHIPS

### Overview

**Current UK–Italy grant funding in AI, quantum technologies and HPC is modest but impactful, showing how relatively small schemes can seed dense, durable collaboration.** Mobility-oriented programmes, scholarships and small bilateral grants have already generated joint outputs and networks, especially in AI and the natural sciences, but there is still a clear gap in both small and medium- to large-scale, technology-specific funding.

- The UK–Italy Trustworthy AI Visiting Researcher Programme supported 36 short exchanges and produced roughly 70 joint outputs (papers, conference submissions, grant proposals), demonstrating how low-cost mobility schemes can catalyse high-impact AI collaboration.

- GREAT Scholarships for Italian master's students and Royal Society–CNR cost-share grants broaden and deepen talent pipelines and senior research links, yet remain small and largely untargeted to AI, quantum or HPC.

- **These Modest Collaborative Grants (MCGs) are effective "relationship builders" but do not yet fund shared infrastructure or multi-year flagship projects, suggesting an opportunity for additional cognate programmes as well as additional interventions designed to scale up partnerships.**

Current UK–Italy funding for AI, quantum technologies, and high-performance computing is characterised by a patchwork of targeted but relatively small-scale bilateral schemes alongside broader European instruments that have been challenged since Brexit. Recent and current programmes and pilots such as the UK–Italy Trustworthy AI Visiting Researcher Programme, GREAT Scholarships, and the Royal Society–CNR cost-share grants demonstrate that modest, mobility- and exchange-oriented funding can generate dense research links and substantial joint outputs, especially in AI and the natural sciences. However, there are few dedicated, medium- to large-scale bilateral funding streams focused specifically on AI, quantum, and HPC, and current schemes tend to support individuals or small teams rather than shared infrastructure or multi-year flagship projects. The analysis below provides a snapshot of these Modest Collaborative Grants (MCGs) and the value derived from them.

### Turing Fellowships: Doctoral researchers and above

The UK-Italy Trustworthy AI Visiting Researcher Programme was a 2023–24 bilateral mobility and collaboration scheme focused on ethical and trustworthy AI. It funded short research exchanges for early-career and other researchers between UK and Italian institutions, to build networks and generate joint research outputs in safety-critical AI domains.

The programme ran from 2023 to 2024 and supported 36 researchers working across areas such as healthcare, cybersecurity, and machine learning, all under a "trustworthy AI" lens (resilient, safe, secure, ethical systems). It was launched at the Ital-IA conference in May 2023 and delivered with The Alan Turing Institute and FAIR Foundation, illustrating a government–research–foundation partnership model.

The initiative was funded via the FCDO Tech Standard and Partnership Fund, with an average cost of about £2,400 per exchange, making it a relatively low-cost intervention per researcher. Stays ranged from one week to two months in host institutions, explicitly framed as visiting researcher placements rather than full fellowships.

The exchanges generated around 70 research outputs, including joint publications, conference submissions and project proposals targeting European and national funding (e.g. Horizon Europe and Marie Curie Fellowships). The scheme emphasised early-career development, helping participants establish international partnerships, and achieved broad geographic spread across institutions in both the UK and Italy.

The programme was coordinated by the UK Science and Technology Network in Italy (STN Italy) and culminated in a November 2024 workshop titled "UK-Italy Exchange of Researchers in Trustworthy AI: A Blueprint for Future Collaboration?". That workshop explicitly linked the scheme's lessons and networks to the planned UK–Italy Science and Technology Dialogue between DSIT and MUR, positioning this model as a template for future bilateral programmes (e.g. in quantum and HPC).

At roughly £86,000 of total programme cost for the mobility component, the pilot showcases the value of a scoped thematic frame, with collaborative governance, and a standardised short-stay envelope. The design could provide inspiration for programmes focused on other technological subfields.

Participants at the UK-Italy roundtable on critical technologies collaboration identified early-career mobility as a key constraint on sustained UK–Italy cooperation. Drawing from the Trustworthy AI model to develop cognate programmes in quantum and HPC—with FAIR's analogue role potentially taken by NQSTI or ICSC —could help address this constraint at marginal cost and generate the network needed for better integration between the two research ecosystems.

### GREAT Scholarships: Taught masters students - subject agnostic

UK GREAT Scholarships are a UK-wide scholarship scheme for international students, run by the British Council in partnership with the GREAT Britain campaign and participating universities. They provide a tuition-fee contribution (typically around £10,000 or more) for one-year taught postgraduate degrees (master's level) at selected UK institutions, and are targeted at nationals of specific partner countries, with each university deciding which countries and subjects it will support in a given year. Applicants apply directly to participating universities, must already hold or be applying for an offer for a one-year postgraduate course, and are selected on academic merit, motivation, and their potential to contribute to their home country after study; successful candidates also join a small national GREAT Scholars cohort and are invited to British-Council-run networking and welcome events during their year in the UK.

The GREAT Scholarships scheme was opened to Italian students for the first time in the 2025–26 academic year. That first round funded 8 Italian students with scholarships worth at least £10,000 each towards one-year postgraduate courses in the UK. 5 awards are expected in 2026-26. Italian-focused GREAT awards are offered by a set of named UK universities (e.g. Warwick, Bath, Leicester and others), typically as one scholarship per institution, sometimes at higher values (Warwick has offered awards of £15,000–£30,000 for an Italian master's student in business/management in recent years).

### Royal Society and CNR Co-funding: Established researchers - natural sciences

This specific funding scheme supports small, bilateral research collaborations between UK-based researchers and colleagues at Italy's National Research Council (CNR), co-funded by the Royal Society and CNR. In practice, these are usually 2–3-year "joint research projects" or "international exchanges – cost share" grants of up to around £12,000, which pay mainly for short research visits, travel and sometimes modest research costs, with each side funding its own researchers. They are seen as excellent channels for international exchange because they are light-touch, flexible seed funds that help teams build relationships, generate pilot data and position themselves for larger joint grants.

The scheme is relatively small-scale (5 projects were selected for 2026-27, with 31 applications received across fields). Research leaders recommend not only maintaining but expanding the awards (e.g. more awards, larger budgets, or targeted themes like quantum and HPC), which attract high-quality and diverse applications.

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# 6. KEY BARRIERS

**Overview**

**The most frequently cited barriers to UK-Italy cooperation across the three technologies concern student and early-career mobility, the post-Brexit funding environment, weak formal frameworks, and specific capability gaps.**

- **High international tuition fees** make longer-term PhD exchanges financially unrealistic, undermining what researchers see as the "fundamental" engine of collaboration.

- **Brexit has reduced predictable access to EU-level joint projects and infrastructures**, leaving many once-routine collaborations constrained and ad hoc.

- **Most partnerships are informal and project-by-project**, with few structured, government-backed bilateral schemes capable of supporting larger, longer-term or infrastructure-heavy work.

- **Italy's still-maturing fabrication and quantum hardware facilities, and a perceived lack of UK awareness of Italian strengths, further limit the scale and ambition of joint initiatives.**

Several key barriers present a challenge to UK-Italy research cooperation in HPC, Quantum, and AI. We present the five most frequently cited barriers, each of which dominated the interview and roundtable discussion. Those relating to student mobility, Brexit, and a lack of formalised opportunities cut across academic disciplines. Barriers relating to capability, infrastructure, and awareness are more specific to the fields analysed in this report.

**High cost of international fees for European students in the UK:** This challenge to student mobility is consistently cited by research leaders as a major obstacle to the exchange of PhD students, which researchers consider "fundamental" for scientific collaboration. Previous research notes that prohibitive fees, across all university subjects, primarily concern undergraduate students, but across the fields discussed here, research leaders consistently raised student mobility as an issue at the postgraduate level. While the UK is rejoining Erasmus + and Horizon programming in 2027, there remains a gap before the full-scale of scientific collaboration can be reignited through these schemes alone.

**Broader impact of Brexit:** The UK's departure from the EU has presented significant challenges for collaboration, particularly in relation to historical joint projects dependent upon access to research infrastructure. Existing relationships have not disappeared: CINECA, for example, continues to engage with centres such as EPCC, and UK universities can still access Italian supercomputing resources through Horizon projects and other European initiatives, but these initiatives have become severely limited and ad hoc.

**Lack of formalised bilateral collaborations:** Many existing interactions are described as "spontaneous" and "informal," indicating a lack of formal, structured, or government-funded agreements to sustain partnerships. In some disciplines, this informality may not, *per se*, pose challenges. However, for the fields under discussion here, more formal routes are requisite to achieve the scale of investment likely needed to support sustainable partnerships. The UK-Italy Science, Tech, and Innovation Dialogue is a welcome step. The planned future MoU will further strengthen possibilities.

**Specific Capability/Infrastructure Gaps:** Italy has historically been less advanced than leading countries in superconducting quantum technologies, with domestic fabrication capabilities only now maturing. It possesses relevant clean-room and nanofabrication facilities, but these are still being expanded and specialised; this can constrain the scale and speed of joint projects in superconducting platforms. The Italian Strategy for Quantum Technologies (MUR) acknowledges underfunded or under-exploited facilities, and the need to upgrade. This requirement, if unaddressed, could limit joint projects.

**Lack of awareness:** There is a perception among the Italian research community, supported by UK research leaders with Italian collaborations, that UK researchers are not always aware of the quality and size of the Italian ecosystem, including in fields where Italy has clear research strengths.

> *"Here in Oxford, if a visiting student comes for more than three months, they have to pay the internation fee  as if they were enrolled... exchanges with students have become practically impossible"*
> **Giuseppe De Giacomo, University of Oxford**

> *"We collaborate informally by sending samples, and they are analysed by our collaborator's team in the UK. Having a grant-supported collaboration would be more beneficial. It wouldn't just be 'I send you the sample, and you study it,' but something we do together, for example, sending a PhD student who can learn"*
> **Interview participant**

Prior research notes a lack of English-language undergraduate courses at Italian universities as a barrier to accommodating UK students in the Italian university system. At the research student level across AI, QT, and HPC, language is not a primary barrier given that English serves as the research *lingua franca* across much of the international research community; even if some labs primarily work in Italian, they are generally able to accommodate and integrate English speakers. Leading technical universities (e.g. Politecnico di Milano) require certified English for programmes taught in English and have adopted English as the normal medium for many postgraduate and doctoral courses in engineering and computing, as part of their internationalisation strategy.

# 7. PRELIMINARY RECOMMENDATIONS

**Overview**

This chapter proposes practical, relatively low-cost steps to turn UK–Italy commitments on AI, quantum and HPC into shared capacity by linking infrastructure access, people pipelines and programme design. It suggests:

- **Creating reciprocal access to flagship HPC and early-stage quantum platforms** (e.g. Leonardo, UK exascale and quantum testbeds), organised through joint calls and co-branded sandboxes in priority domains such as fusion, climate and advanced materials, so researchers can treat each other's facilities as extensions of their own systems.
- **Rebuilding and upgrading early-career mobility** via short exchanges, targeted postgraduate scholarships/fee-support in quantum/HPC/AI, and replicated schemes like the Trustworthy AI Visiting Researcher Programme, to restore dense UK–Italy networks that underpin successful Horizon and EuroHPC bids.
- **Supporting Horizon preparation** through small, targeted workshops and a biannual UK–Italy research leader convening in AI/QT/HPC; and small "pump-priming" seed grants for binational consortia, enabling teams to shape competitive proposals ahead of key European calls.
- **Establishing a UK–Italy scientific steering group on AI, QT and HPC** under the forthcoming MoU to set 2–3-year priorities, champion joint programmes, and surface barriers to cooperation.
- **Exploring "moonshot" programmes** that pair UK and Italian strengths in quantum–AI–HPC for critical infrastructure and advanced compute, positioning the partnership at the frontier of high-risk, high-reward research and innovation.

This chapter sets out targeted, bilateral measures that would enable the UK and Italy to turn high-level commitments on AI, QT, and HPC into tangible joint capacity, by aligning infrastructure access and investment with concrete people pipelines and programme design. It proposes reciprocal access to flagship HPC and early-stage quantum platforms through a virtual joint facility and co-branded sandboxes in priority domains, so that researchers in both countries can treat one another's systems as extensions of their own national capability.

On the people-side, the recommendations focus on restoring and upgrading early-career mobility and network-building through short-term exchanges, targeted postgraduate support, and structured Horizon-oriented preparation, helping to rebuild dense, trust-based ties that were weakened after Brexit and are essential for competitive European consortia. Taken together, these recommendations are designed to be pragmatic, relatively low-cost levers that can be sequenced over the next 2–3 years to deepen UK–Italy scientific cooperation, improve joint performance in Horizon Europe and EuroHPC calls, and strengthen both countries' positions in critical technologies central to European security and economic resilience. Table 6. Provides approximate costings over a three-year period for each recommendation.

## 7.1 Access to Shared Infrastructure

Italy hosts Leonardo, a EuroHPC pre-exascale system at CINECA's Bologna Technopole, providing petascale-class capability for climate modelling, fusion research, and AI-intensive workloads that is already used as a European hub for initiatives such as Destination Earth. In parallel, the UK is investing heavily in its next national supercomputer and a broader exascale ecosystem, alongside DSIT- and UKRI-backed research infrastructures such as national Tier-1/Tier-2 services and the National Quantum Computing Centre, which will support emerging quantum-HPC hybrid workflows.

Researchers in both countries emphasised the benefits of access to *both* sets of infrastructure, both for “homegrown” research and to foster research cooperation. They emphasised that infrastructure access and early-career mobility go hand-in-hand. Thus, the recommendations here should be taken in conjunction with those that concern mobility (Section 2., below).

**Joint Facility Usage:** The UK and Italy could establish preferential reciprocal access to flagship HPC and early-stage quantum platforms, for example giving UK researchers priority allocations on Italy’s Leonardo supercomputer and CINECA facilities, and Italian teams on UK national quantum testbeds and UKRI quantum hubs. This could be structured through jointly governed calls, to encourage collaborative projects that make the most of the respective infrastructure in both countries. Such predictable, priority access to one another’s flagship systems through shared calls and harmonised policies for code porting, data management, and security would create significant research efficiencies and open up collaboration that draws on the respective strengths of each country.

**Co-branded testbeds for priority domains:** Co-branded testbeds—a technical or operational environment such as shared datasets, networks, or hardware platforms for experimenting with and demonstrating earlier-stage technologies under realistic conditions—in domains such as fusion, climate, and advanced materials could then sit on top of this joint facility usage, with jointly defined benchmarks and validation protocols so that results generated on Italian hardware are automatically recognised within UK programmes (for example, under the National Quantum Strategy’s test and validation activities) and vice versa, lowering transaction costs for collaboration and making it easier to assemble competitive binational teams for EuroHPC and Horizon calls.

Within the testbed, an emphasis on evaluation could be particularly beneficial given the need to evaluate competing quantum approaches rigorously. Both countries lack the strength of institutional and technical capacity that the US has developed through DARPA. Thus, there is a clear efficiency to be built through partnership. UK–Italy cooperation in quantum sensing and metrology evaluation already rests on a developing foundation. NPL and INRiM are core partners in the new NMI-Q framework, which implements G7 commitments on joint work in quantum measurement, pre-standardisation research and standards development, and builds on their earlier joint chronometric levelling experiments.

A dedicated UK–Italy workstream (for example on optical clocks, gravimetry or chronometric levelling feeding into CEN-CLC/JTC 22, the European standards technical committee) could therefore extend an existing collaboration ecosystem rather than starting from scratch, while delivering visible industrial, security and infrastructure benefits at relatively low cost.

*Box 4.*

**A Quantum Twin-Hub**

Italy is backing Q-Alliance as a publicly supported hub tying together both Italian and international quantum industry leaders (IonQ, D-Wave), Italian institutions, and government input to build a Lombardy quantum centre. Q-Alliance focuses on industrial applications of QTs, bridging research and industry. It complements the work of CINECA, which integrates quantum hardware into supercomputing infrastructure.

UK Government could support a “twin-hub” arrangement: a UK quantum hub (Harwell, Daresbury, etc.) formally partnered with Q-Alliance, with co-funded testbeds, joint calls for quantum-enabled chips and photonics, and shared training programmes, building on both countries' national quantum strategies and workforce initiatives.

One promising possibility could be to link Q-Alliance's photonic and neutral-atom platforms in Lombardy with the UK's QuSIT/QuantIC sensing hubs to develop and benchmark gravity and infrastructure-monitoring sensors for landslide, subsidence, and critical-asset surveillance. Drawing on early work in Italy, the twin-hub could host a testbed with this focus, enabling joint field deployments in Italian geohazard sites, with shared UK–Italy data and evaluation protocols. The testbed could provide an environment to co-design devices, compare architectures and generate evidence for standards and future procurement.
Calls should be explicitly bi-national, with every project including UK and Italian partners and selection should prioritise projects that could uniquely benefit from access to both ecosystems, and contribute to them.ss-site HPC/quantum resources rather than single-country runs.

## 7.2 Postgraduate and Early-career Mobility

Research and industry leaders consistently emphasise the importance of early-career mobility to foster research collaborations and long-term relationship building. Brexit caused significant challenges to this process, but the return of the UK to the European Union's Erasmus+ framework is welcomed by researchers in both countries. There is strong demand from the research community to re-establish mobility pathways. Beyond Erasmus + (scheduled to resume in 2027), possible routes include:

**Continuation and expansion of short-term exchange programmes such as the Turing Fellowship:** The UK–Italy Science and Innovation Network has piloted bilateral exchanges such as the "Trustworthy AI Exchange Programme," from which participants noted positive outcomes in terms of both immediate research gains and long-term relationship building. The relatively low-cost approach could be replicated across quantum and HPC. The STN should consider whether open calls across all three areas, or targeted calls focused on subfields with particular joint strength and opportunity (e.g. quantum algorithms, HPC for climate or energy, and quantum-enhanced security) would add most value.

**Italy-targeted scholarships:** Scholarships could cover all or most tuition for Italian postgraduates (while keeping them formally classified as international students), and include a living stipend if funding permits: The approach could expand upon the GREAT Scholarships model (currently only available on taught courses), funded by the British Council and British institutions, which already offer £10,000 towards fees for Italian students at selected UK universities.

**Built in a participation requirement in bilateral activities for all forms of funding and support** (UK–Italy Research Day, joint labs): The STN team should explicitly engage any financial waivers and other funding as a mechanism for developing and scaling the cooperation agenda.

> *"Convince English universities to remove international fees for European students... And so we suddenly have a pool of potential students from all over Europe, including Italy"*
> **Angelo Cangelosi, University of Manchester**

> *"In cognitive robotics, Italy is very present... it would be important to convince UK universities to remove international fees for European students so it becomes feasible again to recreate the student exchange from which the UK benefits greatly"*
> **Roberto Navigli, La Sapienza Universita' di Roma**

*Box 5.*

**Researcher Exchange Programme Case Study: Scotland and Germany**

The new Scotland–Germany academic exchange scheme is a jointly funded Royal Society of Edinburgh–DAAD programme that supports short research visits and targeted training between EPCC and Juelich Supercomputing Centre (JSC), enabling early- and mid-career researchers to build networks, develop joint projects and prepare larger bids under Horizon and other schemes. It includes structured training elements designed around clearly identified skills gaps in the participating communities.

The Exchange is also linked to specific tool use. EPCC's collaborators at JSC have developed Scalasca, a software tool important for understanding the performance of scientific programmes run on large supercomputers. JSC will develop training for EPCC staff to ensure they are able to engage fully with the tool and its newest features as EPCC hosts the next national supercomputer.

**A UK–Italy version could follow this model by combining mobility funding with similarly precise tools and training offers in areas like quantum-HPC software engineering, AI for science, or research commercialisation. Doing so would ensure that such schemes extend beyond moving people, also systematically addressing specific capability needs, which could make relatively modest bilateral mechanisms far more impactful.**

## 7.3 Horizon Preparation

Continued participation in Horizon Europe, ERC grants, and Marie Sklodowska-Curie Actions remains critical for funding large-scale, long-term research. The reintegration of the UK into Horizon funding is welcomed by both the UK and Italian scientific communities. However, they emphasise that networks established prior to Brexit have sometimes been eroded, and a younger generation of researchers in both countries have had less interaction with researchers in the other country respectively. Given the competitive nature of Horizon funding, and the impact of pre-existing acquaintance on application success rates, there is a need to foster new bilateral research networks, with sufficient time to build trust and detailed understanding of potential collaborations, ahead of Horizon funding calls. The approach is also valuable for other large-scale funding opportunities. Possible routes include:

**Targeted workshops:**

Targeted thematic workshops tied to the Opportunity Areas would help to nurture expert bilateral communities. In-person workshops could be held twice a year, with 20-30 attendees each time from representative organisations in both countries.

Workshops could begin with a short plenary on funding opportunities (Horizon Europe, EuroHPC, UKRI–MUR joint calls), followed by curated thematic sessions where researchers give short presentations of their work or problems that they seek to tackle, with time for structured matchmaking and small-group discussion. Afternoon parallel tracks could focus on co-designing project ideas, with facilitators helping translate discussions into draft work packages and identifying likely call targets.

It would be useful to hold workshops prior to the application period for pump-priming funding (see below), such that it becomes a funnel for applicants. The intended outcome would be to raise awareness of research strengths in the partner country, and develop relationships for future cooperative project applications, including through the Horizon mechanism.

**Bilateral research leaders convening:**

A high-level convening could be designed explicitly to build relationships and showcase bilateral expertise and leadership potential. With a focus on convening research leaders, the event could sit within the UK–Italy Science, Tech & Innovation Dialogue, providing an opportunity for e.g. research centre directors both to meet and to support identification of strategic bilateral opportunities in a dedicated session as part of the Dialogue. This identification process could, in turn, inform the thematic selection for the targeted workshops. Alternatively, the symposium could function as a stand-alone one-day, rotating event (e.g. London or Cambridge one year, Rome or Bologna the next).

**Pump-priming funding:**

Pump-priming funding in the form of £7, 000–12, 000 seed grants could valuably be offered to build UK–Italy consortia and prepare larger bids into Horizon Europe, EuroHPC, or national calls, based on current practice where small awards fund feasibility work, partnership building, and proposal development. These micro-grants could be run jointly with Italian agencies (for example CNR or MUR), aligned with both the UK National Quantum Strategy and Italy's National Strategy for Quantum Technologies and Q-Alliance, and targeted at specific future calls (e.g. EuroHPC applications, quantum for health or energy).

The model could draw inspiration from the British Academy (BA) Horizon Europe Pump Priming Scheme (last round, 2025), funded by DSIT. Should the BA programme be continued, the Italy STN can consider either actively promoting the programme within Italy to encourage Italian co-applicants, or exploring the potential to co-fund an Italy-specific strand within the overall Scheme.

## 7.4 UK-Italy Scientific Steering Group

The forthcoming Memorandum of Understanding (MOUs) is welcomed as a mechanism to provide greater structure and awareness to the collaborative scientific relationship. The research

and technology communities also believe that a joint scientific committee could provide further structure and stability, and support activation of the MOU.

A UK–Italy joint scientific committee on AI, QT, and HPC could be established to serve as a sounding board for key joint scientific priorities and inform concrete programme design. The committee could operate under the UK–Italy Memorandum of Understanding and the new Science, Innovation and Tech Dialogue, with a specific mandate for quantum technologies, AI and high-performance computing. The committee would ideally include industry experts alongside senior and emerging research leaders. Its remit could include:

**Setting 2–3 year priority themes** (e.g. quantum for health and energy, AI-ready supercomputing, standards and security) and reviewing progress against a joint workplan at each meeting.

**Presenting updates** at key research, policy, and industry forums such as Pontignano, and raising the profile of joint research and innovation in these spaces.

**Serving as ambassadors for the bilateral scientific relationship** within their own domestic networks and in broader international research settings.

**Raising awareness of barriers to cooperation** to FCDO and other relevant bodies.

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## 7.5 A Moonshot or Challenge-based Approach

**UK-Italy "Moonshot" Programmes**

Given the level of talent and ambition in both countries, there is value in exploring novel funding models to inspire high-risk, high-potential joint UK–Italy "moonshots" in areas where there is a clear, and potentially high-value, opportunity for bilateral cooperation. The recently signed Italian state-CamGraPhICS €211 million deal demonstrates scope and appetite for first-of-a-kind, ambitious, high-value joint projects.

A "moonshot" approach—focused on identifying and supporting highly ambitious projects that tackle large-scale real-world challenges—could put the UK-Italy relationship at the forefront of developing the innovation science collaboration structures needed for the coming decades. To kick off this approach, it would be valuable to host a "moonshot" workshop to encourage the deepest thinking on the three to five opportunities most likely to bring about revolutionary change through UK-Italy leadership.

A kickoff workshop should include senior policymakers, research leaders, and industry experts and investors, with a focus on identifying the highest value areas within AI/QT/HPC where there is a UK-Italy advantage. The identified Opportunity Areas could be shared with them in advance for inspiration.

**Thematic focuses could include:**

- Quantum-enhanced AI for critical infrastructure (energy, finance, transport): co-design algorithms and architectures that combine quantum computing, quantum communication, and AI for tasks like grid optimisation, portfolio risk, or anomaly detection in infrastructure networks.
- Quantum-sensing opportunities
- AI/Quantum/Supercomputing for science
- High-risk R&D on quantum-resistant cryptography, QKD-enabled links, and AI-based monitoring tools for payments and market infrastructure (see case study box below)

Italy could contribute via NQSTI, CINECA, and Q-Alliance, potentially providing quantum and HPC hardware testbeds. In the UK, organisations such as EPCC and ARIA could play a role.

*Box 6.*

**Sample Moonshot Focus: Quantum-Secure Financial Infrastructure**

The UK and Italy have a track record of collaboration in financial market infrastructure, notably through the London Stock Exchange Group's acquisition of Borsa Italiana in 2007, which was driven in part by the desire to integrate Italian trading and post-trade technologies within a larger cross-border platform. Based on this foundation of collaborative technology-based financial innovation, a joint-challenge prize could focus on quantum-safe finance.

The technological challenge would focus on high-risk R&D on quantum-resistant cryptography, QKD-enabled links, and AI-based monitoring tools for payments and market infrastructure; with pilots potentially run between UK financial institutions and Italian counterparts (e.g. building on Banca d'Italia's work on quantum-safe payments).

The programme could pull in researchers and startups from both ecosystems, aligned with both countries' stated goals in relation to technology sovereignty and secure digital infrastructure.

*Table 6. Approximate Costings per Recommendation*

| No. | Recommendation and representative activities | 3-Year Funding Range (EUR) | Notes |
|---|---|---|---|
| 1 | Access to shared infrastructure & co-branded testbed (incl. Quantum Twin-Hub design + small joint calls) | 1,000,000 – 1,400,000 | Compute allocations, integration work, joint mini-calls and testbed operations. |
| 2 | Postgraduate & early-career mobility (short exchanges, targeted fellowships) | 200,000 – 600,000 | Travel, stipends, admin for 30-40 recipients annually; focuses on AI/QT/HPC priority topics; Level of funding may vary depending on whether tied to access to specific tools and facilities |
| 3 | Horizon preparation (workshops + biannual symposium + pump-priming seed grants) | 400,000 – 600,000 | 4 workshops; 1 symposium; c. 25–40 seed grants of 10–20k each. |
| 4 | UK–Italy Scientific Steering Group (meetings, secretariat, evaluation) | 90,000 – 160,000 | 2 meetings/year (one in person), light analytical support, communications. |
| 5 | Moonshot / challenge-based approach | 500,000 – 1,000,000 | Single flagship challenge with initial challenge identification process: prize purse and limited project support, or lean bilateral testbed/pilot; larger prize purse could be supported by private-sector participation in a public-private partnership model |

# APPENDICES

## Appendix 1: Methodology

Mixed-methods research design were employed to map the critical technology landscape and assess future pathways for UK–Italy cooperation across Artificial Intelligence (AI), Quantum Technologies (QT), and High-Performance Computing (HPC). The research was conducted in four sequential but overlapping phases, with findings from each phase informing the next.

### 1. Technology Mapping and Keyword Development

The research team developed detailed technology maps to characterise the specific value chains, components, and application areas of AI, QT, and HPC. These visual frameworks isolated specific sub-domains—such as quantum sensing modalities, HPC system integration, or AI application layers—drawing on established taxonomies including the European Quantum Flagship's pillar structure and OECD technology classification frameworks, and refined through consultation with domain experts and with FCDO. The maps guided the formulation of keyword strategies used for data extraction across the quantitative strands.

### 2. Desk Research and Literature Review

The research team conducted an extensive review of academic and grey literature in both English and Italian. This encompassed peer-reviewed publications on innovation capability and technology ecosystems; policy documents and strategy papers from relevant UK and Italian government ministries, including MUR, MIMIT, and DSIT; publications from key research infrastructures such as CINECA and ICSC; and EU-level frameworks including the Digital Europe Programme, EuroHPC regulations, and the EU AI Act.

### 3. Quantitative Landscape Analysis

To establish a quantitative baseline of the research and innovation landscape, data were extracted and analysed across two dimensions.

*Bibliometric analysis:* Publication data were retrieved from the OpenAlex database (extracted December 2025), capturing journal articles published between 2021 and 2025. The dataset was systematically filtered to isolate UK-authored, Italy-authored, and UK–Italy co-authored articles across each of the three technology domains. Given AI's status as a general-purpose technology with cross-disciplinary reach — spanning STEM, social sciences, and applied domains — keyword strategies for AI required broader scoping than those applied to the more bounded QT and HPC fields; this is reflected in the substantially larger publication volumes observed for AI relative to the other two technologies. OpenAlex's deep-learning classification models were used to identify primary research topics for each article.

*Grant analysis:* Data was retrieved from Cordis.Europa.eu. on 30.01.2026 for QT, 16.03. 2026 for HPC and AI. Grants were specifically filtered for Horizon Europe, which automatically includes projects for the period 2021-2027. No distinctions between projects that have already commenced and between the ones that are to commence have been made.

All Horizon Europe projects with at least one Italian partner (coordinator, participant, third party, etc.) were considered.

Keywords used were:

- *quantum*
- *'high performance computing' OR 'high performance computer'*
- *'artificial intelligence' OR (artificial AND intelligence)*

### 4. Qualitative Expert Interviews

Semi-structured interviews were conducted with leading stakeholders across the UK and Italian science and technology ecosystems. A snowball sampling approach was adopted for accessing senior decision-makers and institutional leaders. At least 14 interviews were conducted between November 2025 and February 2026, some involving multiple participants, reaching thematic saturation across all three technology domains. Participants spanned national research infrastructure operators, academic research leaders, technology start-ups, and industry and policy representatives, with coverage across AI, QT, and HPC.

Interviews were conducted predominantly in Italian, with some conducted in English according to participant preference. Italian-language interviews were transcribed and analysed in the original, with translation provided where material is quoted directly in the report. Participants were offered anonymisation where requested or where there was strategic value in doing so, and a number of contributions in the report are therefore unattributed.

The interview guide systematically explored national capabilities, the implications of recent policy strategies, preferred funding mechanisms, specific barriers to bilateral cooperation, and participants' assessments of the most promising areas for joint work.

### 5. Expert Roundtable

To validate preliminary findings and surface operational barriers to and priorities for cooperation, a dedicated expert roundtable was hosted in Rome on 4 February 2026, co-organised with the Science and Technology Network Italy Team at the British Embassy in Rome. The event convened around 20 research and policy participants, from Italian and UK institutions, and spanning academic research leaders, national infrastructure operators, government policy representatives, and private investment, with coverage across all three technology domains, though with a stronger representation of quantum specialists reflecting, in part, the maturity of existing networks in that field. Notes and transcriptions were recorded in real time and used to identify cross-cutting themes, validate patterns from the bibliometric and interview data, and surface operational priorities not fully captured in the quantitative analysis.

### Limitations

Several limitations should be noted. The bibliometric analysis reflects publication activity captured up to December 2025 and does not capture the full impact of more recent policy and funding developments. OpenAlex's classification of institutions introduces some aggregation effects—most notably, the University of London is recorded as a federation encompassing multiple institutions, which may affect apparent publication counts relative to standalone institutions—and users of the quantitative data should bear this in mind when interpreting organisation-level comparisons. The qualitative programme—both interviews and the roundtable—focused predominantly on senior institutional and research leaders, and may not fully represent the perspectives of early-career researchers, smaller enterprises, or regional actors outside major research centres.

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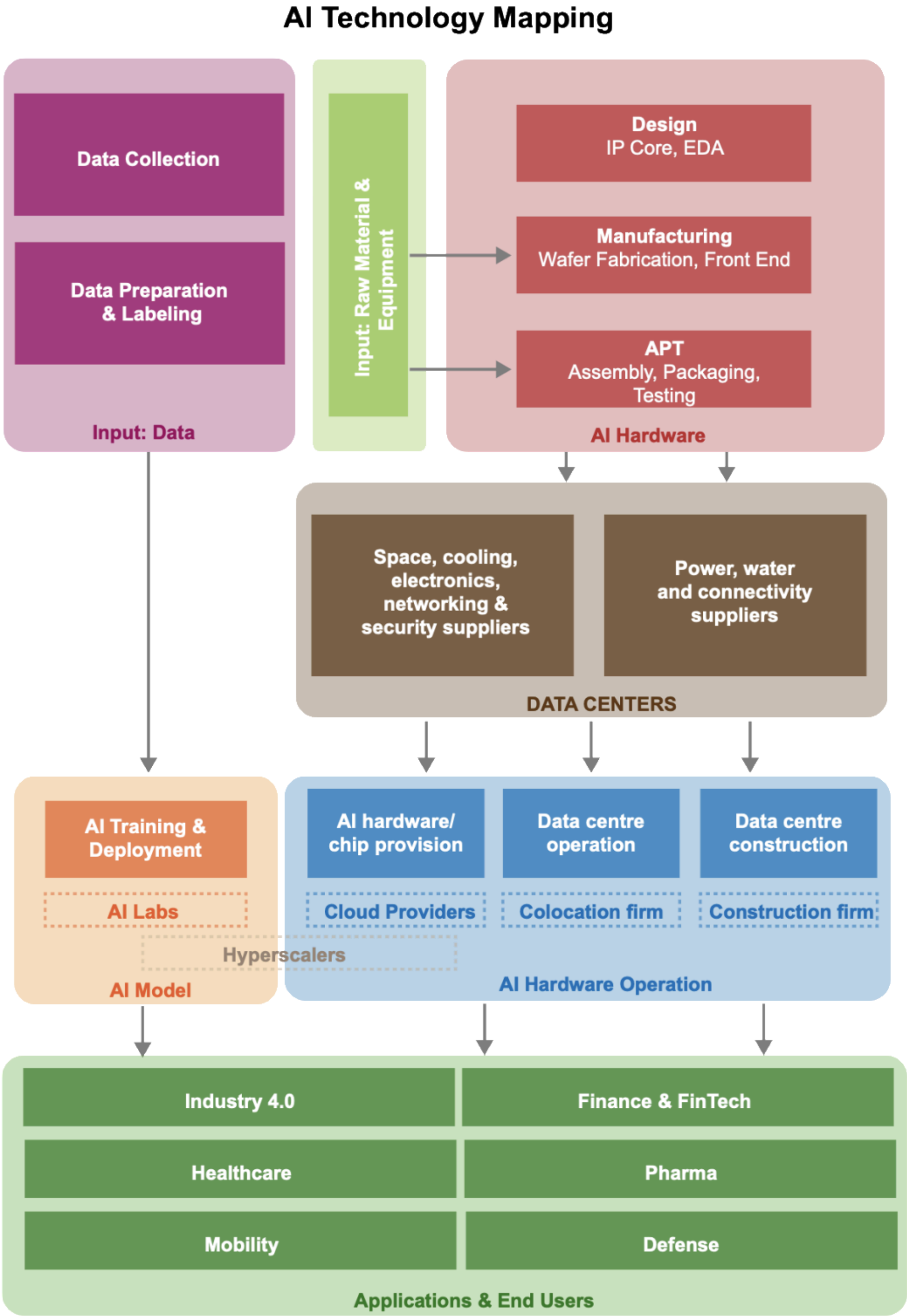
## Appendix 2. Technology Maps

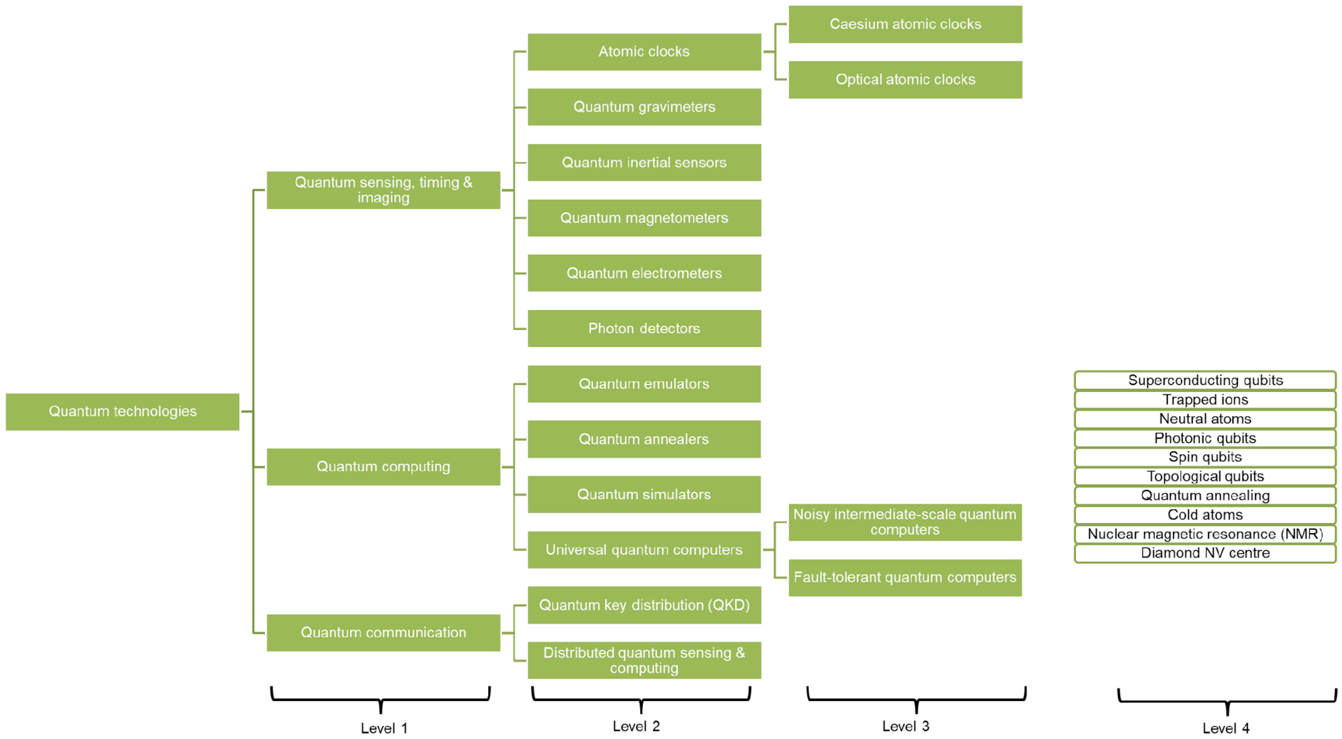
We constructed (and refined with interviewees) three 'technology maps', whose aim is to capture the different parts of the systems, both in terms of components and applications.

*Figure 12. AI Technology Map*



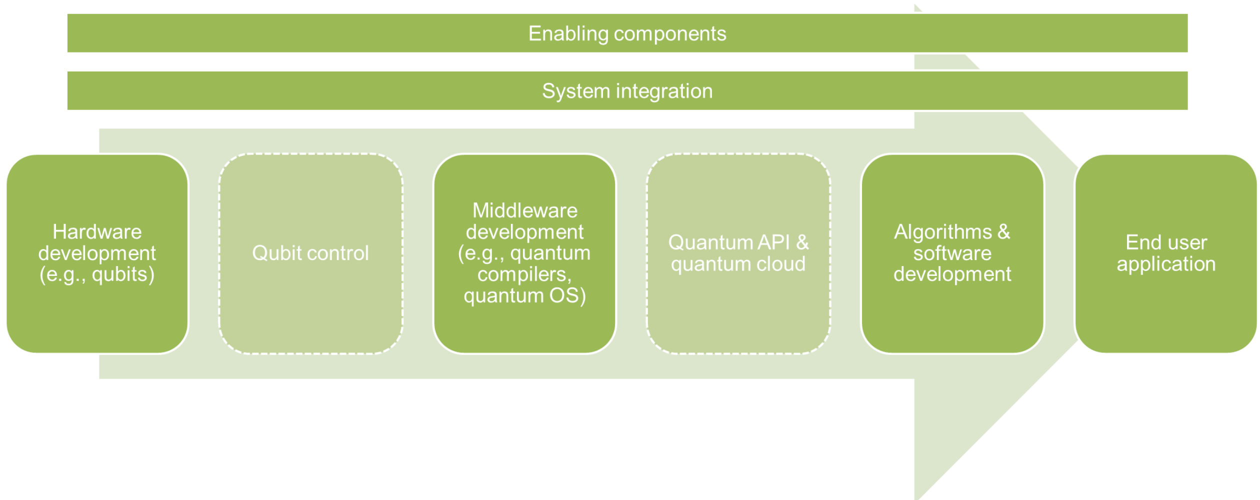

*Source: StateUp*

Figure 13. Quantum Technology Map




Source: StateUp, Data: OECD (2025); European Commission (2025); European Quantum Flagship (2024); Italian Ministry of University and Research et al. (2025).

Figure 14. Quantum Technology Map: Value chain.




Source: StateUp, Data: European Quantum Flagship (2024); Italian Ministry of University and Research et al. (2025).

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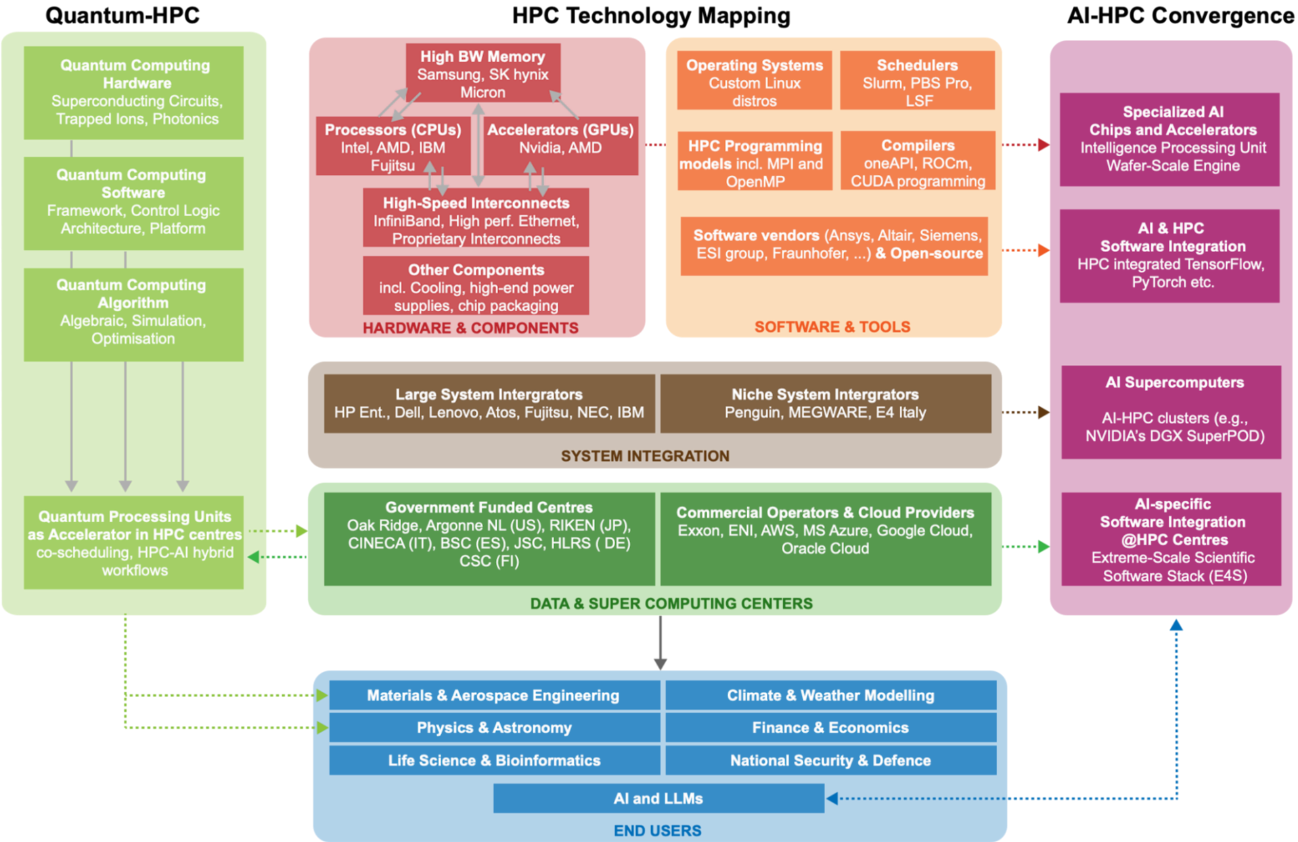
*Figure 15. HPC Technology Map*




*Source: StateUp*

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## Appendix 3: Recommendations Matrix

*UK-Italy HPC, Quantum and AI Cooperation: Recommendations, Barriers Addressed, Opportunities Unlocked*

| Recommendation | High Cost of International Fees | Broader Impact of Brexit | Lack of Formalised Collaborations | Capability / Infrastructure Gaps | Lack of Awareness of Italian Ecosystem | Sample Opportunities Unlocked |
|---|---|---|---|---|---|---|
| **Access to Shared Infrastructure** | — | Partially addresses. Re-establishes access to research infrastructure disrupted by Brexit, particularly for joint projects previously dependent on shared European facilities. | **Directly addresses.** Creates jointly governed calls, harmonised data management and security policies, and formal reciprocal access agreements — replacing ad hoc arrangements with durable institutional structures. | **Directly addresses.** Gives Italian researchers access to UK quantum testbeds and UKRI hubs; gives UK researchers access to Leonardo/CINECA. The Quantum Twin-Hub links Q-Alliance with UK facilities, helping to offset Italy's maturing fabrication capacity through shared access rather than parallel build-out. | Partially addresses. Co-branded sandboxes and joint calls expose researchers in both countries to the depth and range of the partner country's infrastructure, correcting misperceptions of relative capability. | • Defence & Security: Joint quantum-HPC testbeds can support dual-use research in encryption, sensing, and secure communications<br>• Energy Resilience: Shared HPC capacity accelerates fusion and climate modelling critical to energy transition<br>• Economic Growth: Reciprocal infrastructure access lowers entry costs for SMEs and start-ups building on national quantum/HPC platforms<br>• Knowledge Aggregation: Co-branded sandboxes create shared datasets, benchmarks, and validation protocols across both research communities |
| **Postgraduate and Early-career Mobility** | **Directly addresses.** Rebuilds mobility pathways eroded by Brexit, complements Erasmus+ return in 2027, and expands Turing-style exchanges. | **Directly addresses.** Rebuilds mobility pathways eroded by Brexit; complements the Erasmus+ return in 2027 and expands Turing-style exchanges | **Directly addresses.** Participation requirements built into all bilateral funding and support create structured, recurring | Partially addresses. Early-career researchers gain hands-on access to facilities in the partner country, supporting capability development. | Partially addresses. Student and researcher exchange is the most direct mechanism for building first-hand knowledge of each country's research | • Defence & Security: Early-career researchers embedded in partner institutions could build the trusted personal networks underpinning future |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | to fill the gap before full Erasmus+ activation. | routes for early-career exchange. | | culture, strengths, and community — including in fields where Italian excellence is underappreciated in the UK. | sensitive research collaboration<br>• Economic Growth: A pipeline of researchers with cross-border experience feeds both countries' quantum and AI industries<br>• Research Security: Joint vetting and participation requirements in bilateral programmes can embed research security norms from the earliest career stage<br>• Knowledge Aggregation: Long-term relationship building between early-career researchers creates the informal networks that sustain knowledge exchange across career stages |
| **Horizon Preparation** | — | Directly addresses. Explicitly addresses erosion of pre-Brexit research networks; builds new networks ahead of Horizon reintegration, where prior acquaintance affects application success. | Directly addresses. Pump-priming funding and the bilateral research symposium create structured, government-supported mechanisms to form and formalise consortia. | Partially addresses. Symposium thematic sessions and co-designed project ideas can surface specific capability gaps; pump-priming funding can be targeted at areas such as quantum algorithms or HPC for energy where bilateral complementarity is highest. | Directly addresses. The symposium is explicitly designed to raise awareness of research strengths in the partner country; opens with a plenary on funding opportunities. | • Economic Growth: Competitive Horizon and EuroHPC bids generate large-scale co-funded research programmes with direct commercial spillovers<br>• Energy Resilience: Pump-priming targeted at HPC for climate and energy can seed larger collaborative projects on grid modelling and fusion |

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|---|---|---|---|---|---|---|
| | | | | | | • Knowledge Aggregation: Pre-competitive consortia building creates shared intellectual frameworks and research agendas across both national communities<br>• Defence & Security: Pump-priming for quantum-enhanced security subfields can seed sensitive-but-shareable research at an early stage before larger classified programmes |
| **UK-Italy Scientific Steering Group** | — | Partially addresses. Provides institutional structure to manage ongoing challenges of the post-Brexit scientific relationship; committee remit includes raising barriers to cooperation with FCDO. | **Directly addresses.** The joint scientific committee, operating under the MOU and Science, Innovation and Tech Dialogue, provides the highest-level formal structure for the bilateral relationship; sets priority themes and a joint workplan. | Partially addresses. The committee sets 2–3 year priority themes (e.g. quantum for health and energy, AI-ready supercomputing) and can direct attention and resources to capability gaps. | **Directly addresses.** Committee members serve as ambassadors; they present at Pontignano and other forums to raise the profile of joint research. Raising awareness is an explicit part of the remit. | • Defence & Security: A standing committee with industry representation is well-placed to identify dual-use research themes and coordinate with relevant security-cleared bodies<br>• Research Security: The committee can develop and maintain shared norms and standards for research security, IP protection, and sensitive technology governance within the bilateral relationship<br>• Economic Growth: Setting strategic 2–3 year priority themes provides industry with the predictability |

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| | | | | | | needed to co-invest alongside public research programmes<br>• Knowledge Aggregation: A shared workplan with regular progress reviews creates a living record of bilateral research activity, reducing duplication and identifying synergies |
| **UK-Italy "Moonshot" Programmes** | — | Partially addresses. Trilateral and minilateral frameworks reduce dependence on bilateral EU-UK structures; ARIA's agile model sidesteps some EU regulatory constraints. | **Directly addresses.** ARIA moonshot programmes represent a novel, high-level formalisation of the bilateral relationship; a dedicated workshop to co-design programmes creates structured routes for collaboration. | Partially addresses. Moonshot design can target areas of joint high-value rationale, including domains where bilateral complementarity (UK quantum hardware + Italian HPC) offsets individual gaps. | **Directly addresses.** ARIA's profile and the novelty of UK-Italy moonshot framing raise the international visibility of the bilateral relationship and Italian research strengths. | • Defence & Security: High-risk, dual-use moonshot programmes in quantum sensing, secure communications, or AI-enabled defence could position the UK-Italy partnership at the frontier of allied science and technology cooperation<br>• Economic Growth: Successful ARIA moonshots generate IP, spin-outs, and deep-tech ecosystems with long-term industrial value in both countries<br>• Energy Resilience: Moonshots targeting fusion, grid resilience, or climate computing could accelerate timelines in areas of strategic national importance to both governments<br>• Research Security: A |

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|---|---|---|---|---|---|---|
| | | | | | | novel bilateral ARIA programme creates an opportunity to design research security and IP-sharing frameworks from scratch, setting a model for future allied science cooperation |

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