FORTIA INSIGHT
an RSK company

Evaluation of EPSRC Quantum Technology Research Hubs and Skills Investments 2014-2024

UK Research and Innovation

Final Report

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List of Abbreviations

Abbreviation	Definition
BCR	Benefit-Cost Ratio
CBA	Cost–Benefit Analysis
CDT / CDTs	Centre(s) for Doctoral Training
Co-I / Co-Is	Co-Investigator(s)
DSIT	Department for Science, Innovation and Technology
EDI	Equality, Diversity and Inclusion
EPSRC	Engineering and Physical Sciences Research Council
EU	European Union
FWCI	Field-Weighted Citation Impact
HM Treasury (HMT)	His Majesty's Treasury
ISCF	Industrial Strategy Challenge Fund
KPI / KPIs	Key Performance Indicator(s)
MoD	Ministry of Defence
NPL	National Physical Laboratory
NQCC	National Quantum Computing Centre
NQIT	UK Quantum Technology Hub: Networked Quantum Information Technologies
NQTP	National Quantum Technologies Programme
PI / PIs	Principal Investigator(s)
PRF	Partnership Resource Fund
QCaaS	Quantum Computing as a Service
QCOMMS	The EPSRC Quantum Communications Hub
QCS	EPSRC Hub in Quantum Computing and Simulation
QKD	Quantum Key Distribution
QTEC	Quantum Technology Enterprise Centre
QT	Quantum Technology
QuantIC	The UK Quantum Technology Hub in Quantum Imaging
R&D	Research and Development
ROI	Return on Investment
S&T Research Hub	UK Quantum Technology Hub for Sensors and Metrology
SIC	Standard Industrial Classification
SME	Small and Medium-sized Enterprise
STEM	Science, Technology, Engineering and Mathematics
STFC	Science and Technology Facilities Council
T&S Hubs	Training and Skills Hubs
ToC	Theory of Change
TRL	Technology Readiness Level
UK	United Kingdom
UKRI	UK Research and Innovation
US / USA	United States / United States of America

Executive Summary

Introduction

The Engineering and Physical Sciences Research Council (EPSRC) invested £300m between 2014 and 2024 in Quantum Technology (QT) Research Hubs (Research Hubs), Training and Skills Hubs (T&S Hubs), and Centres for Doctoral Training (CDTs). This evaluation assesses the impact of these investments using evidence from Fortia Insight surveys, interviews, bibliometric analysis, monitoring data, and cost–benefit analysis (CBA). Findings are structured against the evaluation questions, with an assessment of economic impact, value for money, regional effects, and the UK's international position.

The evidence demonstrates that EPSRC's QT investments have successfully established a high performing and internationally competitive research and innovation system. The investments have delivered substantial benefits to UK science and early-stage economic returns, while also laying the foundations for longer-term commercial and societal impact.

Key Findings against the Evaluation Questions

Benefits of the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs to the academic community

Conclusion: EPSRC's QT investments have transformed the UK quantum research landscape from a fragmented base into a coordinated, capability-rich and internationally competitive system. The investments have strengthened research capability, enabled high-impact outputs and enhanced the UK's global position, while also embedding a more application-oriented research culture

Research Hubs: The Research Hubs were central to consolidating UK quantum research into coordinated, large-scale programmes across multiple institutions. Fortia Insight survey evidence demonstrates the scale of this impact, with 94% of Research Hub respondents reporting strengthened academic capability and 88% reporting increased collaboration. Longitudinal bibliometric analysis found that collaboration within the Hub institutional ecosystem was associated with high citation impact. Publications involving institutions within the same Hub consortium generally performed above the national average and single-institution publications, while collaboration between institutions associated with different Hubs achieved particularly high impact. However, the longitudinal analysis found no statistically significant increase in the prevalence of either intra- or inter-Hub collaboration following the introduction of Phase 1 or the transition to Phase 2. The longitudinal analysis also did not identify evidence that the citation impact associated with collaborative publications increased following establishment of the Hubs. The findings therefore demonstrate the high impact associated with collaboration across the Hub institutional ecosystem but do not establish that the Hubs increased either the prevalence of collaboration or its citation impact.

Stakeholder evidence indicates that coordination supported alignment around shared scientific challenges, access to complementary expertise and facilities, and reduced duplication. The scale and duration of funding supported sustained investment in laboratories, equipment and experimental capability, significantly strengthening the UK's research infrastructure. The Research Hubs also enabled interdisciplinary research at scale, bringing together expertise across physics, engineering and computing. This supported progress in complex research areas and accelerated the development of demonstrators and prototypes alongside foundational science. Research supported through the Research Hubs demonstrates strong performance, with high citation impact and particularly strong performance for collaborative and industry-linked publications, reflecting the quality and relevance of UK research within global systems.

Training and Skills (T&S) Hubs: T&S Hubs played a complementary role in strengthening links between research and application. They supported translational activity, improved industry engagement and created structured pathways between academia and end users. This contributed to greater application awareness and supported movement from research towards real-world use.

Centres for Doctoral Training (CDTs): CDTs significantly expanded the UK's quantum talent base. They provided structured, interdisciplinary training aligned to both academic and industry needs, with 93% of CDT/T&S Fortia Insight survey respondents reporting strengthened capability. The cohort-based model strengthened collaboration and networks across institutions. CDTs also supported the development of hybrid skillsets and industry awareness through placements and engagement with commercial partners.

Contributions made to the UK economy, including the impact of the research, training and skills development, and collaboration

Conclusion: The EPSRC QT investments have made a substantial contribution to the UK economy by strengthening the quantum innovation ecosystem. This includes business formation, investment attraction, workforce development and early-stage commercialisation

Research Hubs: The Research Hubs provided the foundation for the UK quantum innovation system, delivering the scale and coordination required to connect research, industry and investment. This has translated into measurable economic outcomes, including:

- 33 unique spinouts generated through the Research Hubs
- £464.5m in private investment leveraged through Research Hubs
- 2,115 high-value jobs enabled, reflecting the development of a skilled, high-growth workforce

These outcomes demonstrate the ability of the research base to translate into commercial activity and innovation-led growth.

T&S Hubs: T&S Hubs played a key role in supporting commercialisation and enterprise development. They contributed to spinout formation, industry collaboration and innovation activity, while strengthening the interface between research and market application.

- 36 unique spinouts generated through the T&S Hubs
- They leveraged an additional £22.4m in private investment, further demonstrating their contribution to early-stage ecosystem development
- 229 high-value jobs enabled, reflecting the development of a skilled, high growth workforce

In addition, there were 5 spinouts who received support from both Research and T&S hubs. Therefore, the total number of spinouts is 74.

CDTs: CDTs were a primary mechanism for building the UK quantum skills pipeline. Across the investments:

- 419 PhDs and postdoctoral researchers were supported through Research Hubs
- 49 PhDs were supported through T&S Hubs
- CDTs recruited over 160 core researchers, alongside additional funded researchers

Progression outcomes are particularly strong, with:

- 93% of surveyed researchers progressing into quantum-relevant roles
- 15–20% progressing into startups or entrepreneurial activity. This represents a direct pathway from skills investment into economic impact.

Skills and workforce development: The EPSRC QT investments have created a strong pipeline of highly skilled talent aligned to industry needs. Evidence indicates this has supported both talent

retention within the UK and attraction of international expertise. However, stakeholders noted that, while doctoral-level training remains essential and is the primary mechanism within EPSRC's remit, future commercialisation and deployment will require a broader mix of capabilities, including engineering, systems integration and other practical industry-facing skills alongside quantum research expertise. Evidence on the specific level of technician provision required is limited.

Aggregate economic impact of the Quantum Technology Research Hubs and the T&S Hubs[1], and the corresponding Return on Investment, including the impact on UK Industry

Conclusion: The EPSRC QT investments have delivered a positive economic return, with monetised benefits exceeding total costs. Returns are driven primarily by innovation activity, particularly spinouts and associated employment

Total monetised benefits across the Hubs are estimated at £545.6m, against total costs of £442.8m, resulting in a combined benefit–cost ratio (BCR) of 1.23[2]. HM Treasury guidance emphasises that there are no fixed thresholds for interpreting BCRs and that value for money should not be judged on this metric alone. This is particularly important in early-stage technologies such as quantum where returns can only be seen over the long term. The positive return is driven primarily by innovation-related impacts, particularly spinout activity and associated employment and wage premiums.

- There is evidence of £464.5m of benefit to Research and Development (R&D) spinouts associated with the Research Hubs and £22.4m to spinouts linked to the T&S Hubs[3].
- Estimated wage premium benefits total £46.0m for the Research Hubs and £4.6m for the T&S Hubs, with additional wage uplift from training and skills development estimated at £3.2m and £0.9m respectively.

Patent activity linked to the investments includes 12 granted patents and 60 patent applications from the Research Hubs, and 74 patent applications from the T&S Hubs, with a combined estimated value of £3.1m after adjustments. These patent numbers are sourced from Researchfish and reflect a conservative valuation approach based on standard patent value proxies. They do not include wider commercial value generated by individual spinouts (e.g. Oxford Ionics acquisition in 2025 by a United States (US) firm for nearly £1b). As such, the Return on Investment (ROI) figure should be interpreted as a conservative estimate, as several benefit streams, particularly T&S employment data, longer-term skills impacts, wider industry adoption, and downstream ecosystem effects, are not fully captured within the monetised analysis.

Impact of not having the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs on UK science

Conclusion: Without EPSRC QT investments across research, skills and ecosystem development, aligned with a collaborative way of working, the UK would likely have had a smaller, more fragmented and less capable quantum science base, with reduced capacity to sustain coordinated, world-leading research in a rapidly advancing field. While some quantum research activity would have continued through standard funding routes, the evidence indicates that the scale, pace, and strategic coherence of the UK's progress in quantum science would have been materially diminished

[1] An ROI for CDTs is beyond the scope provided by EPSRC for this evaluation.
[2] Note – where the term 'Hubs' is used on its own (e.g. Hub-funded research/Hub-supported researchers), this is referring to the Research Hubs and T&S Hubs as a collective. Where the term EPSRC QT Investments is used, this is referring to all three investments as a collective – Research Hubs, T&S Hubs and CDTs.
[3] These estimates reflect the valuation of spinouts included within the cost-benefit analysis, recognising that data constraints limited inclusion to a subset of identified companies.

The integrated delivery model has been central to the EPSRC QT investments' success. The Research Hubs, T&S Hubs and CDTs worked most effectively as a coordinated system, with benefits emerging from the interaction of research, skills and collaboration rather than from individual components in isolation. Individually they all had a role to play, but it was the coordination and collaboration that was central to success.

Research Hubs: Stakeholders consistently reported that the **collaborative, multi-institutional research programmes** addressing shared technological challenges would have been extremely difficult to deliver through standard responsive-mode funding alone. The absence of the Research Hubs would likely have resulted in:

- **Weaker research infrastructure and experimental capacity** - the scale and duration of Research Hub funding gave universities the confidence and resources to invest in specialist laboratories, shared facilities, and high-value equipment. Without this, the UK's physical research capacity in quantum would have remained significantly more limited, constraining the scope and ambition of experimental programmes.
- **Reduced research quality and international standing** - stakeholder and wider evaluation evidence suggests that, without the coordinated research environment supported by the Research Hubs, the UK's quantum research capability and international standing would likely have been weaker. Bibliometric evidence shows that collaboration across the Hub institutional ecosystem was associated with high citation impact, although the longitudinal analysis does not establish that establishment of the Hubs itself increased citation impact.
- **Fewer cross-institutional collaborations** - stakeholders reported that the Research Hub model supported the establishment and maintenance of long-term collaborative relationships between research groups that may have been more difficult to develop or sustain through individual project funding alone. However, the longitudinal bibliometric analysis did not identify a statistically significant increase in the prevalence of institutional collaboration following establishment of the Hubs.

T&S Hubs: The T&S Hubs played a distinct and complementary role by bridging the gap between fundamental quantum research and real world application. Without them, the translational pathway from laboratory discovery to commercial and societal use would likely have been significantly weaker. Specifically:

- **Reduced industry engagement and awareness** - the T&S Hubs created structured mechanisms for industry to engage with quantum research, including collaborative projects, industry challenge events, and co-development activities. Without this bridging function, industry awareness of quantum opportunities would likely have remained lower, and the flow of knowledge between academia and the private sector would have been slower and less systematic.
- **Fewer spinouts and commercialisation opportunities** - spinout activity was a primary driver of the T&S Hubs' economic impact. Without the T&S Hubs' focus on translation and commercialisation, fewer research outputs would have progressed to the point of commercial viability, and the UK's emerging quantum startup ecosystem would likely be smaller and less mature.
- **A weaker basis for sustained public and private investment** - the T&S Hubs helped demonstrate the commercial potential of QT, building the evidence base and investor confidence that supported follow-on public funding and private venture capital.

CDTs: The CDTs were the primary mechanism through which the investments built the UK's quantum skills pipeline. Without them:

- **A smaller and less specialist quantum workforce would exist** - the CDTs trained a significant cohort of doctoral researchers with deep quantum expertise and the interdisciplinary skills needed to work across academia and industry.
- **Greater risk of talent loss overseas** - the evidence suggests a significant proportion of emerging quantum talent could have pursued opportunities in countries with better-resourced quantum programmes. The CDTs, by offering a high-quality training environment embedded within the EPSRC QT investments ecosystem, helped retain talent within the UK.
- **Weaker academic succession** - CDT graduates have since acquired academic positions, postdoctoral roles, and industry research posts that sustain the UK's long-term quantum research capacity. Without this pipeline, the UK would have fewer early-career quantum researchers, with implications for the sustainability of the research base over the next decade.

System-level effects on UK science: The absence of EPSRC QT investments would likely have resulted in a more fragmented and less coordinated national research ecosystem, with weaker alignment across institutions and reduced ability to sustain a coherent research agenda. The UK's scientific capability would likely have been less visible and less competitive internationally, with reduced capacity to build and maintain large-scale collaborations and to sustain momentum in a rapidly evolving field.

Regional growth impacts and benefits

Conclusion: The EPSRC QT investments in Research Hubs, T&S Hubs, and CDTs generated measurable regional benefits across the UK, primarily through company formation, high-skilled employment, follow-on infrastructure investment, and local ecosystem development. These benefits were strongest in locations hosting sustained Research Hub, T&S Hub or CDT activity and where existing research excellence and established industry links provided a foundation for growth

In this context, regional growth refers to the strengthening of place-based quantum ecosystems, through talent, capability, industry engagement and follow-on investment, rather than uniform economic uplift across all regions. The evidence shows regional impacts aligned to the maturity of the Hubs and CDTs. In locations with deep, long-standing research capability and sustained EPSRC QT investment, the Hubs and CDTs acted as anchor institutions for local quantum ecosystems, for example:

- **Oxford:** Research Hub linked activity supported a local quantum startup ecosystem and high-value employment. The university's investment in the Beecroft Building, a major new physics facility, was cited by stakeholders as enabled in part by the confidence created through long-term EPSRC QT investment, illustrating how sustained national investment gives institutions the confidence to co-invest at scale.
- **Bristol:** Quantum Technology Enterprise Centre (QTEC)-supported companies raised over £65m and created around 230 high-skilled jobs. This also helped secure £35m from the West of England Combined Authority to establish a QT Innovation Centre, demonstrating how national research investment can catalyse significant regional infrastructure co-investment
- **Glasgow/Edinburgh:** Research Hub activity strengthened the photonics sector in Scotland, with QuantIC - The UK Quantum Technology Hub in Quantum Imaging contributing to spinout formation, specialist jobs in quantum photonics, and the development of new facilities including the Advanced Research Centre. Stakeholders

noted that the long-term stability of EPSRC QT investment gave Scottish universities confidence to invest in quantum academics and facilities, reinforcing a regional cluster with strong links to defence, sensing, and imaging industries.

- **London:** CDTs and T&S Hubs produced a significant concentration of quantum-trained professionals, many of whom moved into industry roles, EPSRC QT investment-supported spinouts, or research positions within the capital. The investments also supported links to national measurement infrastructure through the National Physical Laboratory (NPL), where EPSRC QT investments were cited as a key enabler of major new infrastructure in quantum metrology. Sector stakeholders reported that the investments expanded NPL's role in benchmarking, testing, and assurance for QT, creating both the demand and confidence for significant capital development.

Emerging regional networks showed that EPSRC QT investment helped translate local university strengths into commercially meaningful outcomes, for example:

- **Birmingham:** the UK Quantum Technology Hub for Sensors and Metrology (S&T Research Hub) created pathways into transport and defence applications through work on resilient positioning, navigation, and underground sensing, demonstrating how targeted national investment can connect quantum capabilities to adjacent regional sector strengths.
- **Wales (Newport) and Devon (Paignton):** QLM Technology's manufacturing growth was supported by £12m in venture capital, illustrating how spinout activity supported via the EPSRC QT investments can generate high-value employment and manufacturing capability outside traditional research-intensive regions.
- **Nottingham and the Midlands:** Delta.g's scale-up in quantum sensing, supported by a £4.6m seed round, demonstrated that EPSRC QT investment could catalyse early-stage commercial activity in regions with credible but less established quantum research bases.

While the EPSRC QT investments were not designed primarily as place-based interventions, they generated meaningful and measurable regional economic benefits, and in several cases, catalysed significant additional public and private co-investment that amplified the original EPSRC funding. The evidence also shows that benefits extended beyond the traditional Golden Triangle (unlike some other emerging technologies). Emerging regional networks in Birmingham, Nottingham and Wales demonstrated that EPSRC QT investment helped translate local university strengths into commercially meaningful outcomes, including Delta.g's scale-up in quantum sensing, and QLM Technology's manufacturing growth in Newport, supported by £12m venture capital funding. Birmingham's S&T Research Hub activity created pathways into transport and defence through work on resilient positioning, navigation and underground sensing, demonstrating how targeted national investment can link adjacent sectors and strengthen regional innovation where credible local capability exists. Stakeholders emphasised that the impact of public investment is closely tied to ecosystem maturity. In their view, sustaining and reinforcing established clusters should be prioritised where critical mass exists, while targeted support is required to build capacity in emerging regions, balancing the need for concentrated research excellence with broader ecosystem development.

How does the UK compare internationally?

Conclusion: The UK is a top-tier quantum research nation with a strong and internationally competitive science base, a growing commercial ecosystem, and a well-regarded strategic framework through the National Quantum Technologies Programme (NQTP). However, the UK's position is increasingly contested. Several competitor nations, notably the US, China, and the European Union (EU), are investing at significantly greater scale in both public research funding and commercial infrastructure. While the UK currently punches above its weight relative to its investment level, sustaining this position will require continued and potentially increased commitment to maintain the momentum generated by the EPSRC QT investments.

Research strength: The UK is positioned among the leading countries globally for quantum research impact. Bibliometric analysis finds:

- The UK competes closely with the US on research quality, with period-average Field-Weighted Citation Impact (FWCI) scores of 1.85 (UK) and 1.82 (US). The UK is not consistently outperformed by any territory on this measure, despite the US and China producing significantly larger volumes of publications.
- Among peer comparators, Germany produces a higher volume of quantum publications than the UK, and Japan's output is broadly comparable. However, the UK demonstrates stronger research impact than both, as reflected in its higher FWCI and greater share of publications in top citation percentiles. Canada and Australia also perform well, but the UK's impact remains highly competitive throughout the assessment period.
- The EPSRC QT investments contributed to this strong international research standing through mechanisms and opportunities for cross-institutional collaboration, the development and upgrading of specialist laboratories and shared facilities and increased institutional confidence to co-invest in quantum infrastructure and recruit specialist talent. These system-level contributions strengthened the UK's collective research capacity and international visibility in ways that go beyond individual publication metrics.

Commercial translation and industrial ecosystem: The UK shows credible evidence of translating quantum research into commercial and end-user pathways, positioning it as one of a small number of countries with an active quantum startup ecosystem. The clearest research-to-use pathways are in applied areas such as sensing, imaging, and quantum-secure communications exemplified by companies such as Delta.g and Cerca Magnetics, and by quantum-secure communications trials with BT, Cisco, Network Rail, and Toshiba. However, the UK's commercial ecosystem remains less mature than larger, industry-led ecosystems, particularly in the US, where significantly greater volumes of venture capital and corporate R&D investment have supported a more developed quantum industry. The US hosts many of the world's most highly capitalised quantum companies, while China has pursued state-backed commercialisation at significant scale. While the UK's approach, building commercial pathways from a strong public research base, has produced promising results, many technologies supported by the EPSRC QT investments remain at prototype, demonstrator, or research-use stage. The UK's commercial performance is internationally credible but still developing relative to these larger competitors.

International collaboration and influence: The UK's NQTP has enhanced the country's standing as a credible and attractive international partner. The EPSRC QT investments supported international research collaborations and attracted overseas doctoral researchers and postdoctoral staff, contributing to the UK's reputation as a leading destination for quantum science. The UK's early strategic commitment to quantum through the NQTP also positioned it as an influential voice in international discussions on quantum standards, regulation, and research coordination. Maintaining this collaborative position will be important as QT moves closer to deployment and

international frameworks for standards, security, and supply chains become increasingly significant.

Governance, Equality, Diversity and Inclusion (EDI) and monitoring

Conclusion: The integrated delivery model, which combined research, skills and collaboration into a coherent system was a key strength. However, limitations in governance evidence, monitoring frameworks and data consistency constrain the ability to fully assess the impacts generated

In addition to the key evaluation questions above, several cross-cutting conclusions are evident:

- **Governance arrangements were important and broadly effective however there are opportunities for development.** While advisory structures supported oversight and coordination, there is little evidence on how challenge translated into specific decisions, how expertise gaps were assessed, or how governance evolved over time.
- **While there is clear evidence of EDI activity, there is limited evidence of measurable outcomes**. Inclusive practices were implemented, but no systematic tracking of representation, progression or leadership diversity was in place. There were also no female Research Hub directors across Phases 1 and 2.
- **Monitoring and data could be strengthened to support comprehensive assessment across all outcomes**. Variability in reporting and gaps in data mean that some impacts, particularly long-term, downstream and regional effects, are likely underestimated.

Caveats

The impacts detailed in this report are likely to be underestimated for three reasons:

- Employment data is based on Fortia Insight survey findings only and survey responses were not received from all beneficiaries.
- The value of new products and prototypes generated via EPSRC's QT investments is measured in terms of patents emerging from research supported by the investments. This is a very early indicator of potential commercialisation. It is too soon to consider potential longer-term benefits such as market uptake and commercialisation of new products, and these have not been considered.
- Value of research supported by EPSRC's QT investments is measured through patents and patent applications that cite Hub-supported research. These have been identified through Lens and are based on a keyword search approach. This may be an under-representation.

Recommendations

Recommendation 1: EPSRC should continue to invest in Research Hubs and skills investments as an integrated package, rather than as separate or standalone interventions

Detail: Future investment should retain the core features identified as central to programme effectiveness: long-term funding, national coordination, interdisciplinary collaboration, and strong links between research, training and application. The evidence indicates that the Research Hubs, T&S Hubs and CDTs were most effective when operating as a coordinated system. Next steps could include:

- Maintaining a nationally coordinated model convening leading capability across institutions and sub-fields.
- Embedding doctoral and researcher training within the wider research and innovation architecture.
- Sustaining mechanisms enabling cross-institutional collaboration, shared infrastructure and engagement with industry and public sector users.
- Continuing to support application-aware research alongside foundational science.

Rationale: The strongest cross-cutting finding is that programme benefits arose from the combined effect of coordinated investment across research, skills and ecosystem development. Sustaining this integrated model is therefore critical to maintaining momentum and maximising future impact.

Recommendation 2: EPSRC should further develop and sustain doctoral-level quantum training as a central pillar of the UK QT ecosystem

Detail: The evidence indicates that doctoral-level training is most effective when integrated with research, industry engagement and innovation pathways. Next steps could include:

- Sustaining and expanding doctoral-level training provision to ensure a sufficient pipeline of quantum-skilled researchers.
- Strengthening alignment between doctoral training, Research Hubs and industry to improve integration, knowledge exchange and application.
- Enhancing the industry-facing and practical components of doctoral training, including placements and applied research opportunities.
- Ensuring doctoral training programmes are responsive to evolving skills needs, including interdisciplinary and systems-level capabilities.

Rationale: The UK Quantum Skills Taskforce report suggested it is not yet clear if the commitment made in the National Quantum Strategy to fund over 1,000 PhD studentships between 2024 and 2034, will be sufficient to meet future demand, given the rapidly growing sector. It also states market analysts project that new jobs created globally in the quantum computing sector reach 250,000 by 2030, and 840,000 by 2035, with many attributed to leading quantum nations such as the US and UK. This equates to a significant increase in the number of jobs in the sector globally by 2030. Key stakeholders highlighted doctoral level training as a key mechanism to develop quantum PhD graduates and grow the UK quantum workforce and is critical to attracting, retaining and developing talent in a globally competitive field. Without continued and expanded investment, there is a risk the UK will face constraints in workforce capacity, limiting future growth and competitiveness. However, doctoral training needs to take on board the need for more commercialisation experience/expertise.

Recommendation 3: EPSRC should work with partners across the skills and innovation landscape to ensure the UK quantum workforce continues to develop the engineering, systems-integration and practical industry-facing capabilities required for commercialisation / deployment

Detail: Skills should continue as a central pillar of the EPSRC QT investments. As the sector matures, EPSRC should continue to evolve its offer within its remit and work with partners where capability needs extend beyond it. Next steps, in collaboration with others, could include:

- Continuing to strengthen the industry-facing and practical components of doctoral training, including placements, co-funded projects and exposure to end users.
- Supporting the development of engineering and systems-integration capabilities required to translate quantum research into deployable products and services.
- Retaining interdisciplinary entry routes that bring together quantum science, engineering, computing and commercial expertise.
- Ensuring training remains responsive to evolving industry needs associated with scale-up, validation, deployment and commercialisation.

Rationale: The skills model has been a major source of programme value, supporting the development of a strong pipeline of highly skilled quantum researchers and contributing to talent retention and attraction. Evidence also suggests that industry engagement, commercialisation support and applied training have helped researchers translate academic innovation into commercially relevant applications. However, stakeholders highlighted that future growth of the sector will require a broader mix of capabilities alongside doctoral-level quantum expertise, particularly engineering, systems-integration and other practical industry-facing skills associated with commercialisation, scale-up and deployment. While the evidence identifies these emerging capability needs, it does not clearly indicate the specific qualification levels required or the extent to which these fall within EPSRC's remit. As such, continued development of the skills offer will require collaboration across the wider skills and innovation landscape.

Recommendation 4: Strengthen structured pathways from research and training into commercialisation, end-user engagement and deployment

Detail: Future programme design should build on existing translational strengths while making pathways to application more explicit and better supported. EPSRC could:

- Continue to support industry-facing collaboration mechanisms.
- Retain flexibility for prototypes, demonstrators and testbeds.
- Strengthen career pathways into startups, industry and national infrastructure.
- Improve the capture of evidence on downstream adoption and wider sector impacts.

Rationale: EPSRC's QT investments have generated spinouts, investment, employment and early commercial outcomes. Strengthening pathways and evidence capture will help convert this progress into sustained and demonstrable impact.

Recommendation 5: Adopt a differentiated, place-sensitive approach to quantum investment that reflects regional ecosystem maturity

Detail: Future quantum policy should reflect differences in regional ecosystem maturity and capacity. This should maintain research excellence as the foundation of the UK quantum ecosystem, while tailoring delivery to maximise value for money. For regions with established capability and critical mass, investment should focus on reinforcing cluster effects, sustaining infrastructure and strengthening links between research, industry and investors. For emerging regions, more targeted mechanisms should build capability, including skills, translation and alignment with existing sector strengths.

Rationale: A differentiated approach is required to maximise value for money, as investment generates different outcomes depending on regional context. Where critical mass exists, continued investment reinforces clusters and supports scale-up and international competitiveness. In emerging areas, targeted interventions are needed to build capacity and enable participation in the wider ecosystem. Balancing these approaches is essential. Maintaining concentration is necessary to sustain research excellence, while complementary mechanisms enable broader ecosystem development over time. A place sensitive framework will therefore improve efficiency by aligning investment with regional capability and supporting both global excellence and wider economic benefit.

Recommendation 6: EPSRC should move beyond process-level EDI activity and introduce clearer measurement, reporting and accountability for diversity outcomes

Detail: Future requirements should emphasise measurable outcomes alongside existing inclusive practices. EPSRC should:

- Define a core set of EDI indicators.
- Require regular outcome-based reporting.
- Embed clear accountability within governance structures.
- Retain and evaluate effective inclusive practices.

Any additional monitoring requirements should be proportionate and focused on generating meaningful evidence rather than increasing administrative burden.

Rationale: The evidence shows strong activity but limited outcome visibility. Strengthening measurement and accountability will enable more effective assessment and targeted improvement.

Recommendation 7: EPSRC should retain existing governance strengths while strengthening evidence of challenge, expertise review and follow-through

Detail: EPSRC should continue with the existing structures and processes, however operate with greater clarity and traceability. EPSRC should:

- Require explicit assessment of board expertise needs.
- Strengthen recording of challenge, decisions and actions.
- Maintain effective risk oversight and coordination mechanisms.
- Clarify expectations on accountability and follow-through.

Rationale: Governance structures supported oversight and agility. However, there is little evidence of formal expertise review, consistent engagement, or clear links between challenge and strategic decisions. Targeted improvements will strengthen both programme delivery and future evaluation.

Recommendation 8: EPSRC should consider the benefits of strengthening the monitoring and evidence collection to better capture longer-term, downstream and regional impacts, against the costs and challenges of doing so. However, improved evidence collection is key to building a robust evidence base of the impacts being generated

Detail: Future monitoring should support more consistent and longitudinal assessment of a wider range of programme impacts. EPSRC should consider:

- Standardising the monitoring of employment, progression, commercial and regional outcomes;
- Strengthening evidence on adoption, procurement and sector uptake;
- Ensuring consistent reporting across investments; and
- Establishing a longitudinal evidence approach for post-programme impacts

Rationale: Strengthening monitoring will improve the ability to demonstrate value, understand system effects and inform future investment design.

1 Introduction, Background, Methodology and Evaluation Framework

1.1 Introduction

The Engineering and Physical Sciences Research Council (EPSRC) invested £300m from 2014 to 2024 in the Quantum Technology (QT) Research Hubs (Research Hubs); Training and Skills Hubs (T&S Hubs) and Centres for Doctoral Training (CDTs). UK Research and Innovation (UKRI) commissioned Fortia Insight (formerly RSM UK Consulting LLP) to evaluate the impact of the EPSRC QT investments.

1.2 EPSRC's Quantum Programme Investment 2014-2024[4]

As part of the wider National Quantum Technologies Programme (NQTP), EPSRC made three significant QT investments[5] which collectively aimed to advance QT, strengthen the UK's position in the global QT ecosystem, and deliver economic and societal benefits through innovation and workforce development.

Research Hubs

Overview: They aimed to build and connect the UK's research capability in QT, foster collaboration between academia, industry and government, develop a skilled quantum workforce, and create the conditions for the eventual commercialisation and exploitation of quantum science.

Phases:

- **Phase 1 (2014-2019)**: Focused on building capabilities in QT, including investments in postgraduate skills, research programmes, and cutting-edge equipment. For Phase 1, the following Research Hubs were funded[6]:
  - **UK Quantum Technology Hub for Quantum Communications Technologies (lead organisation: University of York):** Focused on developing secure quantum communication technologies, including Quantum Key Distribution (QKD) and quantum networks for use in Defence, Health Care, Finance and Telecommunications amongst others.
  - **UK Quantum Technology Hub for Sensors and Metrology (lead organisation: University of Birmingham):** Focused on developing deployable quantum sensors and metrology systems for highly precise measurement and imaging applications, including gravity sensing, timing, navigation, magnetic sensing and healthcare.
  - **UK Quantum Technology Hub in Quantum Enhanced Imaging (lead organisation: University of Glasgow):** Focused on developing advanced quantum-enabled imaging systems that deliver enhanced sensitivity, resolution, and information content for applications across sectors such as healthcare, security, and environmental monitoring.

[4] Specification for the Evaluation of the EPSRC QT Investments 2014 -2024; Annex A: Specification Document – Services / Supplies & Services

[5] Where 'EPSRC QT investments' is used in this report, it is referring to the investments as a whole (i.e. Research Hubs, CDTs and T&S Hubs).

[6] Note – unless referring specifically to Phase 1 delivery, the Phase 2 Hub names are used throughout the report when discussing impacts ranging from 2014-2024 (i.e. incorporating Phase 1 and Phase 2 of the Hub) for consistency and clarity.

Research Hubs

- **UK Quantum Technology Hub: NQIT - Networked Quantum Information Technologies (lead organisation: University of Oxford):** Focused on developing networked quantum information technologies, including the components, architectures and software needed for scalable quantum computing, simulation, sensing and secure communications.

- **Phase 2 (2019-2024)**: Aimed at consolidating research expertise, advancing industrial applications, generating innovation pipelines, and positioning the UK as a leader in quantum Research & Development (R&D) and commercialisation. For Phase 2, the following Research Hubs were funded:
  - **The EPSRC Quantum Communications Hub (QCOMMS) (lead organisation: University of York):** Phase 2 built on work completed in Phase 1 by the UK Quantum Technology Hub for Quantum Communications Technologies around developing secure quantum communication technologies by placing greater emphasis on network extension, real-world deployment, user engagement and stronger industry collaboration.
  - **UK National Quantum Technology Hub for Sensors and Timing (S&T Research Hub) (lead organisation: University of Birmingham):** Built on the work of the UK Quantum Technology Hub for Sensors and Metrology in Phase 1 by focusing on developing quantum sensors for applications in gravity, time, and magnetic field measurements. These technologies have potential uses in navigation, civil engineering, and medical diagnostics.
  - **QuantIC - The UK Quantum Technology Hub in Quantum Imaging (lead organisation: University of Glasgow):** Continued the work of the UK Quantum Technology Hub in Quantum Enhanced Imaging in Phase 1 work by developing advanced quantum-enabled imaging systems and enhanced focus on industry demonstrators, real-world application testing and commercialisation.
  - **EPSRC Hub in Quantum Computing and Simulation (QCS Hub) (lead organisation: University of Oxford):** Built on the work of NQIT in Phase 1 by focusing on developing scalable quantum computing systems and simulators by exploring architectures for quantum processors and their integration into networks.
- **Phase 3 (from December 2024):** Though not part of this evaluation, Phase 3 of the Research Hubs coincided with a re-structuring of the Research Hub delivery model, increasing the number of Research Hubs from 4 to 5 in alignment with the National Quantum Strategy Missions introduced in 2023[7].

T&S Hubs in Quantum Systems Engineering

Overview: Launched in 2016 with £15m funding, this investment aimed to develop high-level skills in quantum systems engineering through training, mobility, and career development. The Hubs placed strong emphasis on recruiting engineers from disciplines beyond quantum.

Key Initiatives:

- **Quantum Technology Enterprise Centre (QTEC) (University of Bristol):** Focused on training entrepreneurial quantum engineers.
- **InQuBATE (University College London):** Focused on developing engineers capable of working with quantum devices at a systems level and fostering understanding of quantum opportunities within industry.

[7] National Quantum Strategy Missions - GOV.UK

T&S Hubs in Quantum Systems Engineering

- **Imperial Centre for Quantum Engineering, Science and Technology (Imperial College London):** Focused on preparing graduates with skills in quantum engineering, systems design, and public engagement.

Duration: Single-phase programme (2016–2022).

Centres for Doctoral Training (CDTs)

Overview: EPSRC invested £14m in three CDTs in 2013 to fund five years of doctoral training in QT. A second round of CDTs was launched in 2018 with £8.5m funding.

Objectives[8]:

- Training future leaders: Equip students with interdisciplinary expertise to excel in quantum academia and industry.
- Foster collaborations with academia, industry, and international partners via co-funded projects, placements and expert engagement.
- Drive innovation by delivering cutting-edge training to advance quantum research and technology development.
- Promote quantum awareness and policy influence through impactful outreach.

Key Centres:

- **University College London (Delivering Quantum Technologies):** Focused on training leaders for the intersection of quantum physics and engineering.
- **University of Bristol (Quantum Engineering):** Focused on photonic QT and practical device development.
- **Imperial College London (Controlled Quantum Dynamics):** Conducted experimental and theoretical projects on quantum systems.

Phase 3 (announced in March 2024): While not part of this evaluation, Phase 3 of the QT CDTs was announced in March 2024, increasing the number of QT CDTs to 5 as part of UKRI's wider £1b investment in CDTs across disciplines[9].

1.3 Need / Rationale for EPSRC quantum investments (2014-2024)

The investments aimed to address several challenges within the quantum ecosystem, including:

- **The need to improve knowledge translation from QT research to market benefit:** the knowledge generated from QT research was viewed as non-excludable and non-rivalrous, meaning private firms could not fully capture the returns on their investment. This led to increased potential for underinvestment by the private sector in foundational research, as firms cannot prevent others from benefiting from their discoveries. How the investment intended to address this: by funding collaborative academic Hubs that generate widely shared knowledge, support open dissemination, and encourage industry engagement in specific QT-related projects and spinouts.
- **The need to address commercial blockers within the QT ecosystem:** in 2013, QT was an emerging field with high technical uncertainty and long development timelines. This discouraged private investment and made it harder for firms to secure financing. How the investments intended to address this: by publicly funding early-stage quantum

[8] 2014 EPSRC Centres for Doctoral Training (Quantum) Mid-Term Reviews (shared with RSM – January 2025)

[9] £1 billion doctoral training investment announced – UKRI

research, reducing financial risk for private firms, and fostering collaboration and oversight to guide innovation in a high-uncertainty environment.

- **The need to address coordination failures:** effective QT development required collaboration across academia, industry, and government. As a result, public intervention was viewed as necessary to reduce risk of fragmentation of efforts and duplication of research. Without intervention, there would likely have been a reduction in overall efficiency and progress. How the investments intended to address this: via appointing dedicated engagement teams and flexible funding e.g. Partnership Resource Fund (PRF), enabling joint projects, spinouts, and strategic dialogue that aligns research with real-world applications and policy needs.
- **The need to address skills and infrastructure gaps:** The private sector alone was unlikely to invest in the large-scale infrastructure and long-term skills development needed to support a QT ecosystem. This had potential to result in bottlenecks in talent and facilities, hindering the growth of a robust QT industry. How the investments intended to address this: by funding PhDs, Postdoctoral Research Associates, and delivering training programmes across the investments. Also supporting and coordinating key infrastructure and facility development and expanding the network of institutions with quantum expertise beyond the traditional 'golden triangle' area of the UK[10].
- **The need to mitigate against first-mover disadvantage and manage international competition:** the UK faces intense global competition from countries making large-scale investments in QT (e.g. US, China, Canada, Germany and Japan). Without sustained public investment, the UK risked losing its early lead and most talented researchers, and domestic firms may have been outcompeted by better-funded international rivals. How the investments intended to address this: by establishing long-term, large-scale investments to strengthen the UK's position as an early leader to enable sustained capability development, attract and retain global talent and investment, and signal strong government commitment[11].

These challenges in 2013 initiated EPSRC's QT investments, which commenced with Phase 1 of the Research Hubs – from 2014-2019. Following Phase 1[12], Phase 2 of the Research Hubs (2019-2024); the T&S Hubs (2016-2022); and the QT-relevant CDTs (Phase 1: 2014-2019; Phase 2: 2019-2023[13]) were delivered within the 10-year time period to sustain and strengthen the UK's QT research base[14].

1.4 How the investments aligned with the wider NQTP

The Research Hubs provided an entry point for companies in the emerging QT markets. Through co-creation and co-location spaces, the Research Hubs supported quantum spinouts and startups, providing expertise and facilities for early-stage prototype developments. The Hub investments aligned with or complemented other key supports within the UK quantum ecosystem, as detailed in table 1.

[10] This includes support and coordination provided for Hubs and key infrastructure such as the national cryogenic facility
[11] 2014 EPSRC Centres for Doctoral Training (Quantum) Mid-Term Reviews (shared with RSM – January 2025)
[12] Department for Business, Energy and Industrial Strategy (2019) Business Case for Quantum Technologies Research Hubs
[13] Note – this timeline refers to the period where funding started to the final student intake.
[14] Department for Business, Energy and Industrial Strategy (2019) 'Business Case for Quantum Technologies Research Hubs

Table 1: How the investments fit – and collaborated – with other support mechanisms in the UK quantum ecosystem

Support mechanisms	Purpose	Alignment with EPSRC QT investments[15]
Innovate UK Industrial Strategy Challenge Fund (ISCF) for QT	Introduced in 2019, the quantum-specific challenge funding was introduced with the aim of supporting commercialisation of quantum-enabled products via overcoming technological barriers and strengthening the domestic supply chain[16].	▪ The impact evaluation of the ISCF QT programme highlighted that ISCF projects provided a route for translating outputs from the EPSRC-funded Research Hubs[17] ▪ The EPSRC Hubs served as "a key focal point for collaborations," while the ISCF QT expanded networks beyond existing partners and strengthened the scale and intensity of engagement with industry.
National Quantum Computing Centre (NQCC)	Announced in 2018 and launched in 2020 via the NQTP the NQCC was established to accelerate the development and adoption of quantum computing in the UK; provide a testbed for quantum computing and support broader initiatives around collaboration and international excellence[18].	▪ The QCS Hub played a key role in the development of the NQCC. In Phase 1, NQIT (the Hub's predecessor) identified the need for a facility to address the scaling, validation, and benchmarking challenges of quantum computing. ▪ The Research Hubs provided early-stage research, infrastructure and talent that informed NQCC's mission and have collaborated with the NQCC on testbeds, training and responsible innovation.
National Physical Laboratory (NPL) Quantum Programme	The NPL Quantum Programme provides independent test and evaluation, standards, and measurement expertise to accelerate the development and commercialisation of QT[19].	▪ NPL collaborated closely with the Research Hubs through secondments, advisory roles, and joint projects, and has become a formal delivery partner in Phase 3 to support benchmarking and standardisation efforts by providing access to infrastructure and capabilities inaccessible via other routes. The Research Hubs, in turn, enabled NPL to engage deeply with academic and industrial partners.
Innovate UK Quantum Catalyst Fund	Supported via Innovate UK and the Department for Science, Innovation and Technology (DSIT) and delivered as a Small Business Research Initiative competition, the fund aimed to accelerate the adoption of QT in the public sector via production of feasibility studies and prototype development.	▪ The Catalyst Fund has a higher Technology Readiness Level (TRL) focus than the Research Hubs, providing a mechanism for deployment and validation. Together, they form a pipeline from academic research to societal impact.

[15] Based on stakeholder consultations and review of programme documents
[16] New £153 million programme to commercialise UK's quantum tech - GOV.UK
[17] Technopolis (2025) Impact Evaluation of ISCF Commercialising Quantum Technologies
[18] New funding puts UK at the forefront of cutting edge QT - GOV.UK
[19] The NPL Quantum Programme - NPL

Collectively, the EPSRC QT investments operated as an interconnected package within the wider NQTP. The Research Hubs focused on translating fundamental research into practical applications and fostered industry collaboration, while the T&S Hubs and CDTs focused on development of the skilled workforce and entrepreneurial talent needed to sustain the emerging QT sector. These were complemented by the NQCC (quantum computing infrastructure and benchmarking), NPL (test and evaluation, standards and measurement), the ISCF (industry-led commercialisation), and the Quantum Catalyst Fund (public sector deployment at higher TRLs). Together, these mechanisms formed a pipeline from foundational research and skills development through to commercialisation and public sector adoption.

1.5 Evaluation Aims

The purpose of the evaluation is to understand the benefit of the EPSRC major QT investments and the benefits to the overall UK quantum landscape. The evaluation also assesses the value for money and includes two ROI figures for the Research Hubs and T&S Hubs, as well as an overall ROI figure for the EPSRC QT investments. As the UK is the first country to have a national quantum-focused programme and coordinated Hubs and CDTs focused on QT, the evaluation also provides an overview of the international standing and reputation of the UK's QT sector. It also identifies the regional impacts of the investments to add a place-based aspect.

1.6 Format of this report

This report is structured as follows:

- Section 2: Evaluation Overview
- Section 3: Context
- Section 4: Evaluation Questions – Key Findings
- Section 5: Conclusions and Recommendations

2 Evaluation Overview

2.1 Purpose

This section sets out the evaluation questions and explains how the methodology has produced evidence to deliver on these.

2.2 Evaluation questions

The evaluation questions were agreed with EPSRC and the Evaluation Steering Board and are detailed below:

The overarching questions for the evaluation are:

1. The benefits of the Quantum Technology Research Hubs, T&S Hubs and quantum-relevant CDTs to the academic community, as well as the benefits to the international competitiveness of UK science.
2. The contributions that the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs make to the UK economy, including the impact of the research, training and skills development, and collaboration.
3. The aggregate economic impact of the Quantum Technology Research Hubs and T&S Hubs and the corresponding Return on Investment, including the impact on UK Industry.
4. The likely impact of not having the Quantum Technology Research Hubs, T&S Hubs and quantum-relevant CDTs on UK science.
5. How have these investments supported regional growth or provided benefits to particular parts of the UK?
6. How does the UK compare internationally?

The detailed / sub-questions for the evaluation are:

Economic Impact – what has the overall economic impact of EPSRC funded Quantum Technology research been?

- What is the ROI figure from EPSRC's investments in the hubs, considering all the expected impacts of the investments (e.g. research, training and skills, and wider impacts)?
- What is the effect of the hubs and CDTs on leverage and further funding (both public and private)?
- What is the effect of the hubs and CDTs on enabling high-value jobs, both nationally and within the Hubs regions?
- What is the impact of supporting innovations, including new products/processes, patents and spinouts arising from the hubs and CDTs?

Research Impact – what has the impact of research in quantum been?

- What are the demonstrable strengths in EPSRC funded quantum research?
- What is the impact of the hubs and CDTs on different disciplines and sectors (type of research and problem solving in different areas)?
- What has the impact been on enabling growth of new areas of research?

Training and Skills Impact - To what extent has the programme been successful in increasing UK capability?

- To what extent has the programme attracted high calibre individuals?

- To what extent has the programme enabled diversity in QTs research?
- To what extent has the programme contributed to high end skills in public, private and third sectors?
- To what extent has the programme contributed to the aim of achieving a vibrant diverse academic and skills base in QT throughout the UK, for example through staff employed and students

Wider Impact - What is the impact, or potential impact, of the hubs and CDTs on health, society and environment?

- What is the international standing of the UK's QTs?
- What are the regional and wider place-focused impacts of the hubs and CDTs?
- How has the critical mass investment of Hubs and CDTs influenced the UK's Quantum Technology landscape and other large investments in relevant sectors?
- How has the governance of the UK's QT programme through NQTP and advisory structure enabled agility of research and projects as the quantum landscape evolved both domestically and globally?

The findings in this report are structured under the six overarching evaluation questions based on the evidence against each sub question. To note:

- Several sub-questions (particularly those on skills, governance and system-level effects) contribute evidence to more than one overarching question; however, their evidence is grouped under their primary analytical focus.
- The counterfactual question (i.e. question 4 of the overarching questions) is not directly linked to a standalone sub-question and therefore relies on contribution-based assessment drawing on findings across the other overarching questions.

2.3 Methodology

The methodology involved the following components during 2025 and 2026:

Theory of Change (ToC) development: The scoping phase of the evaluation has led to the development of three nested ToCs; one for each of the three EPSRC QT investments, and an overall programme level ToC. The nested ToCs have been constructed 'bottom up' by gathering information and evidence through a review of available programme documents and wider relevant documents including Innovate UK, DSIT, Office for Quantum, Department for Business, Energy and Industrial Strategy reports to provide insights on the innovation ecosystem and how quantum investments are expected to contribute to industry growth. This was supplemented by 9 scoping interviews with stakeholders across the three investment areas to test the draft ToCs and gather additional information and perspectives missing from reviewed documents.

Fieldwork: Qualitative interviews and quantitative Fortia Insight surveys were used to collect data and feedback on performance, and explore qualitative outcomes, impacts, and test contribution claims from the Research Hubs, T&S Hubs, and the CDTs.

- During April - June 2025 – 15 in-depth interviews were conducted with key stakeholders, including:
  - 4 interviews with Phase 2 Research Hub staff.
  - 6 interviews with Principal Investigators (PIs) and Co-Investigators (Co-Is).
  - 5 interviews with Industry / Public Sector Partners.

- During February 2026 – 39 in-depth interviews were conducted with key stakeholders, including:
  - 9 interviews with QT Experts.
  - 13 interviews with Wider Sector Stakeholders.
  - 8 interviews with T&S Hub and CDT Academic Staff.
  - 9 interviews with CDT Students and Researchers.
- Two targeted Fortia Insight surveys were also administered during May 2025: One to Research Hubs (Phases 1 and 2), yielding 52 responses (24% response rate) from stakeholders including Research Hub delivery staff, PIs, Co-Is, supported researchers, and industry partners. The second Fortia Insight survey was issued to stakeholders including programme supervisors, coordinators, doctoral students / graduates, and grant holders from the T&S Hubs and CDTs, with 16 responses (23% response rate).

Case study development: For the interim report, 5 case studies were developed using a blend of primary and secondary data to illustrate the impacts and mechanisms of success across diverse QT projects. Case study selection was informed by a comprehensive review and ranking of projects funded across Research Hubs, T&S Hubs, and CDTs, based on criteria such as commercialisation impact, spinouts, funding raised, and awards. Selected case studies were:

- Gas sensing without detection – QuantIC.
- Entanglement networks applied to the UK Quantum Network – QCOMMS.
- Quantum sensor for gravity gradiometry – S&T Research Hub.
- KETS Quantum – QTEC T&S Hub.
- Centre for Doctoral Training in Quantum Engineering (QE-CDT).

For the final report a further 12 case studies were developed to collect evidence of key impacts in areas such as scientific breakthroughs; economy / society / regional impacts and career development. The case studies are listed below and detailed in full within section 6 of the appendices report):

- The Career Journeys of Ross Donaldson & Aurora Maccarone – Developing Future Leaders in Quantum *(QCOMMS and QuantIC)*
- Dr Sarah Croke – Building the Quantum Workforce *(QCS Hub)*
- Scottish Quantum Corridor: QuantIC-led cluster building and place-based impact *(QuantIC)*
- Delta.g: from quantum gravity research to field deployment for safer, faster underground insight *(S&T Research Hub)*
- Siloton: from quantum training to portable eye imaging (EPSRC Quantum Engineering CDT and QTEC)
- QLM Technology: from Research Hub support to commercial methane emissions monitoring *(QTEC and QuantIC)*
- Cerca Magnetics: From EPSRC Hub Research to Wearable, Mobile Quantum Brain Imaging *(S&T Research Hub)*
- Phasecraft: Leveraging EPSRC-funded Ecosystem to Accelerate Quantum Computing Innovation *(InQuBATE and Delivering Quantum Technologies CDT)*
- Matter-Waves at Sea: Deploying Quantum Sensors in Extreme Maritime Environments *(S&T Research Hub)*
- Widening Access to Quantum – Enabling Diversity and Empowering Minority Voices *(QTEC)*

- Cross-Hub Collaboration: How the UK's Research Hubs Built a Globally Recognised Showcase for Quantum Innovation *(all Research Hubs)*
- Researcher development: how the QCS Hub supported the careers of Chris Ballance and Josh Nunn *(QCS Hub)*

International comparator analysis: To evaluate the UK's international standing in the QT sector, we conducted a global comparator analysis using a three-stage approach. This included:

- A rapid literature review to benchmark the UK against global leaders using both grey literature and academic articles.
- Bibliometric analyses of QT research, including the original international analysis completed in 2025, updated in March 2026, and an October 2026 longitudinal analysis, completed by Prof. James Millen from King's College London.
- Benchmarking the UK against selected comparator countries to identify areas of strength and opportunities for improvement. Comparator countries were selected based on the availability of information, similarity to the UK's quantum landscape, position in the global quantum ecosystem, strategic investment levels, and the presence of defined quantum targets or Key Performance Indicators (KPIs). Based on this assessment, Germany, the US, the Netherlands, Canada, and Japan were identified as key comparator nations in consultation and agreement with EPSRC and the Steering Board

Contribution analysis: Four contribution claims were agreed to test the causal pathways to the key impacts. The contribution claims include both a causal hypothesis of how the investments contributed to observed impacts, and alternative explanations of how these impacts may have occurred. Using the interviews, case studies, and Fortia Insight surveys, the following contributions claims were tested to develop a robust contribution narrative of how the package of investments led to impacts:

- **Contribution Claim 1:** EPSRC's QT investments have enabled more and faster commercialisation of QT than would have occurred otherwise.
- **Contribution Claim 2:** EPSRC's QT investments have contributed substantially to a better resourced and equipped quantum sector in the UK than would have occurred otherwise.
- **Contribution Claim 3:** EPSRC's QT investments have led to greater adoption of QT within the UK than would have occurred otherwise.
- **Contribution Claim 4:** EPSRC's QT investments have enabled the UK to maintain its position as a global leader in quantum more successfully than would have occurred otherwise.

These contribution claims were tested through process tracing tests, which can be used to assess the qualitative strength of the evidence and the extent to which the specific support provided by EPSRC contributes to the impacts. These are: Smoking Gun (confirmatory); Hoop Test (disconfirmatory); Doubly Decisive (both confirmatory and disconfirmatory); and Straw-in-the-Wind (neither confirmatory nor disconfirmatory)[20]. Collectively, these identify whether the causal mechanisms described in the contribution claims are sufficient and/or necessary to explain the outcomes.

4Es assessment: A qualitative assessment covering Economy, Efficiency, Effectiveness, and Equity. A detailed rubric is in section 4 of the appendices report and the summary scoring is:

- Excellent**:** Clear and robust evidence of impact in several areas.

[20] A more detailed breakdown of these process tracing tests can be found here - Process tracing | Better Evaluation

- Very good: Robust evidence of impact; minor improvements possible.
- Good: Some/moderate evidence of impact; some improvements needed.
- Fair: Limited evidence of impact, significant improvement needed.
- Poor: No evidence of impact; major improvements required.

The 4Es assessment is underpinned by evidence from interviews, Fortia Insight surveys and secondary data (for the EPSRC QT investments). Evidence is linked to specific initiatives where this is possible. Some beneficiaries and stakeholders interviewed have affiliation to more than one initiative.

Cost and benefit assessment: Includes estimations of the economic benefits generated by the QT Research Hubs and the T&S Hubs. This analysis covers both Phase 1 and Phase 2 of the investments. The assessment draws on available data (survey data, Beauhurst, Researchfish, and Hub annual reports) to estimate aggregate outcomes and impacts, with a focus on the key drivers of economic benefit. All estimates are presented in real terms and have been adjusted for inflation and optimism bias to ensure conservative and robust results.[21] Assumptions for attribution and displacement of benefits are presented alongside estimates. Attribution is the extent to which observed outcomes can be causally linked to the intervention, rather than to other external factors. Displacement is the extent to which the benefits of an intervention are offset by reductions in activity elsewhere in the economy, reducing the intervention's net impact. Benefits are assessed in relation to five benefit areas: employment, private investment, the number and value of new quantum products, the commercial use of academic research, and wage uplift. Due to incomplete datasets and data reporting, not all benefit categories are included in the T&S assessment. The following table presents the benefit estimations used in the analysis, the time horizons across which estimated benefits are accrued and data sources. As the Investments have differing start and end dates, benefit accrual periods vary accordingly:

- Research Hubs: Benefits are accrued up to 2024/25, unless otherwise specified.
- T&S Hubs: Benefits are accrued up to 2022/23, unless otherwise specified.

Where relevant, benefit projections are extended to 2030/31 to capture longer-term impacts that continue beyond the formal funding period.

Table 2: Overview of benefit estimations and data sources

Benefit estimation	Research Hubs Years accrued over (projected over)	Data source	T&S Hubs Years accrued over (projected over)	Data source
Employment - Wage premium due to employment generated by the Hubs	2014-2024	Fortia Insight Survey to Research Hub stakeholders	2016-2022	T&S Hub reports**

[21] A 10% optimism bias is assumed in estimations. As per Green Book Guidance, all costs and benefits are adjusted using HMT Gross Domestic Product Deflators to account for inflation. The last full financial year 2024/25 is considered as the base year for the model. Please note that time discounting is not modelled. The Green Book recommends that benefits be discounted at 3.5% for Cost–Benefit Appraisals. However, this model provides a Cost–Benefit Analysis of benefits arising from an investment decision that has already been made. Consequently, the Green Book does not require the application of discounting in this context. In addition, all benefits and extrapolations are expressed in 2024 prices.

Benefit estimation	Research Hubs Years accrued over (projected over)	Data source	T&S Hubs Years accrued over (projected over)	Data source
Private investment leveraged by Research Hub and T&S Hub supported spinouts	2014-2025 (projected to 2030/31)	Beauhurst	2016-2022 (projected to 2030/31)	Beauhurst
New products and prototypes: Granted patents that can be linked to the EPSRC QT investments	2014-2024 (projected to 2030/31)	Researchfish and literature	-	[Data gap]
New products and prototypes: Patent applications that can be linked to the EPSRC QT investments	2014-2025 (projected to 2030/31)	Researchfish and literature	2016-2022 (projected to 2030/31)	Consultation with QTEC Hub leads***
Commercial use of academic research: Value of granted patents and patent applications that cite research papers linked to Research Hub-funded research	2014-2025 (projected to 2030/31)	Lens*	-	[Data gap]
Wage uplift for students from training and skill building programmes offered by the EPSRC QT investments	Not identified - Uplift is assumed for 10 years	Research Hub Reports	2016-2022 Uplift is assumed for 10 years	T&S Hub reports

Note: *Lens analysis considers patents and patent applications filed in the UK patent office or patents where the UK is part of the simple family that have cited journal articles where: i) One or more authors are affiliated with the EPSRC QT investments, OR ii) Publication acknowledges contribution of the Research Hubs in the Simple Family Member Jurisdictions. ** In the absence of Researchfish data, the estimations rely on employment figures from update reports by T&S Hubs. *** Monetised based on consultation with QTEC Hub leads, which revealed that 74 patent applications were filed which could be linked to QTEC Hub support.

2.4 Methodological challenges and limitations

The following challenges and limitations were experienced during the application of the methodologies for the interim and final reports:

Analysis of performance was limited due to several reasons:

- Lack of a standardised monitoring framework to capture progress across the investments.
- Many of the business case or proposal objectives lacked specificity or measurable indicators (e.g. Specific, Measurable, Achievable, Relevant, and Time-bound (SMART) targets).
- No specific objectives for both the Phase 1 Research Hubs and CDTs, making performance assessment unfeasible for that period.
- No tracking data on spinouts by each individual Research Hub, or on the number of trainees, PhDs, and subsequent career pathways of those supported through the T&S Hubs and CDTs. The S&T Research Hub was the only Research Hub to include

timeframes in its objectives. As a result, assessments rely heavily on narrative based annual reports, which varied in structure and depth.

Limited ability to assess longer-term ToC impacts: While the investments have been in place since 2014, impacts require widespread adoption / integration of QT within mainstream society which – as highlighted in government research[22] – has not yet been achieved (anywhere in the world). As such, the evaluation focuses on early progress towards these impacts to account for their long-term nature.

Response rates to Fortia Insight surveys: For both the Research Hub and CDT/T&S Hub Fortia Insight surveys responses were 24% and 23% respectively against targets of 30% for both. Engagement was encouraged through EPSRC, Hub leads and PIs, supported by reminder emails and clear messaging on the importance of the Fortia Insight survey.
Some key economic estimates, such as employment impacts and wage premiums, rely on primary survey data from the Fortia Insight surveys: These are subject to response bias and limited coverage, which may affect the replicability and robustness of the analysis and the accurate reflection of certain monetised benefits with respect to value for money.

The full commercial value of research supported, and the estimated intellectual property generated by the investments are likely to be underestimated: The value of Research and T&S Hub-supported research is measured through patents and patent applications that cite Research and T&S Hub-funded publications. This is a conservative proxy. Hub-funded publications were identified in Lens through a keyword search and not all Research and T&S Hub-funded publications and linked patents may have been identified, and the overall approach does not enable capturing the full extent of (current and future) downstream commercial use. Furthermore, the value of new products and prototypes linked to Research and T&S Hub-supported research is measured through the number of granted patents and patent applications filed by Research and T&S Hub-supported researchers. While this is an early indicator of potential commercialisation, it does not account for longer-term benefits such as market uptake, licensing revenues, or the strategic value of IP portfolios in high-growth quantum firms.

Several expected benefits of the investments: Particularly from commercialisation, skills development, and wider sector impacts - are likely to emerge beyond the 2014–2024 appraisal window, leading to potential underestimation of long-term value - meaning the current ROI (ranging from 1.23 to 1.29:1) is a conservative estimate. Future evaluations should extend the timeframe and improve data collection on revenues, supply chain impacts, skills outcomes, and international positioning, as current evidence is limited by the early stage of commercialisation and lack of longitudinal tracking.

Longitudinal bibliometric analysis of Hub collaboration: Assessing whether the Research Hubs changed institutional collaboration required comparison with a pre-Hub comparison period (2010–2014). As Researchfish does not cover this period, the analysis considers QT-remit publications and collaborations produced by institutions that were members of the Research Hubs, rather than only publications directly attributed to Hub funding. Consequently, the analysis measures changes in collaboration across the wider Hub institutional ecosystem and cannot isolate the causal effect of Hub funding on individual publications. Membership of multiple Hubs also creates some ambiguity in distinguishing intra- from inter-Hub collaboration. These limitations mean that the analysis is most appropriately used to assess whether collaboration patterns changed following establishment of the Hubs, rather than to attribute individual collaborations directly to Hub support.

[22] UK Quantum Skills Taskforce report - GOV.UK

3 Context

3.1 Purpose

This section details how the context within which UK QTs operate has changed since 2014 and how this may shape future QT Policy.

3.2 Quantum Technology Context: Pre-2014

Before 2014, QTs were largely confined to academic and laboratory settings. While rooted in quantum physics, the field already drew on contributions from a range of disciplines including engineering, mathematics, photonics and computer science though these efforts remained largely siloed and lacked coordination. The global landscape was characterised by fragmented, low-TRL research efforts, with minimal commercialisation and no coordinated national strategies except for a handful of early pilots. Key features included:

- **Research:** Highly academic, dominated by small physics groups.
- **Commercialisation:** Almost non-existent; no Quantum Computing as a Service (QCaaS), few prototypes, and no supply chains.
- **Government Strategy:** No major national programmes, only early foundations in select countries.
- **Investment:** Low, scattered, and dependent on research grants.
- **Startups:** Very few globally; most modern quantum companies were founded after 2014.
- **Hardware Maturity:** Sub-10-qubit lab devices, no scalable architectures.
- **Communications:** QKD was mostly experimental, with no national networks.
- **Sensing:** Limited to scientific instrumentation, lacking field-deployable systems and engagement with potential end-users.

Key international developments

United States (US): Leads in quantum research funding, industrial R&D, and patent efficiency, with major corporate players (IBM, Google, IonQ, DWave). The US ecosystem is industry-driven, reinforced by federal programmes (e.g. National Quantum Initiative) and considerable private investment.

China: Dominates quantum patent filings, accounting for over 50% of global quantum patents (2020–2024). Heavy state funding and prioritisation of secure quantum communication networks position China as a strategic competitor.

Europe: Maintains global leadership in fundamental quantum research and standards-setting, with large initiatives (EU Quantum Flagship, EuroQCI). Commercialisation is slower than in the US and China.

United Kingdom: Recognised as an early mover with the NQTP (launched 2014), and Europe's most structured public-private quantum ecosystem. The UK's hub-and-spoke model is now emulated globally.

Japan & Canada: Japan invests heavily in hardware and standards, while Canada excels in quantum communications and Artificial Intelligence / Machine Learning integration.

Market & investment trends[23]

- Global QT revenues reached $4B in 2024, forecasted to hit $97B by 2035.
- By 2030, QTs are expected to generate $200B in economic value and create 250,000 jobs globally.
- QCaaS is the fastest-growing segment, with 2,800 enterprises expected to adopt it by 2030.
- Governments worldwide have committed over $40B to national programmes, with the US, UK, and Germany leading among Western economies.
- Major corporate and venture deals are consolidating around fewer, stronger companies as the field matures.

International competition & strategic themes

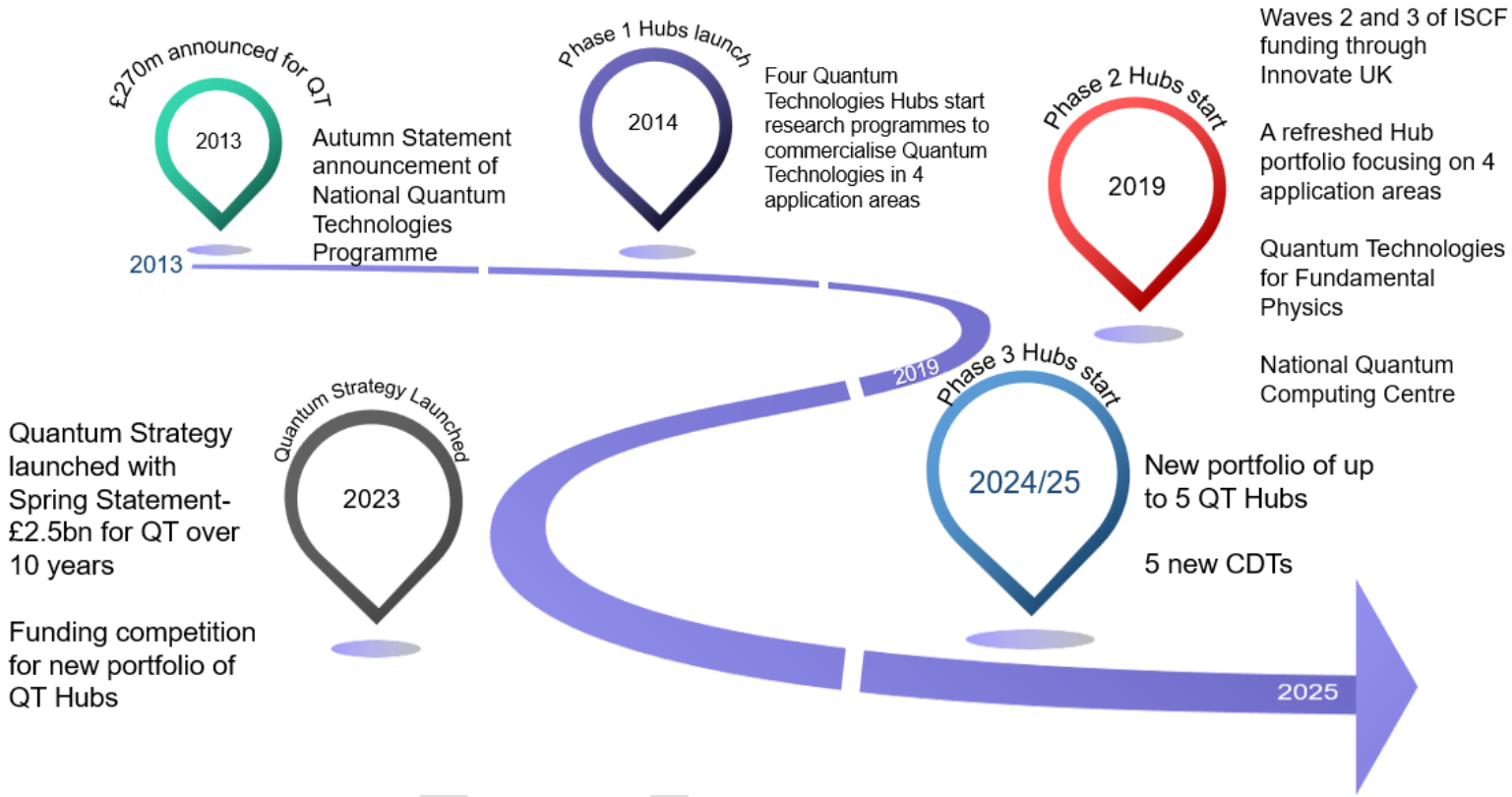
- The global race is driven by sovereignty, national security, industrial adoption, talent shortages, and standardisation.
- The UK, US, China, Germany, Japan, and Canada are major actors, each with distinct strengths in research, commercialisation, investment scale, and intellectual property.
- China leads in patent volume, the US in business-impacting IP, and the UK in research-driven innovation.

3.3 UK Quantum Investment Timelines: Research Hubs, Skills Hubs, and CDTs

Figure 1 shows the EPSRC QT investments over the 2013 to 2024 period. While the EPSRC QT investments are a substantial part of the investment, other funding streams mean it is challenging to disentangle specific outcomes attributable to EPSRC funding.

[23] McKinsey & Company (June 2025), The Year of Quantum: From concept to reality in 2025 (4th annual QT Monitor) and The Quantum Insider (Jan 2025), 2024 Annual Report

Figure 1: EPSRC QT investments over the last 2 phases of the NQTP[24]



Source: Provided by EPSRC to Fortia Insight

[24] Note that the 'Quantum Technologies for Fundamental Physics' programme was jointly funded by both the Science and Technology Facilities Council (STFC) and EPSRC, with STFC leading delivery.

In 2013 the UK formally announced £270m of funding for a new five-year coordinated national QT programme. This aimed to harness the UK's world-leading quantum science base and translate it into strengths in QTs by bringing together academia, industry and government in the establishment of four Research Hubs to drive progress towards commercialisation. This initial investment was complemented by a commercialisation-focused stream through ISCF grants to businesses, alongside recognition of the need for dedicated national infrastructure, including the NQCC. EPSRC has also worked closely with other parts of UKRI to support the application of QTs in adjacent fields, for example through the jointly funded QTs for Fundamental Physics programme with the Science and Technology Facilities Council (STFC), which applies QTs to challenges such as understanding dark matter and gravity. Talent and skills development has been supported through sustained investment in PhD studentships and fellowships.

Table 3: UK QT Investment Timeline

Year	Investment/Programme	Focus Area	Funding/Impact
2014	NQTP Launch	All QTs	£270m (initial)
2014–2019	Phase 1 Quantum Hubs & CDTs	Sensing, Imaging, Computing, Comms	49 startups, 470+ PhDs
2019–2024	Phase 2 Quantum Hubs	Translational research, partnerships	£94m, 140+ partners
2020	NQCC Launch	Quantum computing scale-up	100+ qubit roadmap by 2025
2023	National Quantum Strategy	Missions, sectoral expansion	£2.5B (2024–2034), formal missions
2024–2034	Ongoing Hubs, Skills, CDTs	Skills, sectoral deployment	Continued investment, real-world applications

Conclusion: The UK's quantum investment timeline demonstrates a sustained, strategic approach, beginning with the NQTP in 2014. The government's initial commitment to long-term funding, formal strategies, and sectoral expansion positioned the UK as a global leader in quantum research, skills, and commercialisation. However, international competition has been intensifying and investment accelerating. This places the UK in a very competitive market with clear research strengths, but a more limited track record in patent development or commercialisation.

4 Evaluation Questions – Key Findings

4.1 Purpose

The following section sets the findings against the evaluation questions. Evidence comes from Fortia Insight surveys and interviews, bibliometric analysis, EPSRC reporting data and cost-benefit analysis.

4.2 Benefits of the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs to the academic community, as well as the benefits to the international competitiveness of UK science

EPSRC's investments have reshaped the UK quantum research landscape, moving from fragmented activity to a coordinated, interdisciplinary system. This strengthened research capability, infrastructure and opportunities for coordinated working, alongside stakeholder-reported benefits for collaboration and scientific progress. The scale and coherence of EPSRC's investments have positioned the UK as a leading global quantum research nation, with strong research quality, visibility and influence.

Benefits to the academic community

Connected and collaborative system: The investments helped to shift from a pre-2014 landscape characterised by dispersed centres of excellence to a more coordinated system with stronger mechanisms and opportunities for collaboration, shared strategic focus and reduced duplication of effort. This in turn bolstered UK academic ability, as reported by 94% of Research Hub and 93% of CDT/T&S survey respondents.

Funding: The funding provided universities with confidence to make long-term commitments to quantum research, including investment in specialist equipment, laboratories and research facilities. These institutional investments expanded the UK's physical research capacity and enabled advanced experimentation and testing, strengthening the foundations for both fundamental and applied quantum research (see section 4.7).

Research: The Research Hubs spanned quantum computing, sensing and timing, imaging and communications, and supported advances across these domains. Interviewees highlighted academic breakthroughs, including progress in quantum computing architectures and software, advances in quantum sensing and imaging, and the development of quantum communications systems.

Innovation: Survey findings suggest the Research Hubs combined curiosity-driven research with targeted exploration of quantum applications**,** enabling foundational science to progress into application driven innovation. Key examples include:

- QCS delivered the world's first distributed quantum computing demonstration using ion traps, alongside advances in silicon-based two-qubit gates and cold-atom control.
- Development of software tools such as VQD and QuEST is now adopted by the NQCC and made freely available as open-source tools, enabling use across government, industry, and academic researchers.
- S&T Hub advanced quantum sensing from laboratory prototypes to field-ready systems, including the first quantum gravity gradiometer deployed in uncontrolled environments. While still pre-commercial, this technology provides a clear potential across end-user sectors such as defence, logistics, and aviation.

- Cerca Magnetics commercialised a wearable quantum brain scanner, with end-users in healthcare settings (e.g., hospitals and clinical research), supporting improved brain imaging and diagnostics. The company reported £6.4m in sales in 2024, including healthcare and research centres in 12 countries.

Culture Change: The investments also helped the development of a notable cultural shift within the academic community through the increased emphasis on application-oriented problem solving. Researchers across stakeholder groups described a move towards earlier consideration of use cases and potential applications, without displacing curiosity driven research. This shift supported the development of demonstrators, prototypes and testbeds within academic settings, while maintaining strong links to fundamental science. The integration of quantum research with adjacent fields such as Artificial Intelligence / Machine Learning further reinforced this trend, enabling academics to address complex problems in areas including healthcare, finance, logistics and chemical simulation.

Skills: The CDTs and T&S Hubs played a critical role in broadening the talent base, embedding interdisciplinarity and strengthening links between academic training and industry need. The T&S Hubs intentionally brought together physicists, engineers, computer scientists and researchers from other science, technology, engineering and mathematics (STEM) disciplines, while also exposing participants to industry through mechanisms such as industry placements and engagement with commercial quantum organisations (see further detail in Section 4.3).

Contribution to UK competitiveness

The investments have helped enhance international competitiveness. The quality and quantity of Hub related publications compare very favourably internationally (see section 4.9). In addition, the volume of patents and patent applications linked to Hubs (see section 4.4.4), is evidence that UK research is contributing to global technological development and innovation pathways**.** Stakeholder feedback has also highlighted the Hubs have positioned the UK as a valued partner in global quantum research networks. An example of the EPSRC QT investments expanding the UK's capability and position of UK science is the Matter-Waves at Sea project, a world first demonstration in the field of atom-interferometry gravity gradiometers, alongside the formation of Delta.g.

Case Study Vignette: From Lab to Field — Quantum Sensing for Safer National Infrastructure

Based on the Delta.g spinout from the Quantum Sensors and Timing Hub

Context

Before 2014, quantum gravity sensing was widely considered too delicate for use outside carefully controlled laboratory environments. Through the S&T Hub at the University of Birmingham, **researchers developed cold-atom gravity gradiometry techniques and began testing whether these could function under real-world conditions**.
Delta.g was founded in 2023 to commercialise this capability, with a focus on detecting hidden subsurface risks such as voids, buried structures and unmapped utilities — challenges that contribute to avoidable costs, service outages and safety incidents across UK infrastructure.

How the Hubs enabled transition from lab to field

Hub funding **enabled the long-term development of core prototypes, the recruitment of engineers, the purchase of specialist hardware** (including lasers and vacuum systems), and early engagement with end users including the Defence Science and Technology Laboratory, the Ministry of Defence and the Royal Navy. This combination of technical validation and applied focus shaped research questions around practical constraints such as noise, robustness and usability, rather than purely scientific performance.

The pathway culminated in the **2023 "Matter-Waves at Sea" demonstration** — a world first in operating a cold-atom gravity gradiometer on a maritime vessel — **followed by further Royal Navy trials in 2024**.

Delta.g has since translated this Hub-developed capability into strong commercial momentum:

£4.6m oversubscribed seed round	**£2.5m commercial contract via the Small Business Research Initiative with Department for Transport**	**Growth from 4 to 16 employees**

This commercial growth has all been anchored in Birmingham and positioning the West Midlands as a centre for quantum sensing outside the traditional Golden Triangle. The company's achievement was recognised externally through the 2025 qBIG Prize (Institute of Physics) and the Clifford Paterson Medal for the realisation of the first commercialised quantum sensor of gravity gradients.



Outlook

Delta.g illustrates how Hub-enabled quantum sensing can serve as a near-term contributor to national infrastructure and resilience priorities.

However, stakeholders also recognised challenges to the UK's competitive position. Some interviewees cautioned that EPSRC, Innovate UK, and other funding councils alone cannot match the scale of investment being made by many other governments, and that continued competitiveness will depend on sustained public investment and international collaboration.

4.3 Contributions the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs have made to the UK economy, including the impact of the research, training and skills development, and collaboration

EPSRC's investments have enabled the development of commercially relevant technologies, supported spinout formation and private investment, skills development and high-value employment. Economic effects are still emerging and cannot yet be fully evidenced; however the investments have already delivered material benefits and established a strong foundation for future growth. The analysis also identifies areas for future development to maximise future returns.

The EPSRC investments have delivered significant commercial/economic activity, including spinouts, investment and high value employment.

Spinouts: 74 spinouts have been linked to the Hubs. Of these, 33 were uniquely linked to the Research Hubs, 36 were uniquely linked to the T&S Hubs, and five received support from both. Spinout information is sourced from Researchfish, EPSRC monitoring information, and the 10-year update reports.[25]

Public Investment leveraged: The Hubs and CDTs have supported public investment, including:

- The £153m Quantum Technology ISCF Challenge (with £205m industry co-investment).
- The creation of national facilities such as the NQCC (~£93m).
- Regional investments, e.g., £35m from the West of England Combined Authority for Quantum Technologies Innovation Centre innovation infrastructure.
- Substantial industrial co-funding for PhD studentships and collaborative projects. In some CDTs, at least one third of PhD students each year were co-funded by companies.

Private investment leveraged: Spinouts from the Hubs with equity investment were identified via Beauhurst. In using this data to calculate estimations of the private sector investment leveraged, equal proportions are attributed to spinouts that are commonly linked to both the Research Hubs and the T&S Hubs, ensuring no double counting of impact. The data shows that:

- In real terms (2024=100) the Research Hubs have leveraged £464.5m of private equity funding.
- In real terms (2024=100) the T&S Hubs leveraged £22.4m of private equity funding.

[25] EPSRC provided a list of 47 spinouts included the grant IDs of the grant they were most closely associated with. Of the 38 spinouts (including 5 common) linked to the Quantum Research Hubs 18 of the spinouts on the EPSRC list were confirmed using EPSRC grants data / Researchfish; 2 were confirmed through 10-year reports, and 18 cannot be corroborated through Researchfish or other secondary data. For the T&S Hubs, all 41 spinouts (including 5 spinouts that benefitted from both R&D and T&S Hubs) were identified through reports. The QTEC report includes a list of 39 spinouts and the UCL report includes 2 spinouts.

Table 4: Estimated private investment leveraged (base year is 2024)

	Research Hubs	T&S Hubs
Number of spinouts	38 [33 (unique) + 5 (dual support)]	41 [36 (unique) + 5 (dual support)]
Number of spinouts with data on equity (Beauhurst)	25	17
Private investment (equity funding) leveraged across the programme years	£410.2m (2014/15-2024/25)	£6.5m (2015/16-2022/23)
Private investment leveraged including investment following programme engagement	£482.6m (2014/15-2025/26)	£23.3m (2015/16-2025/26)
Private investment leveraged including projected value until 2030/31[26]	£880.7m (2014/15-2030/31)	£49.5m (2015/16-2030/31)
Estimated private investment leveraged, after controlling for attribution, displacement, and optimism bias.	£464.5m (2014/15-2030/31)	£22.4m (2015/16-2030/31)

Source: Spinout data from Researchfish, EPSRC monitoring information, and the 10-year update reports. Equity data from Beauhurst

The estimated additional private investment leveraged includes benefits incurred and attributed to the Hubs as well as benefits that are still expected to emerge and can be attributed to the Hubs.

- **Displacement assumptions**: Displacement rates were derived from post-2020 evaluation reports of Small and Medium sized enterprise funding support programmes by the British Business Bank and others such as UKI2S[27]. On average, the evaluations estimate displacement at 35%.
- **Attribution assumptions**: Attribution of private investment leveraged by the quantum Hub grants (RDB2) is based on the extent to which each spinout also received funding from other government bodies. While the precise level of Hub funding received by individual spinouts is unknown, it is assumed the Hubs provided most early support[28]. Where no other funders supported a spinout, 100% attribution is applied (i.e. spinout activity is considered to have been realised because of the EPSRC QT investments). Where one additional public funder provided support, a 90% attribution to the Hubs is assumed. For each additional funder, attribution to the Hubs is reduced by 5%. This approach recognises the Hubs as the primary driver of early investment readiness, while proportionately adjusting for complementary public funding from elsewhere.

Employment impacts: The Research Hubs are estimated to have directly enabled 2,115 high-value jobs between 2014 and 2024. These roles were reported by 13 survey respondents across

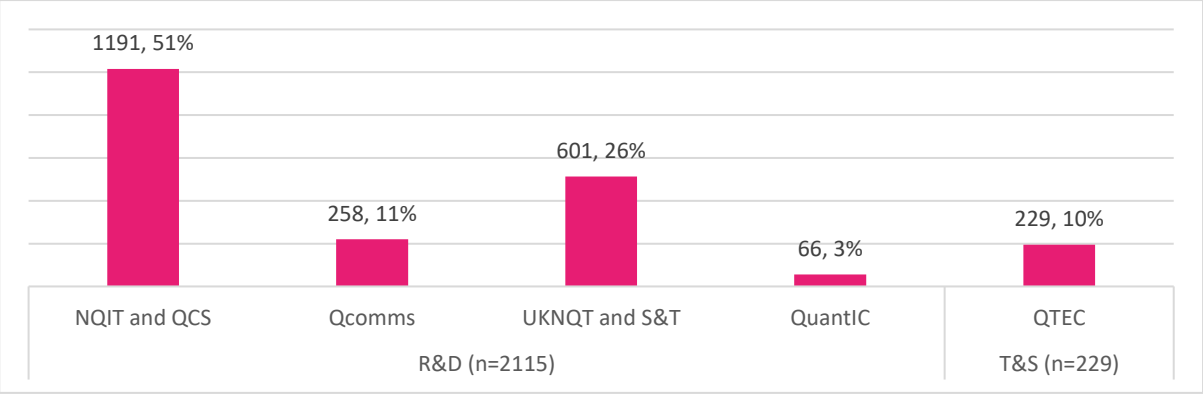
[26] A three-year moving average is applied to project the benefit up to 2030.
[27] The following studies were considered: British Patient Capital Interim Evaluation report | British Business Bank; RLS 1.0 Evaluation Report 2024 | British Business Bank; Microsoft Word - ECF Evaluation Report Final Accessable.docx; Northern Powerhouse Investment Fund Interim Evaluation Report | British Business Bank
[28] The analysis included checking for other government funding from Arts and Humanities Research Council, Biotechnology and Biological Sciences Research Council, Economic and Social Research Council, Medical Research Council, Natural Environment Research Council, Research England, STFC, and Innovate UK. For the Research Hubs: 16 spinouts had received funding one additional source (Innovate UK) - 10% discounting. 2 spinouts had received funding from two additional sources (Innovate UK and STFC & Innovate UK and Medical Research Council) - 15% discounting. For the T&S Hubs: All 17 Hubs had received funding from one additional source (Innovate UK) - 10% discounting.

all Research Hubs and represent high-value employment enabled as a direct result of activities delivered through the EPSRC QT Investments. The distribution of jobs enabled across the individual Research Hubs is as follows:

- QCS Hub: 1,191 jobs (56%)
- QCOMMS: 258 jobs (12%)
- S&T Hub: 601 jobs (28%)
- QuantIC: 66 jobs (3%)

Additional high-value jobs may have been enabled linked to the Research Hubs since survey data collection in 2025. The estimation may also not be comprehensive as evidence was only collected from select representatives. For the T&S Hubs, the 10-year update reports show 229 high-value jobs were enabled between 2016 and 2022[29]. These jobs are attributed to QTEC at the University of Bristol. As the UCL and Imperial College London T&S Hubs did not report job metrics in their 10-year update reports, the total figure of 229 jobs is likely an underestimate. If the UCL and Imperial College London T&S Hubs were similarly successful in enabling high-value jobs, the T&S initiative may have realised 687 jobs.

Figure 2: High-value jobs enabled directly as a result of the EPSRC QT Investments



Source: Fortia Insight Survey and EPSRC Annual Reports

Successful Commercial Development: There are several strong examples of the Hubs supporting a successful transition from **research into commercial development,** for example the journeys of Josh Nunn, Chris Ballance, and formation of Phasecraft.

[29] For the Research Hubs, data for high-value jobs enabled in the quantum industry is based on survey responses from Research Hub stakeholders. Data for the T&S Hubs is sourced from annual reports.

Case Study Vignette: From Hub Investment to Global Quantum Enterprises

Based on the pathways of Chris Ballance and Josh Nunn through the QCS Hub, alongside the development of Phasecraft

Context

The Hubs have supported commercial growth through multiple routes — **from directly enabling spinout formation to accelerating the development of independently founded companies** through talent and ecosystem support. Chris Ballance and Josh Nunn built their research careers and founding teams through the QCS Hub, with Chris turning down competing offers in Switzerland and California to stay in the UK when the Hub launched.

Phasecraft, by contrast, was founded independently in 2019 as a spinout from UCL and the University of Bristol — one of the first quantum software startups globally — but its growth was significantly accelerated by the Hub and CDT ecosystem, which provided a critical talent pipeline at a formative stage of the company's development.

How the Hubs enabled commercial growth

For Oxford Ionics and ORCA Computing, the **Hub directly enabled formation**: Chris recruited the team that became Oxford Ionics through Hub-supported research, while Josh's leadership of the Hub's Photonics programme led directly to the invention of ORCA's core quantum memory technology.

"I built my company off the research and the team of people built off of that… We have a strong, dense network of people built up in Oxford because of that." *– Chris Balance*

For Phasecraft, the Hub and CDT ecosystem played a different but equally important role — **co-funding PhD studentships that contributed directly to product development** (including at least one patent), and supplying the PhD-level quantum scientists who make up much of its ~50-strong workforce.

"[Without the talent pipeline from the Hubs and CDTs] the startups would have been starved of key talent at a critical moment in their inception." – *Phasecraft Co-founder*

Together, these companies represent a substantial return on initial public investment. **Oxford Ionics grew to ~100 employees** before being acquired by US-listed IonQ in September 2025 for $1.075 billion – the highest-value acquisition of any University of Oxford quantum spinout. **ORCA Computing has delivered 10 on-premises quantum photonic systems worldwide and led a record £11.6 million UK Government grant**. **Phasecraft has raised over $50 million in venture funding** – including a $34 million Series B in 2025 – and won a £1.2 million Innovate UK contract for power grid optimisation with National Grid.

Outlook

Through direct support and involvement in the Hubs, these companies are creating jobs, attracting private capital, and reinforcing the UK's position as a globally competitive centre for quantum innovation.





Skills Impacts: Training and skills economic impacts delivered include:

- Approx. 419 PhDs and post docs were supported by the Research Hubs and 49 PhDs through T&S Hubs, while the CDTs recruited 162 core (fully funded) researchers and partially funded 56 other researchers.[30]
- 93% of surveyed researchers progressed into quantum relevant roles and 15–20% founded or joined quantum start-ups, reinforcing long-term workforce capacity. One academic staff member highlighted that most of their PhD cohort had come through the CDT pipeline, describing the **CDT as a "magnet" for exceptional candidates** who would have been difficult to attract through standard studentships alone.
- Stakeholders highlighted that the CDT and T&S Hubs have been highly effective in developing a high quality, interdisciplinary talent pipeline. Qualitative evidence shows that placements, co funded projects, and industry facing activity enabled students to apply quantum skills in practical settings, while industry partners shaped research themes, provided use cases, and fed insights back into academia. This strengthened workforce development and knowledge exchange across the quantum ecosystem. For example, the Quantum Engineering T&S Hub made industry placements a requirement, used industry days to shape course development, and reported that all students had industry supervisors.
- Stakeholders also highlighted strong employment outcomes with T&S Hubs participants frequently progressing into senior leadership positions, with one Hub reporting that almost all enterprise fellows became founders or held senior roles within quantum start-ups.
- Internationally, the CDT model is widely regarded for advanced training, with aspects of the approach replicated in other countries. The T&S Hub offer has also included entrepreneurial skills, industry exposure and placements, supporting knowledge exchange and more application aware research. The cohort based structure, combined with broad first year training, exposure to multiple disciplines, and industry engagement, has supported the development of well-rounded researchers and "world-class quantum engineers". They have been particularly **successful in broadening participation beyond traditional quantum physics**, attracting candidates from engineering, computer science and mathematics, and fostering hybrid skill sets such as quantum engineering. This has strengthened the overall capability and adaptability of the workforce.
- Stakeholders emphasised that, without the scale and long-term certainty provided by the Hubs and CDTs, a material proportion of this emerging UK quantum talent would likely have been lost to overseas opportunities. This **retention of skills within the UK** represents an important economic contribution, particularly given the global competition for quantum expertise. The UK Quantum Skills Taskforce report[31] states market analysts project that new jobs created globally in the quantum computing sector will reach 250,000 by 2030, and 840,000 by 2035. These highlight that the UK investment in quantum skills is key to supporting the future UK economy, alongside ensuring there are sufficient career opportunities to retain the skills in this country.
- The journeys of Ross Donaldson, Aurora Maccarone, Dr Sarah Croke and Fergus Hayes; highlighting the role of the Hubs in developing researchers into leaders in the quantum research ecosystem.

[30] CDT Annual Monitoring Reports
[31] DSIT (2025) UK Quantum Skills Taskforce report

Case Study Vignette: Retaining and Growing the UK's Future Quantum Research Leaders

Based on the career journeys of Dr Ross Donaldson, Dr Aurora Maccarone, Dr Sarah Croke and Dr Fergus Hayes

Context

The four researchers profiled here illustrate different dimensions of this challenge. In each case, **the Hub model – whether through long-term core funding that provided career continuity, or flexible mechanisms like the QCS Hub's PRF – proved decisive in keeping or drawing these researchers into the UK's quantum workforce.**

How the Hubs enabled research leadership

The Hub model **provided the stability, flexibility and connectivity needed to accelerate career progression**. Core funding allowed researchers to build expertise and move into leadership roles – leading major national facilities, securing prestigious fellowships, and progressing to senior academic positions – without the disruption of short-term grant cycles. Flexible mechanisms like the PRF complemented this by enabling rapid, targeted investment. **Dr Croke's PRF award (£130,000, 80% Hub-funded) re-activated a stalled research programme and ultimately unlocked approximately £1 million in follow-on EPSRC and UKRI funding**, contributing to her promotion to Professor in 2024.

The Hub environment **also facilitated cross-disciplinary collaboration** – between quantum sub-fields (e.g. Dr Donaldson and Dr Maccarone on Single-Photon Avalanche Diode arrays) and across disciplinary boundaries (e.g. Dr Croke bridging quantum computing and gravitational wave physics) – while Hub networks and events helped Fergus Hayes build the credibility needed to transition from gravitational wave astronomy into a quantum computing career in industry, first at PASQAL and then Qubitra.

"[PRF funding] allowed us to be much more agile in starting up a new project, and to sustain collaborative activity in a new area, which would have taken a lot longer to set up through traditional EPSRC mechanisms." *– Dr Sarah Croke*

Importantly, these pathways are now self-reinforcing. **All four researchers contribute to the next generation through PhD supervision, mentoring and outreach** — including Dr Croke's co-founding of the Quantum Technology School at the University of Glasgow, which has reached nearly 300 secondary school pupils since 2018.

"The EPSRC funding allows early career academics to become independent earlier [than] other countries." *– Dr Ross Donaldson*

Outlook

These four career journeys show how the Hub model – through long-term core funding and flexible mechanisms like the PRF – builds, retains and diversifies the UK's quantum workforce.



Further examples of how the skills support helped develop entrepreneurial and commercial skills needed to establish and grow Siloton and Cerca Magnetics are shown below:

Case Study Vignette: Training Pipeline to Societal Impact — Quantum for Healthcare

Based on the Siloton and Cerca Magnetics spinout case studies

Context

Siloton and Cerca Magnetics illustrate two distinct however complementary routes from EPSRC quantum investment to healthcare application. Both companies were founded in 2020 and address the same underlying challenge: **making high-quality diagnostic imaging more accessible, portable and patient-friendly.**

Siloton emerged from the University of Bristol's EPSRC Quantum Engineering CDT and QTEC, developing portable eye scanners based on photonic chip technology. **Cerca Magnetics spun out of the S&T Hub**, developing wearable brain scanners using optically-pumped magnetometers (OPMs) that replace bulky, cryogenically cooled systems with lightweight, room-temperature sensors integrated into wearable helmets.

How EPSRC training investments enabled the pathway

For Siloton, the **CDT's cohort model gave the founders broad exposure to quantum platforms, structured training in IP and commercialisation**, and the autonomy to drive their own research direction. QTEC then shifted their approach from "academic solution-first" to "problem-first", using structured market discovery to identify portable OCT as a high-value clinical need.

"Pretty much any skill that I have either came from the CDT and QTEC or it came from having been taught how to teach yourself… Those are the majority contributors to what I can do today." – *Siloton co-founder*

Both companies are demonstrating real-world traction. Siloton has produced sub-surface retinal images in humans, deployed a research-use system to an Australian consortium for remote First Nations eye screening, and **received interest from five National Health Service Trusts, with an independent health economics analysis estimating widescale deployment could save the National Health Service over £1.5 billion annually**.

Cerca reported £6.4m in sales in 2024 across 12 countries, was placed **No.15 in the Sunday Times 100 Tech 2026** and has secured **£3.1m in Ministry of Defence funding** to build the world's first fully mobile quantum-enabled Magnetoencephalography brain scanner.

Outlook

Siloton plans further chip iterations, clinical trials and regulatory progression. Cerca illustrates a mature hub-to-market pathway but, as with Siloton, future impact depends on clinical validation and regulatory progress. Together, they demonstrate how EPSRC's quantum investments – through both doctoral training and long-term Hub R&D – can produce founders and research teams capable of converting advanced quantum science into products shaped by real health-system constraints



These case studies, alongside those provided in Appendix 6, highlight that EPSRC supported skills pathways have incorporated strong links to industry and commercialisation opportunities. For example, the Quantum Engineering CDT and QTEC supported Siloton's founders through broad technical training, structured IP and commercialisation exposure, and market discovery activity that shifted their approach from an academic "solution-first" model to a "problem-first" clinical need. Similarly, evidence from Cerca Magnetics demonstrates how Hub-linked expertise supported progression from research into a commercially visible healthcare technology. However, stakeholders also highlighted some areas for development:

- While CDTs and T&S Hubs included industry facing elements, including placements, co-funded projects, industry supervision and entrepreneurial training, stakeholders highlighted **scope for more consistent practical, commercialisation focused and real world problem solving experience across provision**.
- Provision remains heavily focused at doctoral level (the level primarily within EPSRC remit), **with limited support for non-PhD routes, technician training, or continuing professional development**, constraining the development of a broader, industry-ready workforce.
- **Structural issues also affect effectiveness**. Weak alignment between CDTs and Research Hubs has limited opportunities for integration and knowledge exchange, while geographic concentration has restricted access and reduced the development of local talent pipelines in some regions.
- The discontinuation of the T&S Hubs created a **gap in dedicated skills infrastructure**, raising concerns about sustaining momentum, international visibility, and the long-term strength of the training pipeline.

The Research Hubs, T&S Hubs and CDTs have made a substantial contribution to the UK economy by strengthening research and innovation capability, building a highly skilled workforce, and supporting collaboration, translation and commercialisation. The programme has delivered material economic benefits to date and has strengthened the foundations for longer term growth. As global competition increases the focus should be on continuing to develop the model, building on the strengths and actioning areas for development.

4.4 Aggregate economic impact of the Quantum Technology Research Hubs and the T&S Hubs, and the corresponding Return on Investment, including the impact on UK Industry

The aggregate economic impact of the Research Hubs and the T&S Hubs is based on the cost–benefit analysis. The assessment focuses on monetised impacts where robust data are available and is complemented by qualitative evidence on wider and longer term contributions to UK industry and the quantum ecosystem. The investments have generated a positive economic return over the period assessed, with monetised benefits exceeding total public and co-investment costs. However, the results should be interpreted as a conservative estimate of impact, reflecting data limitations and the early stage of commercialisation.

Costs, benefits and return on investment

Total investment across the Research Hubs and T&S Hubs is estimated at £367.5m, comprising £353.5m for the Research Hubs and £13.9m for the T&S Hubs. This includes both EPSRC and non-EPSRC funding. Under conservative assumptions, total monetised benefits are estimated at £545.6m against total costs of £442.8m, yielding a combined BCR of 1.23. ROI has also been calculated under a more positive scenario which applies less conservative assumptions to wage uplifts and patent valuation. This indicates total monetised benefits of £571.6m and a combined BCR of 1.29. At the individual investment level, the Research Hubs return a BCR of between 1.21

(conservative) and 1.24 (positive scenario), while the T&S Hubs return a BCR of between 1.73 and 2.68.

Table 5: Summary of costs, benefits and ROI

	Conservative ROI			Positive scenario ROI		
	Research Hubs	T&S Hubs	Combined	Research Hubs	T&S Hubs	Combined
Total monetised benefits	£516.1m	£29.5m	£545.6m	£526.0m	£45.6m	£571.6m
Total EPSRC & non-EPSRC costs	£425.8m	£17.0m	£442.8m	£425.8m	£17.0m	£442.8m
Net present value	£90.4m	£12.5m	£102.8m	£100.3m	£28.6m	£128.9m
BCR	1.21	1.73	1.23	1.24	2.68	1.29

The positive return is driven primarily by innovation-related impacts, notably the value attributed to R&D spinouts and associated employment effects. The analysis also highlights that several categories of benefit, particularly those related to the commercial use of research and longer-term skills impacts, can only be partially captured within the monetised estimates.

Employment and wage premium impacts

The Research Hubs are estimated to have directly enabled 2,115 high-value jobs between 2014 and 2024. For the T&S Hubs, the conservative estimate identifies 229 roles enabled between 2016 and 2022, based on reported data from QTEC at the University of Bristol.[32] As the remaining T&S Hubs (UCL and Imperial College London) did not report employment figures, the positive scenario estimate assumes comparable levels of high-value jobs enabled generation across all three T&S Hubs, yielding an estimated 687 roles (see section 4.3).

Wage premium due to high-value employment enabled by the EPSRC QT investments: The economic value of these jobs has been estimated using a wage premium approach, comparing earnings in quantum-aligned sectors with a realistic counterfactual sector. To estimate the wage uplift, the following steps are undertaken:

- **Sector wage estimates**: median nominal earnings for 2025 are used to establish annual wages for sectors C: Manufacturing (£37,297), J: Information and communication (£49,353), and M: Professional, scientific and technical activities (£41,599). This median wage is then compared to the median wage of sector 'SIC-28' (£39,174).[33]

[32] For the Research Hubs, this data is sourced from survey responses from Research Hub stakeholders asking for specific number of high-value jobs enabled in the quantum industry space because of the Hubs. Data for the T&S Hubs is sourced from annual reports.

[33] The classifications used here are Standard Industry Classifications (SIC) as defined by the ONS. The sectors chosen here are based on the distribution of the spinouts connected to the Research and Training & Skills hubs.

- **Sector weighting**: sectoral wage estimates are weighted to reflect the distribution of spinouts across sectors.
    - Research Hubs: 33% (C), 19% (J), 47% (M).
    - T&S Hubs: 29% (C), 15% (J), 56% (M).

A weighted average annual wage is then calculated for each EPSRC QT investment type.

- **Uplift calculation**: difference between the weighted sector wage and the counterfactual sector wage results in an estimated uplift of:
    - £2,499 per job for the Research Hubs.
    - £2,300 per job for the T&S Hubs.
- **Inflation adjustment**: values are converted into 2024 real terms, resulting in:
    - £2,417 per job for the Research Hubs.
    - £2,225 per job for the T&S Hubs.
- **Total wage premium**: The wage uplift is multiplied by the number of high-value jobs enabled. Benefits estimations are projected from 2014-2024

Attribution and displacement assumptions: The estimated wage premium is fully attributed to the Research and T&S Hubs. Survey respondents were explicitly asked to report high-value jobs enabled because of Hub activity and the T&S Hub 10-year update reports similarly attribute high-value jobs enabled due to their programmes. Displacement is assumed to be negligible, as wage uplift measures only the added value of jobs enabled directly due to the Research Hubs and T&S Hubs' support. After adjustments for optimism bias, the total wage premium attributable to employment enabled is estimated at £46.0m for the Research Hubs under both scenarios. For the T&S Hubs, the wage premium ranges from £4.6m (conservative estimate) to £13.8m (positive scenario estimate).

Table 6: Estimated wage premium due to employment generated by the Research Hubs and T&S Hubs (base year is 2024)

	Research Hubs	T&S Hubs (conservative estimate)	T&S Hubs (positive scenario estimate)
Number of high-value jobs enabled	2,115	229	687
Wage premium, after controlling for optimism bias	£46.0m	£4.6m	£13.8m

Fortia Insight Survey and EPSRC Annual Reports. Estimations by Fortia Insight

Wage uplift for students from training and skill building programmes: The economic value of skills development is captured through wage uplift analysis, building on the workforce impacts described in Section 4.3. Yearly wage uplift is measured using the Longitudinal Education Outcomes data.[34] Specifically, the difference between the median earnings 10 years after graduation, of students with Masters' degrees vs those with PhDs or postdoctoral experience has been considered. Sectors closely related to quantum, such as computing, engineering, materials and technology, mathematical sciences, and physics and astronomy, have been selected for this analysis. The estimated annual uplift per person is £3,400 in nominal terms (£3,532 in real 2024 prices). It is assumed that graduates benefit from this uplift for a period of 10 years. The estimates

[34] Create your own tables on leo graduate and postgraduate outcomes - Explore education statistics - GOV.UK

total wage uplift is discounted using the HM Treasury Green Book's recommended 3.5% rate of social time preference[35] and we adjust for optimism bias.
After discounting and optimism bias, total wage uplift attributable to training supported by the Research Hubs is estimated at £3.2m, and £0.9m for the T&S Hubs. These estimates are consistent across both the conservative and positive scenarios, as the same assumptions are applied under both. While CDTs are not monetised separately, qualitative evidence indicates that they have contributed to industry-relevant skills development and positive career outcomes.

Attribution and displacement: Both Research Hubs and T&S Hubs are recognised as components of a strategic investment aimed at addressing identified market failures, including the emerging quantum skills gap within the UK. In this context, additional training is expected to expand rather than displace the workforce, and displacement is therefore considered negligible in the model. To determine the degree to which benefits can be attributed to the EPSRC QT investments, data on the proportion of individuals trained who entered industry is used. For the Research Hubs, it is known that:

- 12% of former Research Hub researchers entered quantum industry roles (QComms 10-year report, 2024).
- 46% of former Research Hub researchers went to industry, including 32% to QT-related industry and 14% to other industry/organisations (S&T Hub lead consultation).

Based on this data, it is assumed that (on average) 29% of former Research Hub researchers enter industry and this percentage is used for estimating the value that can be attributed to the Research Hubs. A percentage is calculated to attribute and estimate wage uplift to the T&S Hubs. Data on the Imperial Hub indicates that 8 out of 9 graduates (88.9%) entered industry, while information from the UCL InQuBATE T&S Hub on funded Postdoctoral Fellows shows that 3 out of 7 postdocs (43%) founded industry spinouts. An average of 66% of PhDs who benefited from the T&S Hubs is assumed to have entered industry.

Table 7: Estimated benefit of training and skills (base year is 2024)

	Research Hubs	T&S Hubs
Number of PhDs benefiting from training and skills support	419 - S&T - 110 (26%) - QCS and NQIT – 90 (21%) - QuantIC PhDs - 42 (10%) - QuantIC Post docs – 130 (31%) - QComms - 47 (12%)	49 - UCL – InQuBATE Training & Skills Hub - 22 (45%) - Imperial – Quantum Engineering & Science Hub - 27 (55%)
Total estimated wage uplift, after controlling for attribution, displacement, and optimism bias.	£3.2m	£0.9m

Source: Final reports from the Hubs. Data on the 32 Paid Enterprise Fellowships by QTEC are not included to avoid double counting. These fellows entered industry through the 229 high-value jobs enabled - which is already considered as a separate benefit.

Spinouts

These account for the largest share of monetised benefits; there is evidence of £464.5m of benefit associated with the Research Hubs and £22.4m to spinouts linked to the T&S Hubs. These

[35] This adjustment is applied selectively to this benefit to account for temporal uncertainty of benefit accrual.

estimates reflect the valuation of spinouts included within the cost–benefit analysis, recognising that data constraints limited inclusion to a subset of identified companies.

Patents

Granted patents and patent applications are used to measure two distinct benefit streams arising from Research and T&S Hub-supported research:

(i) new products and prototypes linked to grants awarded by the Research and T&S Hubs; and
(ii) the value of Research and T&S Hub-supported academic research outputs.

The value of a patent is measured using two distinct proxies, for the conservative and the positive scenario ROI calculations, as presented in the following table.

Table 8: The value of a patent

Source	Value per patent '£' (2024=100)	Approach
Serrano (2005)	£28,659	Conservative: Discounted present value of a patent's future income stream over a 20-year time horizon derived from observed patent-market transactions.
Gambardella et al., (2008),	£149,499	Optimistic scenario: Discounted present value of a patent's future income stream over a 20-year time horizon derived from a survey of 8,217 EU businesses and indicates a lower-quartile patent value of £100,000 in 2008 prices.

As not all patent applications result in granted patents, GOV.UK data on patent applications and grants from 2019 to 2024 is used to estimate a median conversion rate of 45%.[36]

New products and prototypes linked to grants awarded by the Research and T&S Hubs: This is measured using the value of patents and patent applications directly linked to / emerging from the hub grants. Research Hubs are associated with 12 granted patents and 60 patent applications directly linked to hub grant IDs, while the T&S Hubs are associated with 74 patent applications identified through consultation with QTEC Hub leads. By comparison, recent evaluation of EPSRC's ARCHER2 supercomputer identified at least six patents and IP items, acknowledged as a significant underestimate, suggesting Research and T&S Hubs' patent output is comparatively strong for a publicly funded research programme.[37] After controlling for attribution, displacement and optimism bias, the Research and T&S Hubs' estimated value of new products and prototypes is valued at £1.4m under conservative assumptions, rising to £7.5m under the positive scenario for the Research Hubs. The estimated value for the T&S Hubs is £1.7m under conservative assumptions and £8.6m under the positive scenario estimates.

Value of academic research outputs: In addition to patents directly linked to Research and T&S Hub grants, a further 41 granted patents and 48 patent applications filed by UK-based organisations have been identified through Lens as citing Research and T&S Hub-funded research publications. This indicates downstream commercial use of the academic knowledge base generated by the Hubs. After controlling for attribution and optimism bias, the estimated value of this citing activity is £0.9m under conservative assumptions, rising to £4.8m under the positive scenario estimate for the Research Hubs. This benefit stream is not monetised for the T&S Hubs, as the data available from Lens was not sufficiently comprehensive to support robust estimation.

[36] Facts and figures: patents, trade marks, designs and hearings: 2024 - GOV.UK
[37] Socioeconomic evaluation of ARCHER2

Table 9: Value of new products & prototypes and academic research emerging from Hub grants

	Conservative estimate		Positive scenario estimate		Combined
	Research Hubs	T&S Hubs	Research Hubs	T&S Hubs	
Value of new products and prototypes linked to hub grants	£1.4m	£1.7m	£7.5m	£8.6m	**£19.2m**
Value of academic research outputs supported by the hubs	£0.9m	Not estimated	£4.8m	Not estimated	**£5.7m**
Hub-wise totals	**£2.3m**	**£1.7m**	**£12.3m**	**£8.6m**	

Source: Researchfish, Lens, Consultation with QTEC Hub leads, and estimation by Fortia

The monetised value of patents and research use is relatively small compared to spinout related benefits. This reflects methodological limitations such as conservative valuation proxies and keyword-based patent identification approach (see section 2.4 Methodological challenges and limitations), rather than a lack of industrial relevance, as economic value may be realised through routes not captured by patent based proxies. Firms may also choose not to apply for a patent to protect commercially sensitive designs and maintain competitive advantage.

Displacement: This is assumed negligible because patent grants and applications emerging out of research linked to the Research Hubs (since 2019) account for a small percentage (0.005% and 0.01% respectively) of total grants and applications in the UK[38].

Attribution: Researchfish data is used to link granted patents and patent applications to specific Research and T&S Hub grants, thereby treating the Hubs as the primary driver of this impact. To account for the contribution of complementary public support, a proportionate attribution approach is applied. Attribution begins at full (100%) for the Hubs, with a diminishing discount of 10% for the first additional public funder and 5% for each subsequent funder, capped at 25%. After calculating each organisation's adjusted attribution proportion, the median across all cases (90%) is taken. This method acknowledges the central role of the Hubs while suitably adjusting for other public inputs.

Two scenarios represent estimates for the aggregate economic impact of the Hubs:

- **The positive ROI scenario** estimate applies a more generous proxy for estimating the value of patents and introduces additional assumptions to account for likely benefit accrual that is not fully captured in reported data (assuming all three T&S Hubs generated enabled 229 high-value jobs like QTEC).
- **The conservative ROI scenario** reflects benefits that can be robustly evidenced during and shortly beyond the operational lifetime of the Hubs, projected to 2030 using observed trends (investment, patent activity) and assumptions (wage uplift).

[38] See also Facts and figures: patents, trade marks, designs and hearings: 2024 - GOV.UK

Together, the two scenarios are intended to indicate the direction and potential scale of impact as the quantum ecosystem matures. It should be noted, however, that neither scenario captures the full extent of likely future returns.

Overall, the evidence indicates that the Research Hubs and associated T&S Hubs have delivered a positive aggregate economic impact over the period assessed, with monetised benefits exceeding costs and a BCR above unity. The analysis also highlights strong complementarities between the Research Hubs, T&S Hubs and CDTs, with stakeholders emphasising that these investments operate most effectively as an integrated package rather than as standalone interventions. Several important benefit streams, particularly those related to longer term skills pipelines, future industrial adoption, public procurement and downstream ecosystem effects, are expected to materialise over a timeframe that extends beyond the current evaluation period and are therefore not reflected in the monetised analysis. As such, while the evidence demonstrates clear economic contributions to UK industry to date, the full economic impact of the investments is likely to extend well beyond the range presented in this evaluation.

4.5 Likely impact of not having the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs on UK science

Without the EPSRC's coordinated investment in Quantum Technology Research Hubs, T&S Hubs and CDTs, the UK's quantum research system would have developed more slowly, unevenly and with significantly weaker foundations. The absence of these investments would have resulted in a less connected, less skilled and less internationally competitive quantum sector.

Without the coordinated national system, research activity would likely have remained **more fragmented**. Ambitious programmes addressing shared technological challenges would have been harder to execute, with research effort more dispersed across disconnected projects and institutions. As a result, progress in several areas of quantum science would likely have been slower, with fewer opportunities to build critical mass or to align research trajectories across disciplines and organisations.

The long-term and visible nature of the investments provided confidence for universities to co-invest in facilities, equipment and specialist staff. Without this confidence, these investments would have been less likely to materialise. This in turn would have meant the UK's quantum research base would likely have been **less well equipped, with weaker enabling infrastructure and lower overall capacity to sustain advanced experimental work**.

As noted in Section 4.3, survey and stakeholder evidence indicates a substantial proportion of the workforce **would not have been trained, or would have followed different career paths**. This would have reduced UK capability and constrained the scale and pace at which quantum research could be advanced and applied. This point is reinforced by stakeholder evidence that, in the absence of the Hubs and CDTs, emerging quantum researchers would have pursued opportunities overseas, with several interviewees explicitly attributing their decision to remain in the UK to the existence of the Hub and CDT ecosystem.

> The UK Hubs are probably the reason why I stayed in the UK. I had an offer to go set up a quantum computing institute elsewhere. I also had a plan to run a research team in California, what caused me to stay in the UK were these hubs starting up and being given a significant sum of money at the time and research funding to build the team I wanted to build here
>
> *- QT Expert Consultee*

Evidence also suggests that **industrial engagement and translation would have been weaker** without the Hubs. Stakeholders highlighted that industry facing mechanisms such as industry days, thematic meetings, secondments and co-funded collaborations helped raise awareness of, and drive interest in, quantum technology research and created practical collaboration pathways. In the counterfactual, these mechanisms would largely have been absent, resulting in fewer structured partnerships, less awareness, reduced opportunities for spin-out formation, and a slower emergence of commercial pathways linked to quantum research.

> Without the Hubs, we would have had a fragmented structure that lacked the resources for industry and public engagement. Bringing everything together allowed us to achieve goals efficiently, which is not possible with a number of small grants
>
> *- QT Expert Consultee*

> The Hubs/CDTs were a 'network of networks' and a 'shop window' that makes it easier to identify and convene relevant academic capability quickly, this saved time and effort compared with approaching individual academics one-by-one
>
> *- Wider Stakeholder Consultee*

Overall, while the exact scale of the counterfactual cannot be measured precisely it is clear the investments have materially strengthened the UK quantum system relative to what would otherwise have been likely.

4.6 Equality, Diversity and Inclusion: To what extent has the programme contributed to the aim of achieving a vibrant diverse academic and skills base in QT throughout UK, for example through staff employed and students

The investments have established a strong foundation for more inclusive practice across the UK quantum landscape, embedding EDI considerations into governance, recruitment, training and outreach. However, while commitments and activities are evident, there is limited systematic evidence of measurable impact on diversity within the talent pipeline or senior leadership. As a result, while the investments have made important strides in shaping more inclusive systems and behaviours, there is insufficient evidence available that demonstrates a commensurate shift in representation and progression across the sector.

EDI in the Programme

Research Hubs were required to develop comprehensive EDI plans aimed at embedding inclusive practices across governance, recruitment, training, and outreach. Common strategies included the appointment of EDI champions or officers, the integration of EDI into leadership structures, and the use of diverse advisory boards and selection panels. All Research Hubs emphasised inclusive recruitment practices, such as advertising roles widely, using inclusive language, and supporting flexible working, and required unconscious bias training for staff involved in hiring and funding decisions. However, tracking performance against each target within the Research Hubs' EDI plans was limited. The following table outlines the performance of each Research Hub against their EDI targets.

Table 10: Research Hub performance against EDI targets[39]

Cross-Research Hub EDI targets	Research Hub performance
Embed EDI principles into leadership, governance, recruitment, training, and outreach	**QCS:** QCS director (an Athena SWAN lead[40]) made responsible for delivery of the EDI plan; developed inclusive speaker policy (for events); provision of work experience and school outreach opportunities (e.g. STEM Hub assembly)
	QuantIC: Establishment of an EDI champion with leadership team; use of inclusive imagery and appointment of diverse speakers for outreach; social media used to promote diversity
	S&T Research Hub: embedded via participation in sectoral events focused on diversity and ensuring that the director is responsible for delivery against EDI plan.
	QCOMMS: appointment of an EDI champion at the leadership level within the Research Hub (responsible for highlighting and promoting inclusive practices); sponsorship of – and collaboration with – several community focused projects (e.g. Women in Physics; Ogden Trust); distribution of outreach material to schools in deprived areas.
Promote inclusive recruitment practices and support flexible working	**QCS:** all partners were expected to demonstrate alignment with inclusive recruitment practises & all staff members were required to complete implicit bias & inclusive recruitment training; use of competitive studentship processes (accounting for diversity) and promotion of opportunities via diversity networks.
	QuantIC: delivery of unconscious bias training to staff / researchers
	S&T Research Hub: implemented inclusive recruitment practices (e.g. representative employment panels) when recruiting project managers; PRF request for proposal was reviewed to ensure accessibility
	QCOMMS: all universities involved have robust EDI recruitment policies; are openly supportive of inclusive recruitment charities / organisations; and require recruitment teams to undertake inclusive recruitment and unconscious bias training.
Ensure accessibility in meetings and events	**QCS:** appropriate thought given to accessibility, timings and religious holidays when scheduling meetings; meetings made accessible electronically where possible; hybrid seminar room with accessibility features developed
	QuantIC: provision of remote participation option for meetings; fund to support those with caring responsibilities to cover cost of meeting

[39] Research Hub EDI reports and annual reporting (phase 1 & 2) (provided to RSM by UKRI)
[40] Athena Swan Charter | Advance HE

Cross-Research Hub EDI targets	Research Hub performance
	attendance; soliciting of anonymous feedback on accessibility; scheduling of meetings and events in core hours and avoiding school and religious holidays (and Fridays).
	S&T Research Hub: sponsorship was offered for attendance at Women In Space conference
	QCOMMS: guidelines for inclusive meetings shared with all staff & accessible locations used; QCOMMS committed to universal use of subtitles in videos; diversity was used as a key criterion for speaker selection at events.
Monitor and evaluate EDI progress regularly	**QCS:** quarterly monitoring & annual reporting
	QuantIC: quarterly monitoring & informal feedback collection
	S&T Research Hub: progress reviewed by management on a quarterly basis
	QCOMMS: tracked via annual and mid-term reporting and ongoing review of governance structures
Share EDI plans and practices across the Hubs to foster collaboration and learning	**QCS:** EDI plan shared to wider EPSRC / Hub network & learning shared with institutions; Equality Impact Assessments used for events and studentship recruitment
	QuantIC: EDI plan shared to wider EPSRC / Hub network; quarterly monitoring and updates for management board; targeted survey distribution
	S&T Research Hub: EDI plan shared to wider EPSRC / Hub network; annual review of EDI plan; EDI discussions at meetings
	QCOMMS: EDI plan shared to wider EPSRC / Hub network; training and outreach initiatives were made available across the Hub network

Evidence from the reporting and interviews shows Research Hubs have demonstrated strong commitment to embedding EDI principles across leadership, recruitment, events, and outreach. However, there is no systematic evidence that these process level measures translated into measurable improvements in representation, progression, or leadership diversity across the investments. Interviewees described gender balance as 'moderately good'; however, this could not be substantiated with data, nor is there evidence of improvement over time due to the lack of consistent data.

4.7 How these investments have supported regional growth or provided benefits to particular parts of the UK

EPSRC investments have delivered tangible regional benefits, particularly in areas with strong research excellence, where they have helped to develop clusters, attract investment and create jobs. There is also evidence of economic impacts in areas with more recent investment and developing networks. However, a range of factors contribute to success, such as private investors and partners alongside public funding, research capabilities, relevant training/support and commercialisation expertise.

Hubs contribution to Regional Economic Growth

While the Research Hubs and T&S Hubs were not designed primarily as place-based or regional development interventions, they were located across much of the UK and generated valuable local benefits in regions. Several stakeholders emphasised that regional development was a secondary

effect of the EPSRC QT investments rather than an explicit goal and the evidence shows a three-tier regional impact story across the UK quantum ecosystem:

Tier 1 – Established quantum clusters (Oxford, Bristol, Glasgow/Edinburgh, and London): These regions already had substantial research activity and the EPSRC investments acted as anchors that deepened local capacity and collaboration and gave confidence for further investment and commercial activity. For example:

- In **Oxford**, the QCS Hub built on decades of university expertise and helped to attract and grow a local ecosystem of quantum start-ups. One such spinout, Oxford Ionics (co-founded by QCS researchers and acquired by a US firm for nearly £1 billion), expanded its team to over 100 high-value jobs in the region, anchoring skilled roles in the Oxford area. Oxford's Beecroft Building was cited by stakeholders as enabled by confidence created through the EPSRC QT investments.
- **Bristol** has similarly become a thriving network of quantum entrepreneurship. QTEC supported formations of over 30 new start-ups, roughly one-third of all known UK quantum spinouts, which together raised more than £65 million in equity capital. The success of these Bristol based ventures has created around 230 high-skill jobs in the South West. Local and regional authorities have also demonstrated strong support. For example, the West of England Combined Authority committed £35 million to establish a Quantum Technologies Innovation Centre in Bristol, indicating the presence of the Hub as a key factor in the development of a regional quantum cluster.
- **London** emerged as a leading cluster, with two T&S Hubs and two CDTs producing one of the UK's largest concentrations of quantum trained professionals. Over 80% of graduates have progressed into quantum related industry roles, supporting the creation of at least five start-ups, including Phasecraft and Quantum Motion. The Quantum Metrology Institute at the NPL in Teddington has been a major delivery partner of the Hub's work. NPL's recent Measurement for Quantum programme supports companies to develop and commercialise quantum products by providing measurement expertise and short-term projects, helping to bridge the gap between research prototypes and market-ready applications. These outcomes reflect wider national patterns of spinout formation and investment with impacts concentrated in locations hosting sustained research activity.
- **Glasgow** and **Edinburgh**, through QuantIC and capability in adjacent sectors, became a national centre of excellence in quantum photonics, enabling the formation of at least seven new spinout companies (e.g. QLM Technology, Sequestim) and directly creating over 70 high-value jobs in Scotland. Stakeholders cited redevelopment of the Advanced Research Centre in Glasgow as enabled by confidence created through the EPSRC QT investments.

Case Study Vignette: Building Scotland's Quantum Corridor

Based on QuantIC's contribution to place-based innovation across Scotland's central belt

Context

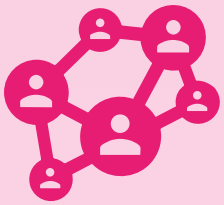
Scotland has long-standing strengths in photonics and imaging research. QuantIC – led by the University of Glasgow – was established in 2014 to translate these strengths into real-world quantum-enhanced imaging systems. While QuantIC's research and industry impact extends across the UK, its delivery model has had a particularly visible effect in Scotland's central belt, where **a recognisable Glasgow–Edinburgh *"quantum corridor"* of connected research, innovation and commercialisation activity has emerged over the past decade.**

How the Hub developed an ecosystem

QuantIC created shared infrastructure. Most notably, the Hub developed the **QuantIC Innovation Space in Glasgow, supported by a £3 million Scottish Funding Council contribution** and located above the James Watt Nanofabrication Centre. This **enabled industry–academia co-location, collaborative prototyping and short-term trials.** It also reduced coordination costs for companies by providing a single hub structure and repeatable collaboration routes, replacing the need to navigate multiple disconnected university groups.

Working closely with Technology Scotland, QuantIC helped Scottish organisations collaborate and compete successfully for Innovate UK funding competitions, with **21 Scottish organisations involved in 38 funded projects, securing £4.9 million of £12.6 million awarded**. Over its lifetime, **the Hub secured £8 million in additional funding and facilitated a further £65 million of industry projects,** while **supporting the development and commercialisation of seven spinouts and creating over 70 jobs.**

QuantIC — alongside the Fraunhofer Centre for Applied Photonics — has also helped attract inward investment from companies such as Coherent Corp and Alter Technology (TÜV NORD), reinforcing the central belt's position as a growing photonics and quantum cluster with international visibility.



Outlook

QuantIC's model – combining multi-university capability, industry-led collaboration and shared physical infrastructure – offers a replicable template for place-based quantum innovation. With Scotland's quantum corridor now anchored by established institutions, a growing company base and proven collaboration routes, the region is well positioned for future investment and international partnership in quantum imaging and photonics.

Tier 2 – Emerging regional networks (Birmingham, Nottingham, and Cardiff): These locations show that EPSRC investment has contributed to commercially significant outcomes beyond the traditional Golden Triangle:

- In **Birmingham and the West Midlands**, the Quantum S&T Hub positioned the region as a leader in quantum sensing and provided a strong pathway into transport and defence sectors through its work on resilient positioning, navigation, and underground sensing. A

notable spinout, Delta g (founded on Hub research in gravity sensing), is now scaling up in Birmingham with £4.6 million in seed funding and expanding its workforce, illustrating how research translated into a local high-tech venture.

- In the **East Midlands**, the Hub's collaboration with the University of Nottingham led to formation of Cerca Magnetics, which has developed novel brain imaging devices and secured a £3.1 million defence contract (Ministry of Defence) and 2026 SPIE[41] Catalyst Award.
- In **Wales**, a combination of photonics expertise in South Wales and training through QTEC helped nurture QLM Technology, a gas-sensing start-up that grew its manufacturing in Newport/Paignton and raised £12 million in venture capital.

Tier 3 – Distributed benefits (York, Lancaster, and Sussex): Outside the above clusters and emerging networks, the direct measurable economic impact is modest. Regions like Yorkshire (host to the QComms Hub), the North West, and the South Coast have seen important knowledge-sharing and training benefits (e.g. PhD graduates and researchers), however there is limited evidence of significant local industry growth or large scale job creation. Local spinouts and collaborations exist (e.g., Lancaster Helium and Universal Quantum in Sussex), however the evidence suggests quantum industry activity remains largely concentrated in a small number of established centres. Stakeholders noted that persistent structural factors, such as the concentration of deep-tech investors and partners in certain regions, have limited broader regional diffusion to date.

Figures 3 and 4 show the regional impacts across multiple regions, however identifiable linkages show a strong concentration around specific Hubs and institutions.

[41] International society for optics and photonics

Figure 3: Geographical distribution of Research Hub spinouts

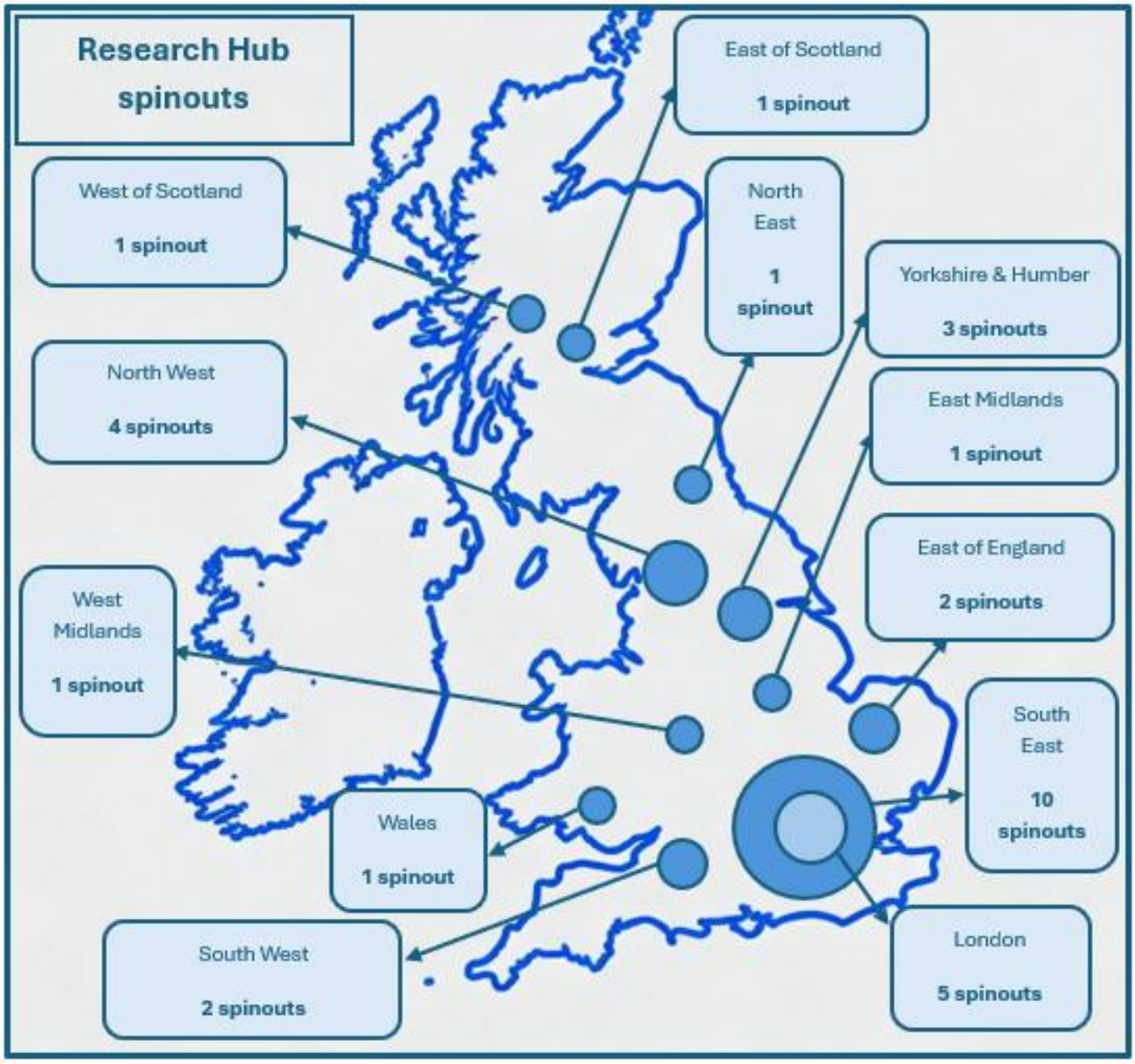
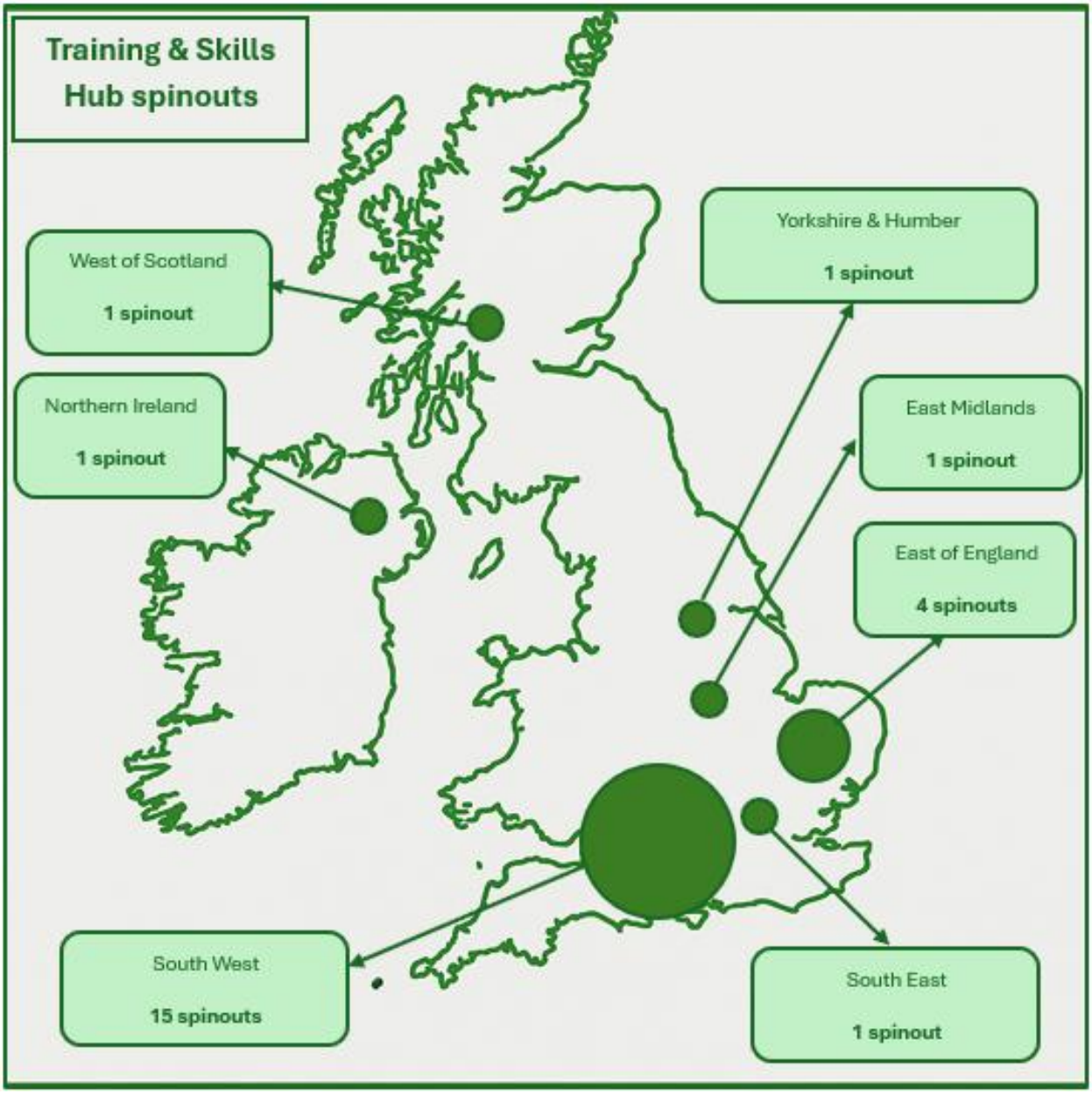


Figure 4: Geographical distribution of T&S Hub spinouts



Comparison to other emerging technologies

While a detailed comparison of Quantum impacts regionally compared to other emerging technologies is out of scope, there is some evidence that the regional impacts of the EPSRC quantum investments are more widely distributed than those of some other emerging technology areas. For example, AI investment in the UK is highly concentrated geographically, with around 75% of AI company offices located in London, the South East and the East of England[42]. By contrast, the EPSRC quantum investments are distributed across multiple UK regions, with

[42] Department for Science, Innovation and Technology (2023) *Artificial intelligence sector study 2023*. London: Department for Science, Innovation and Technology

economic impacts (to varying degrees) across more areas outside London and the South East, the Golden Triangle.

Stakeholders emphasised that the effectiveness of public investment is contingent on the maturity of the wider ecosystem. Central to this is a strong foundation of research excellence, complemented by key enabling factors including engaged private sector partners, access to investment, and a skilled workforce. In regions where ecosystems have reached critical mass, continued public investment was seen to reinforce existing cluster effects and stimulate growth in adjacent sectors. In contrast, for developing or emerging regions, stakeholders highlighted the need for targeted funding and tailored mechanisms to build ecosystem capacity and extend benefits more widely, while maintaining the concentration required to sustain internationally competitive research.

Regional Impacts Summary

The following table summarises regional impacts regarding spinouts, jobs, investment and system development.

Table 11: Overall Summary of regional impacts

Region	EPSRC QT investments	Key Spinouts	Jobs Enabled	Investment Attracted	Infrastructure & co-investment
Scotland (Glasgow & Edinburgh)	QuantIC Hub (Glasgow, Phases 1-2); QCS Hub partner (Heriot-Watt)	7+ QuantIC spinouts (e.g., Singular Photonics, QLM Technology)	70+ high-value jobs directly enabled by QuantIC ~50% of Fraunhofer's ~50 technical staff trained via Hub/CDT 14 Postdoctoral Research Associates retained Phase 1→2	£8m additional R&D grants secured £65m industry projects facilitated £4.9m to Scottish organisations via Innovate UK (38 projects)	£3m Scottish Funding Council (QuantIC Innovation Space) £2.5m Heriot-Watt Optical Ground Station University of Glasgow ARC redevelopment
Oxford & South East	QCS Hub (Oxford, Phase 1-2); Partner in QComms Hub (Cambridge)	5 spinouts (e.g., Oxford Ionics, Inflection)	~100 staff at Oxford Ionics	Oxford Ionics $1b acquisition; multiple follow-on grants & venture capital rounds	Oxford Beecroft Building New Cavendish facilities in Cambridge Harwell Quantum Cluster
Bristol & South West	QTEC T&S Hub (Bristol); Quantum Engineering CDT (Bristol)	30 spinouts (e.g., Nu Quantum, FluoretiQ, Forefront RF)	229 high-value jobs (QTEC-founded companies, 2022)	£65m+ raised by QTEC companies (as reported in 2022) Nu Quantum - £60m (Series A funding, 2025) FluoretiQ - £4m	£35m Quantum Technologies Innovation Centre (West of England CA)
Birmingham & West Midlands	S&T Hub (Birmingham, Phases 1-2)	Delta.g	Delta.g: 4→16 staff (2023–25); 100+ PhD students trained	£34m non-EPSRC contributions in Phase 2 Delta.g £4.6m seed (2025)	Prototype Field Trials (HS2, Rolls-Royce) Aston quantum networks testbed

Region	EPSRC QT investments	Key Spinouts	Jobs Enabled	Investment Attracted	Infrastructure & co-investment
				£2.5m Department for Transport Small Business Research Initiative contract	
Nottingham & East Midlands	S&T Hub partner (Nottingham)	2 spinouts	20+	£3.1m Ministry of Defence contract (Cerca Magnetics)	Mobile quantum brain scanner deployed Nottingham-Birmingham magnetometry lab
London	2 T&S Hubs (UCL & Imperial) 2 CDTs (UCL & Imperial)	5+ spinouts	43% of InQuBATE postdocs founded/joined startups 89% of Imperial CDT graduates into industry	£1.2m Innovate UK Catalyst Fund (National Grid ESO) Phasecraft - $50m+ ORCA - £11.6m govt grant	Quantum Metrology Institute at the NPL
Wales (Cardiff / Newport)	QTEC T&S Hub graduates & spinouts	2 spinouts	QLM: 23 direct jobs Supply chain links to Bristol and Paignton	£12m Series A (2022, QLM) Photonics venture funding SLB (Schlumberger) integration	Compound Semiconductor Catapult (Newport); Cardiff compound semiconductor cluster provides adjacent sector synergies
Yorkshire & Humber (York)	QComms Hub lead (York, Phases 1-2)	4 spinouts	258 jobs (12% of Research Hub total) 12% of researchers into quantum industry	—	—
Lancaster & North West	Research Hub partner (Lancaster)	4 spinouts (e.g., Lancaster Helium)	—	—	—
Sussex	CDT partner (Sussex)	Universal Quantum	CDT-trained graduates entering industry	Significant venture funding – Universal Quantum	—

Source: Hub & CDT reports; Stakeholder interviews; Researchfish; and EPSRC Annual Reports

4.8 How has governance of the UK's Quantum Technology programme through NQTP and advisory structure enabled agility of research and projects as the quantum landscape evolved both domestically and globally?

Governance arrangements across the programme were an important enabler of coordination, oversight and responsiveness as the quantum landscape evolved, providing structures through which direction could be set, risks managed and partnerships sustained. However, while these mechanisms were widely valued and appear to have supported adaptability, there are areas for future development.

The following table provides a summary of how governance was assessed in relation to the EPSRC QT investments.

Table 12: Summary of best practice governance in relation to the EPSRC QT investments

Criterion	What Excellent Looks Like
Strategic Direction & Challenge	Board constructively shapes strategy and decisions, backed by evidence, with visible impact on Hub direction.
Expertise & Engagement	Board has the right mix of technical, commercial, policy and end user expertise, all actively engaged. An assessment of the expertise needed is completed regularly and action taken on any gaps.
Risk Oversight	Board identifies risks early, ensures robust mitigations, and contributes to resilience and continuity.
External Engagement	Board strengthens industry/government partnerships that are key to accelerating real world adoption and demonstrators.
Governance & Accountability	Board operates with high transparency, documentation, EDI integration, and consistent follow through.

Assessment

Strategic Direction and Challenge: Each Hub had governance structures in place, including either an External Advisory Board or Advisory Board, alongside mechanisms such as quarterly directors' meetings and PRF flexibility. Most interviews noted that governance bodies played a role in shaping direction at programme level and were perceived as important.

Expertise & Engagement: External Advisory Boards included representatives from academia, industry, and other strategic stakeholders, providing a broad range of expertise. They contributed to monitoring delivery, identifying risks, and offering challenge, indicating an active role in governance. However, it is not clear that expertise requirements were formally and consistently assessed or that actions were taken to address any gaps. Therefore, it is unclear if boards consistently had the appropriate mix of expertise or how actively and effectively members contributed in practice.

Risk Oversight: External Advisory Boards identified risks and monitored delivery against commitments. The governance arrangements supported continuity during COVID-19, enabling adaptation to disruption and supply chain challenges. However, there is limited evidence on the timeliness of risk identification, quality or robustness of mitigation strategies, beyond the COVID-19 example. This limited detail prevents a full assessment of robustness and consistency.

External Engagement: Governance structures included industry and wider strategic stakeholders, beyond academia. As the programme evolved greater emphasis was placed on industry engagement, translation and commercialisation. The broader governance and advisory arrangements supported coordination, partnership working, and sharing of best practice across the ecosystem. However, linked to the 'expertise and engagement' point above, there is insufficient evidence that the industry/wider stakeholders involved were those needed to push commercialisation.

Governance and Accountability: Governance structures included formal advisory boards with EPSRC representation, providing oversight and monitoring of delivery. The arrangements supported coordination, division of responsibilities, and continuity during disruption, indicating functional governance processes. However, there is a lack of consistent evidence on follow-through or accountability mechanisms (target setting etc) beyond general monitoring functions.

Stakeholders consistently described advisory bodies and related arrangements as valuable in shaping direction, monitoring progress and helping the programme respond to change. However, there are areas that could be strengthened, in particular (a) assessing whether the Boards had the skills/ expertise/ involvement needed to deliver on their roles and (b) increased evidence of follow through/ accountability mechanisms to deliver on the expected outcomes.

4.9 How the UK compares internationally

The UK's coordinated Hub model is widely recognised internationally as a distinctive strength, supporting collaboration, capability building and global influence. The UK performs strongly in quantum research internationally, combining high output with strong impact and visibility.

Hub Model

Stakeholders described the UK as an early pioneer in QTs whose international standing strengthened following the establishment of the Hubs and associated skills investments. Interviewees reported the UK is now widely recognised as a leading quantum nation, frequently referenced alongside the US. Indicators of this recognition include the replication of the UK Hub model overseas, strong international participation in UK quantum showcases, and perceptions among respondents that the UK ranks very highly for quantum start-up investment. Stakeholders also highlighted the UK's enhanced role in international standards development, global research networks and collaboration between governments, supported by national capabilities such as the NPL. In addition, 77% of Research Hub respondents felt that the Hubs boosted the UK's international reputation, with the same proportion citing improved international research standing.



> The [UK's] Quantum Technology Strategy was one of the first in the world at a national level, [it was] coherently organised and wide-ranging in its brief, both quantum computing and quantum technology. Since, similar efforts have been developed in various European countries and Australia now have a coherent strategy, largely built on what was developed in the UK
>
> *- QT Expert Consultee*

An example of the increased profile created is shown in the expansion of the National Quantum showcase event detailed below:

Cross-Hub Collaboration – The UK National Quantum Technologies Showcase
(International Recognition and Ecosystem Building)

Brief Background: The UK National Quantum Technologies Showcase was established as a collaborative, Hub-led annual event to create a single high-profile platform connecting researchers, companies, investors, policymakers and international partners across the UK's quantum ecosystem. The Hubs collectively organised and drove the Showcase from inception — with QuantIC hosting the first event, QComms exhibiting regularly and the S&T Hub contributing demonstrators — establishing the cross-sector collaboration model that defined it.

Impact: The most significant impact is the Showcase's growth from approximately 100 attendees at its inception to over 3,000 attendees and 110 exhibitors by 2025, making it one of the largest quantum technology events globally. *Physics World* described it as *"the Glastonbury of quantum events."* By 2025, the event attracted delegations from six or more countries, with the Department for Business and Trade hosting dedicated sessions for international delegates. The 2025 keynote

was delivered by the DSIT Permanent Secretary, and the announcement of £100 million in funding for new quantum research hubs was made at the 2024 event. The Showcase has served as a launchpad for partnerships (e.g., Nu Quantum's collaboration with the European Organization for Nuclear Research; Aquark Technologies' work with the Royal Navy) and a platform for skills, workforce development and science diplomacy — demonstrating how sustained cross-hub collaboration builds ecosystem infrastructure that extends well beyond individual research outputs.

Bibliometrics and commercial translation

Bibliometric analysis completed in March and longitudinal collaboration analysis completed in October 2026 indicates the UK produces high-quality QT research with publication output growing steadily since 2010. At the same time, global FWCI has generally trended down as volumes surge (with China the notable exception), underscoring intensifying competition.

Collaboration across the Hub institutional network was associated with high-impact research. The original bibliometric analysis identified 56 inter-Hub collaborative publications indexed in SciVal, with a mean FWCI of 2.41 compared with approximately 2.00 across QT Hub publications overall. Further longitudinal analysis found that collaborative publications within Hub consortia generally achieved higher FWCI than single-institution publications, while publications involving collaboration between institutions across different Hubs achieved particularly high citation impact.

However, the longitudinal analysis did not find evidence that establishing the Hubs increased the prevalence of institutional collaboration above underlying trends. During the pre-Hub comparison period (2010–2014), publications from Hub-member institutions had a 22% probability of involving intra-Hub collaboration. After controlling for the underlying time trend, neither the establishment of Phase 1 (OR 1.03; 95% CI 0.89–1.19) nor the transition from Phase 1 to Phase 2 (OR 0.87; 95% CI 0.65–1.16) was associated with a statistically significant change. A similar pattern was found for collaboration between institutions associated with different Hubs. During the pre-Hub comparison period, approximately 4% of publications from Hub-member institutions involved collaboration between institutions associated with different Hubs. The odds ratio for Phase 1 was 0.80 (95% CI: 0.58–1.09), while the odds ratio for the transition from Phase 1 to Phase 2 was 0.61 (95% CI: 0.33–1.14). Neither represented a statistically significant change. Although inter-Hub collaborative publications increased by around 5% per annum across the period, compared with an approximately 2% annual underlying trend for collaborative publications in the UK QT remit, the analysis did not identify a statistically significant step-change associated with either Hub phase.

Taken together, these findings show that collaboration across the Hub institutional ecosystem was associated with high citation impact, particularly where publications involved institutions associated with different Hubs. However, the longitudinal analysis did not identify a statistically significant increase in the prevalence of intra- or inter-Hub collaboration following the introduction of the Hubs or the transition from Phase 1 to Phase 2. The longitudinal analysis also did not identify evidence that the citation impact associated with collaborative publications increased following establishment of the Hubs. The bibliometric evidence therefore demonstrates the high impact associated with collaboration across the Hub institutional ecosystem, rather than an identifiable increase in either the prevalence or impact of collaboration attributable to Hub establishment.

Hub collaboration with industry also delivered strong research output performance. Co-authored Hub publications with industry accounted for 11.2% of publications and achieved a mean FWCI of 3.35, compared to 7.4% of publications and a mean FWCI of 2.66 across the wider UK quantum landscape.

UK performance and trends:

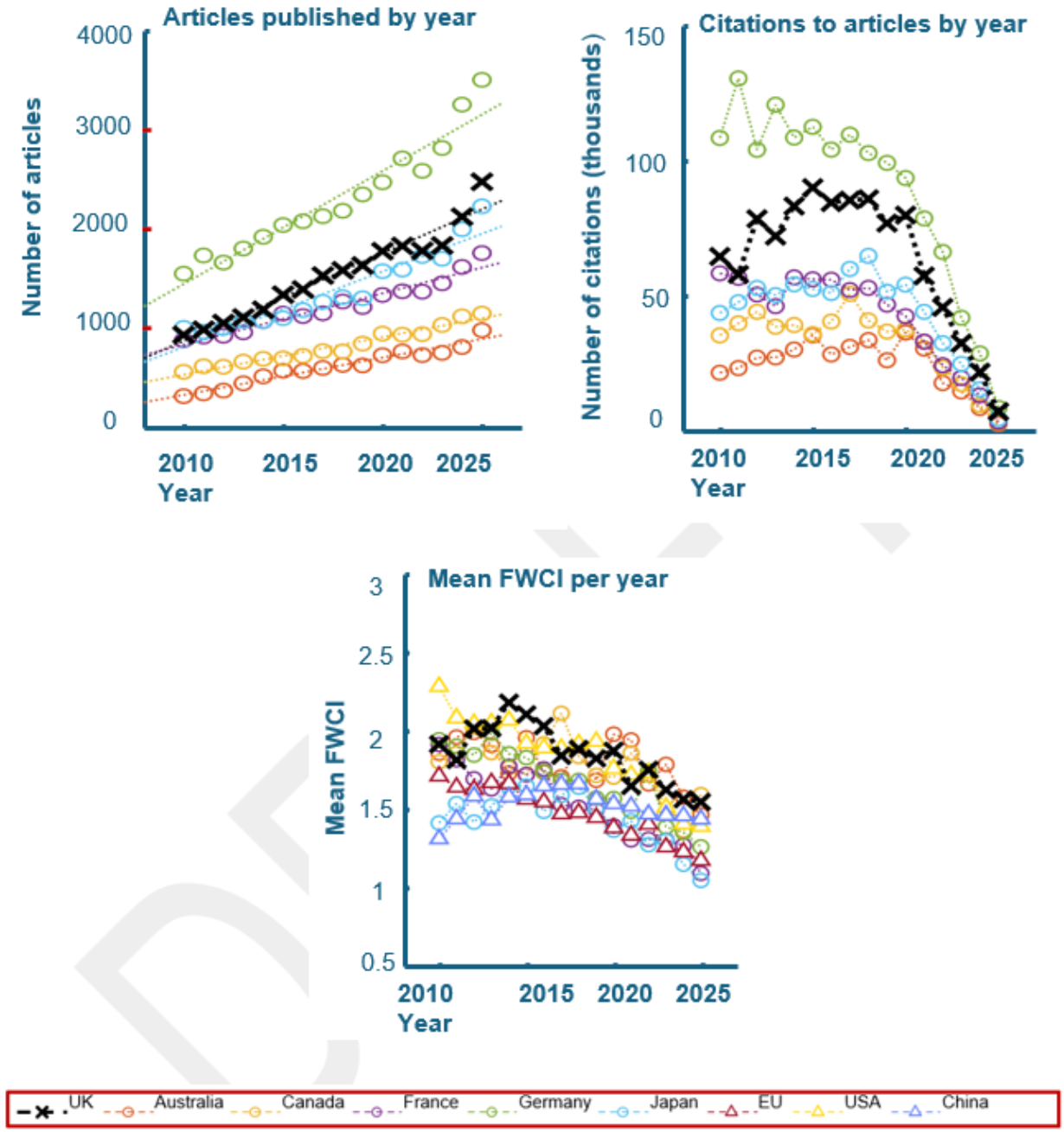
- **Scale and impact:** From 2010-2025, the UK produced ~25,500 QT journal articles accruing ~1.0M citations, with an average FWCI of ~1.85 – well above the world baseline (1.0). The share of UK outputs in the top 10% averaged ~20.5%, and top 1% averaged ~2.4% over the period. Annual publication counts rose from 933 (2010) to 2,479 (2025).
- **Global context:** As QT publication volumes accelerated worldwide, mean FWCI decreased across most territories (again, except China, whose impact held up alongside rapid growth), indicating a high output, high competition environment that can dilute average impact metrics.

International comparison of the UK to other QT-active, research-intensive countries:

- **Positioning of the UK:** The UK competes closely with the US (period averages of FWCI - UK 1.85; US 1.82) and is not consistently outperformed by any territory, despite the US and China producing larger volumes.
- **Peer comparators:** Figure 5 shows that Germany publishes more articles than the UK, while Japan publishes a similar volume. UK publications attract substantially more citations than Japan's but fewer than Germany's. However, the UK achieves higher impact by FWCI and top-percentile shares than both Japan and Germany. Canada and Australia, which have similar quantum programmes, perform strongly, but the UK's impact remains highly competitive across the period.
- **Distinctive UK feature:** The UK's 2014 FWCI uplift is not observed in other territories' time series, suggesting a UK-specific dynamic during that period.

The UK demonstrates growing capability in translating quantum research into application. The strongest research-to-use pathways are in applied areas such as sensing, imaging, communications and quantum computing. Examples include Cerca Magnetics, QLM Technology and ORCA Computing, which demonstrate progress from research into commercially visible technologies, industrial applications and customer-facing systems. Commercial translation in the UK nevertheless remains at an earlier stage than in larger, more industry-led ecosystems such as the US and China. The EPSRC QT investments have helped establish the conditions for translation by building a connected research and innovation ecosystem, strengthening links with industry, and creating pathways into applied sectors including healthcare, defence, transport and communications. However, many technologies are still at the prototype, demonstrator, research-use or early deployment stage. The evidence base is therefore concentrated on spinouts, prototypes, demonstrators, trials and early deployment, with more limited evidence of product revenues, routine end-user adoption, procurement at scale, or comparable international benchmarking of commercial performance.

Figure 5: Performance of the UK compared to other quantum technologies active countries



Source: Bibliometric analysis completed by James Millen at King's College London (March 2026)
Note: Bibliometric data for QT articles covers the period from 2010 to 2025.

The evidence shows that the UK is internationally competitive in quantum science, combining high-quality research outputs with a coordinated ecosystem of research institutions, industry partners, investors and skills programmes. While global competition is intensifying and commercial translation remains less mature than in some larger economies, the evaluation identified strong evidence of spin-out creation, private investment, industry engagement and early-stage commercialisation. The UK's challenge therefore appears to be one of scale relative to major competitors such as the US and China, rather than a lack of capability. Overall, the UK is well positioned internationally across research, innovation and ecosystem development, and EPSRC's investments have made a significant contribution to establishing and sustaining that position.

5 Conclusions and Recommendations

5.1 Conclusions

Benefits of the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs to the academic community, as well as the benefits to the international competitiveness of UK science

Benefits of the Research Hubs, T&S Hubs and quantum-relevant CDTs to the academic community

The EPSRC QT investments have fundamentally reshaped the UK academic quantum landscape, strengthening it from a relatively fragmented base into a more coordinated, capability-rich and strategically aligned system.

The investments:

- Provided sustained investment in infrastructure and facilities, enabling universities to develop specialist laboratories, equipment and experimental capability. In turn, this has expanded research capacity and enabled both the deepening of foundational science and greater progression towards application-focused research.
- Played a significant role in strengthening interdisciplinary working by bringing together researchers from multiple disciplines and supporting the development of hybrid skillsets, which have enabled progress in complex research areas that require integrated approaches.
- Supported movement from fundamental research towards early-stage applications and demonstrators, while maintaining the depth and quality of underlying scientific capability.

Fortia Insight survey respondents perceived that the investments strengthened research capability and collaboration.

Benefits to the international competitiveness of UK science

The EPSRC QT investments have translated into a more prominent and competitive international position for the UK in quantum

The evidence indicates that the EPSRC QT investments have:

- Supported strong research quality, as evidenced in the bibliometric analysis. Inter-Hub collaborative publications achieved a mean FWCI of 2.41, compared with an overall average of around 2.00 across all QT Hub publications. This indicates that collaboration across institutions participating in the Hub ecosystem is associated with particularly high-impact research. Publications co-authored with industry demonstrate even higher impact, with a mean FWCI of 3.35, highlighting the strength of links between the academic research base and applied innovation pathways.
- Strengthened the positioning of the UK within global quantum ecosystems. The Hubs have supported international collaboration, knowledge exchange and the integration of UK research into global innovation pathways. This has enhanced both the visibility of UK research and its influence within the quantum field internationally.

Further longitudinal analysis found that this high impact did not coincide with a statistically significant increase in the prevalence of collaboration following establishment of the Hubs. After taking account of underlying trends, neither the introduction of Phase 1 nor the transition to Phase

2 was associated with a significant increase in intra- or inter-Hub institutional collaboration. This suggests the principal bibliometric distinction is the high impact associated with collaboration across the Hub institutional ecosystem, rather than evidence that establishment of the Hubs increased either the prevalence of institutional collaboration above underlying trends or the citation impact associated with collaborative publications. In addition, the evidence also highlights constraints on the UK's competitive position. The global quantum landscape is characterised by increasing investment in other countries and the growth of more developed, industry-led ecosystems elsewhere, with countries following a similar model to the UK.

Contribution to the UK economy including the impact of the research, training and skills development, and collaboration

The EPSRC QT investments have made a substantial contribution to the UK economy by strengthening the foundations of the quantum innovation system and enabling the progression of research towards economic application. This contribution is reflected not only in measurable outputs such as spinouts, investment and employment, but also in the development of the capabilities, skills and collaborative structures required to support sustained economic impact.

There is clear evidence of commercialisation and business growth. The EPSRC QT investments have delivered:

- 74 spinouts, spanning both Research Hubs and T&S Hubs, demonstrating the capacity of the research base to translate into new ventures.
- Substantial levels of private investment, estimated at £464.5m for the Research Hubs and £22.4m for the T&S Hubs. This indicates strong external confidence in the commercial potential of UK quantum research.
- 2,115 high-value jobs (from Research Hubs), with a further 229 jobs reported by the T&S Hubs, although this is likely to understate total employment effects due to incomplete reporting. These roles reflect the development of a highly skilled workforce aligned to the needs of an emerging, high-growth sector.
- A substantial pipeline of advanced talent, including approximately 419 PhDs and postdoctoral researchers through the Research Hubs, 49 PhDs through T&S Hubs, and a further cohort of CDT researchers.

In addition, evidence from the Fortia Insight surveys indicates that 93% of surveyed researchers progressed into quantum-relevant roles and a notable proportion moved into startups or entrepreneurial activity. This reflects both the strength of the training provided and its alignment with industry demand. The evidence also shows that skills development was not purely academic. The T&S Hubs and CDTs included industry-linked and commercialisation-focused elements, including placements, co-funded projects, industry supervision, entrepreneurial training and market discovery. Case study evidence, including Siloton and Cerca Magnetics, shows how these pathways supported progression into startups, product development and end-user-facing applications

However, structural constraints remain. These include the concentration of provision at doctoral level and stakeholder feedback that training could place greater emphasis on commercialisation, industry engagement and practical application. While doctoral level training remains essential and is the primary mechanism within EPSRC's remit, stakeholders identified scope to strengthen engineering, systems integration and other practical industry facing capabilities required to translate quantum research into deployable products and services. There was also evidence of broader capability needs beyond doctoral training, although the specific qualification levels and responsibilities involved were not consistently defined. These findings suggest that, while the EPSRC investments have established a strong foundation for workforce development, the skills ecosystem will need to continue evolving to support commercialisation, scale-up and deployment,

with EPSRC playing an important convening, coordinating and influencing role alongside wider partners.

Overall, the EPSRC QT investments have made a significant contribution to the UK economy by linking high-quality research, advanced skills development and collaborative networks to early-stage commercialisation and sector growth. The evidence points to a strengthening innovation system that is beginning to generate tangible economic returns, while also highlighting the importance of continued investment and system development to sustain and scale these impacts.

Aggregate economic impact and the corresponding Return on Investment, including the impact on UK Industry

The EPSRC QT investments have generated a positive aggregate economic return, with monetised benefits exceeding total costs under both conservative and more optimistic scenarios. This reflects the combined effect of multiple reinforcing impact pathways, underpinned by the translation of research into innovation, the creation of high-value employment, and the development of skills aligned to industry needs. Across the investments, total funding of £367.5m has generated estimated monetised benefits of between £545.6m and £571.6m, against total costs of £442.8m. This results in a BCR of between 1.23 and 1.29, indicating that the investments have delivered a net positive economic return.

Specifically:

- Research Hubs achieving a BCR of 1.21 to 1.24 and T&S Hubs achieving higher returns, from 1.73 to 2.68, reflecting differences in focus and pathways to impact.
- Monetised impacts from spinouts account for most of the total benefits, including £464.5m generated through Research Hub spinouts and a further £22.4m from T&S Hub spinouts. This highlights the central role of the EPSRC QT investments in translating academic research into commercially viable businesses and strengthening the UK's emerging quantum industry base. Additional smaller contributions arise from intellectual property generation, including patents and downstream knowledge diffusion.

Overall, the evidence indicates that the EPSRC QT investments are beginning to deliver measurable economic returns, driven primarily by innovation and early-stage industry formation. While impacts remain concentrated in the early stages of commercialisation, the results point to a strengthening innovation pipeline with the potential to generate greater returns over time as technologies mature and scale within the UK economy.

Likely impact of not having the Quantum Technology Research Hubs, T&S Hubs and Quantum-relevant CDTs on UK science

In the absence of the EPSRC QT investments, the UK's quantum research system would have been smaller in scale, less integrated and less internationally competitive, with slower scientific progress and weaker connections to industry and economic impact.

Integrated delivery model: the combined delivery of Research Hubs, T&S Hubs and CDTs was central to programme performance. The model provided scale, coordination and visibility that would not have been achievable through fragmented project-based funding. This enabled alignment across institutions and sectors, strengthened collaboration, and supported early-stage translation through prototypes, demonstrators and industry engagement. The EPSRC QT investments also fostered a connected ecosystem linking academia, industry and government. This reduced fragmentation and supported the emergence of spinouts, investment and partnerships. However, many economic impacts remain early-stage, with downstream benefits still emerging and not yet fully evidenced.

The Hubs enabled the scale and continuity required for ambitious, mission-driven research programmes, bringing together expertise across institutions and disciplines. Without this **coordinated framework**, research activity would likely have remained dispersed across smaller projects, limiting the ability to align effort, build critical mass and sustain progress in strategically important areas. This would have had direct implications for the depth and capability of the UK research base.

The EPSRC QT investments supported **the development of advanced infrastructure and institutional capability** that underpin high-quality research. Without these, universities would have had more limited capacity to undertake complex experimental work, and the pace and quality of scientific advancement would likely have been reduced. The absence of the EPSRC QT investments would also have constrained the translation of research into application.
The Hubs provided structured mechanisms for engagement with industry, lowering barriers to collaboration and supporting early-stage translational activity. Without these mechanisms, industry engagement would likely have been more ad hoc and less effective, resulting in weaker pathways from research to innovation, reduced awareness of quantum technologies among potential users, and slower development of commercial applications.

Skills development represents a further critical impact pathway. Without coordinated investments in **training and doctoral provision**, the UK would likely have developed a smaller, less cohesive and less industry-aligned talent pipeline. This would have constrained both research capacity and the growth of the emerging quantum sector. At an individual level, researchers would have faced more limited access to networks, funding and progression opportunities, reducing the likelihood of movement into leadership roles, entrepreneurial activity and investment pathways.
Overall, the absence of the EPSRC QT investments would have resulted in a less coherent national ecosystem, with weaker coordination, reduced collective identity and a more limited ability to present a unified proposition to policymakers, investors and international partners. This would have diminished the UK's visibility and attractiveness as a location for quantum research and innovation, constraining its ability to attract further investment and sustain momentum in a highly competitive global landscape.

How these investments have supported regional growth or provided benefits to particular parts of the UK

The EPSRC QT investments have supported regional growth and generated place-based benefits across multiple parts of the UK, although impacts are uneven and most pronounced in areas with established quantum capability.

In regions with existing strengths, the EPSRC QT investments have acted as anchor institutions, supporting the development of local quantum ecosystems and enabling concentrations of innovation activity. For example, in Bristol, Hub activity has supported a significant cluster of startups, with over 30 firms raising more than £65m in investment and creating around 229 high-skill jobs. Similarly, in Scotland, Hub activity has underpinned the development of a growing ecosystem, including seven spinouts, over 70 high-value jobs, engagement with 62 companies, and the attraction of additional funding and industry collaboration. These examples illustrate how the investments have strengthened regional innovation capacity and supported the emergence of locally concentrated economic activity.

Beyond these established clusters, the EPSRC QT investments have also contributed to regional development through firm-level growth and ecosystem building. In Birmingham, activity linked to quantum sensing has supported the expansion of companies such as Delta.g, which has grown significantly in both employment and funding. More broadly, London has emerged as a major concentration of quantum skills and startup activity, while Yorkshire and the Humber has seen

substantial employment effects linked to Hub activity, with 258 jobs reported. However, the evidence indicates that these impacts are not evenly distributed. In regions without pre-existing clusters, the primary benefits relate to skills development, collaboration and access to networks, rather than large-scale industry growth. This reflects the importance of underlying capability and ecosystem maturity in realising economic benefits.

Qualitative stakeholder feedback indicates that public investment is most effective when aligned with ecosystem maturity. This includes reinforcing cluster effects in established regions, while deploying targeted interventions to build capacity in emerging areas. Sustained impact therefore depends on balancing the concentration required for research excellence with approaches that support broader ecosystem development over time.

Overall, the EPSRC QT investments have supported the development of a UK-wide quantum ecosystem, strengthened key regional clusters while also providing broader benefits through skills, collaboration and knowledge exchange. However, the distribution of economic impact remains concentrated, with the greatest benefits realised in regions with strong existing capability and infrastructure.

How the UK compares internationally

The UK compares favourably internationally, with a strong and competitive research base, high-impact outputs and a distinctive, coordinated model of investment. While translation to large-scale commercial outcomes remains at an earlier stage and global competition is intensifying, the UK has established a robust platform for continued international competitiveness, subject to sustained investment and further progress in translating research into industrial application.

A key feature of the UK's international position is its ability **to deliver high-impact research** despite operating at a smaller scale than some comparator countries. Bibliometric evidence shows that the UK consistently achieves citation impact above the global baseline and maintains a strong share of highly cited publications. While countries such as the United States, China and Germany produce higher volumes of research, the UK demonstrates comparable or higher impact metrics. Relative to countries such as Japan and Germany, UK publications perform more strongly on impact, while remaining competitive with peers including Canada and Australia. This indicates that the UK has sustained a position of quality and influence within the global research landscape.

The UK's **ecosystem-based model represents a further source of competitive strength**. The integration of Research Hubs, skills investments and collaboration mechanisms has created a more coordinated national system than is seen in many comparator countries. This has enabled the UK to act as a convenor within global quantum networks, strengthening engagement across academia, industry and government and supporting international collaboration. Stakeholder evidence reinforces this position, with the UK widely recognised as a leading quantum nation and early pioneer, often referenced alongside the United States and seen as influencing international approaches to quantum development. This international position is also reflected in the growing scale, reach and role of national platforms.

The QT Showcase has developed from a relatively small, domestic-facing event into one of the largest global QT forums, expanding from around 100 attendees at inception to over 3,000 attendees and 110 exhibitors by 2025. It now attracts a wide range of international delegations and participants across academia, industry and government, providing a focal point for showcasing UK capability, facilitating partnerships and signalling the UK's leadership within the field. This growth illustrates not only increased visibility, but also the UK's role in shaping and convening the global quantum ecosystem. However, the UK operates within an increasingly competitive global environment and at a comparatively lower level of investment than some leading countries. While

progress has been made in commercial translation, activity remains largely concentrated at the stage of prototypes, demonstrators and early deployment, rather than large-scale industrial adoption or mature markets.

Governance, EDI and monitoring

Several cross-cutting issues are key to informing future delivery. These are:

- **Governance and oversight:** governance structures were consistently implemented across the EPSRC QT investments and were widely perceived as important and functional. They contributed to strategic direction, monitoring and coordination, and supported adaptation to external challenges. However, the evidence base is limited on how governance drove measurable changes at Hub-level, whether the expertise, or accountability mechanisms were sufficient. As a result, while governance played an important enabling role, there are opportunities for further development.

- **EDI:** there is consistent evidence of EDI activities, including targeted recruitment approaches, inclusive governance practices and outreach activity. However, there is no systematic evidence of outcomes. The absence of consistent data, KPIs and tracking mechanisms means it is not possible to assess whether these activities resulted in measurable improvements in representation or progression. Also, leadership diversity remains limited at Hub-level, indicating further scope for improvement.

- **Monitoring, evaluation and data limitations:** the EPSRC QT investments were supported by established reporting mechanisms, with Research Hubs, T&S Hubs and CDTs required to report through formal grant conditions and annual reporting. This enabled collection of information in core areas, including research activity, skills development, collaboration and early-stage commercialisation**.** However, data is not consistently collected across the investments and coverage is stronger for activities and outputs than for longer-term outcomes. Key metrics such as jobs, investment and commercialisation are partially captured and are likely to underestimate the full scale of impact. In addition, there is limited tracking of outcomes over time, including workforce progression, spinout performance and wider technology adoption. Strengthening consistency, outcome-level tracking and longitudinal data collection would be required to fully capture longer-term and system-level impacts.

5.2 Recommendations

The findings indicate that EPSRC's QT investments in the Research Hubs, T&S Hubs and quantum-relevant CDTs have delivered clear benefits across academic capability, international competitiveness, workforce development, ecosystem coordination and early economic impact. The evidence also identifies areas for strengthening, particularly in skills, EDI measurement, governance, and the capture of longer-term and wider system impacts. The recommendations below are therefore intended to:

- keep and extend areas of demonstrated success; and
- address key limitations evidenced in the findings

Recommendation 1: EPSRC should continue to invest in Research Hubs and skills investments as an integrated package, rather than as separate or standalone interventions

Detail: Future investment should retain the core features identified as central to programme effectiveness: long-term funding, national coordination, interdisciplinary collaboration, and strong links between research, training and application. The evidence indicates that the Hubs, T&S Hubs and CDTs were most effective when operating as a coordinated system. Next steps could include:

- maintain a nationally coordinated Hub model convening leading capability across institutions and sub-fields;
- embed doctoral and researcher training within the wider research and innovation architecture;
- sustain mechanisms enabling cross-institutional collaboration, shared infrastructure and engagement with industry and public sector users; and
- continue to support application-aware research alongside foundational science.

Evidence: Evidence shows the investments transformed a fragmented landscape into a coordinated, interdisciplinary national system, with Hubs and CDTs providing strategic focus, shared infrastructure and cross-institutional collaboration. Qualitative and survey evidence indicates that the Hub model strengthened research capability and supported cross-institutional working, while bibliometric evidence shows that collaboration across the Hub institutional ecosystem was associated with high-impact outputs, particularly for collaboration between institutions associated with different Hubs.

Rationale: The strongest cross-cutting finding is that programme benefits arose from the combined effect of coordinated investment across research, skills and ecosystem development. Sustaining this integrated model is therefore critical to maintaining momentum and maximising future impact.

Recommendation 2: EPSRC should further develop and sustain doctoral-level quantum training as a central pillar of the UK quantum ecosystem

Detail: The evidence indicates that doctoral-level training is most effective when integrated with research, industry engagement and innovation pathways. Next steps could include:

- sustain and expand doctoral-level training provision to ensure a sufficient pipeline of quantum-skilled researchers;
- strengthen alignment between doctoral training, Research Hubs and industry to improve integration, knowledge exchange and application;
- enhance the industry-facing and practical components of doctoral training, including placements and applied research opportunities; and

Recommendation 2: EPSRC should further develop and sustain doctoral-level quantum training as a central pillar of the UK quantum ecosystem

- ensure doctoral training programmes are responsive to evolving skills needs, including interdisciplinary and systems-level capabilities.

Evidence: The CDTs and T&S Hubs delivered a high-quality, interdisciplinary talent pipeline, with strong progression outcomes, including high transition into quantum roles and startups. Training combined academic and industry exposure, with placements and co-funded projects supporting practical application and knowledge exchange.

Rationale: The UK Quantum Skills Taskforce report suggested it is not yet clear if the commitment made in the National Quantum Strategy to fund over 1,000 PhD studentships between 2024 and 2034, will be sufficient to meet future demand, given the rapidly growing sector. It also states market analysts project that new jobs created globally in the quantum computing sector reach 250,000 by 2030, and 840,000 by 2035, with many attributed to leading quantum nations such as the US and UK. This equates to a significant increase in the number of jobs in the sector globally by 2030. Key stakeholders highlighted doctoral level training as a key mechanism to develop quantum PhD graduates and grow the UK quantum workforce and is critical to attracting, retaining and developing talent in a globally competitive field. Without continued and expanded investment, there is a risk the UK will face constraints in workforce capacity, limiting future growth and competitiveness. However, doctoral training needs to take on board the need for more commercialisation experience/expertise.

Recommendation 3: EPSRC should work with partners across the skills and innovation landscape to ensure the UK quantum workforce continues to develop the engineering, systems-integration and practical industry-facing capabilities required for commercialisation / deployment

Detail: Skills should continue as a central pillar of the EPSRC QT investments. As the sector matures, EPSRC should continue to evolve its offer within its remit and work with partners where capability needs extend beyond it. Next steps, in collaboration with others, could include:

- Continuing to strengthen the industry-facing and practical components of doctoral training, including placements, co-funded projects and exposure to end users.
- Supporting the development of engineering and systems-integration capabilities required to translate quantum research into deployable products and services.
- Retaining interdisciplinary entry routes that bring together quantum science, engineering, computing and commercial expertise.
- Ensuring training remains responsive to evolving industry needs associated with scale-up, validation, deployment and commercialisation.

Rationale: The skills model has been a major source of programme value, supporting the development of a strong pipeline of highly skilled quantum researchers and contributing to talent retention and attraction. Evidence also suggests that industry engagement, commercialisation support and applied training have helped researchers translate academic innovation into commercially relevant applications. However, stakeholders highlighted that future growth of the sector will require a broader mix of capabilities alongside doctoral-level quantum expertise, particularly engineering, systems-integration and other practical industry-facing skills associated with commercialisation, scale-up and deployment. While the evidence identifies these emerging capability needs, it does not clearly indicate the specific qualification levels required or the extent to which these fall within EPSRC's remit. As such, continued development of the skills offer will require collaboration across the wider skills and innovation landscape.

Recommendation 4: Strengthen structured pathways from research and training into commercialisation, end-user engagement and deployment

Detail: Future programme design should build on existing translational strengths while making pathways to application more explicit and better supported. EPSRC could:

- continue to support industry-facing collaboration mechanisms;
- retain flexibility for prototypes, demonstrators and testbeds;
- strengthen career pathways into startups, industry and national infrastructure; and
- improve the capture of evidence on downstream adoption and wider sector impacts.

Evidence: The investments have supported clear but still developing pathways from research to commercial outcomes, evidenced by spinouts, significant private investment, and progression from prototypes to real-world demonstrations and products. Case studies show Hub-enabled transition from research to commercial ventures, though many technologies remain at early deployment stages.

Rationale: Strengthening pathways and evidence capture will help convert this progress into sustained and demonstrable impact.

Recommendation 5: Adopt a differentiated, place-sensitive approach to quantum investment that reflects regional ecosystem maturity

Detail: Future quantum policy should reflect differences in regional ecosystem maturity and capacity. This should maintain research excellence as the foundation of the UK quantum ecosystem, while tailoring delivery to maximise value for money. For regions with established capability and critical mass, investment should focus on reinforcing cluster effects, sustaining infrastructure and strengthening links between research, industry and investors. For emerging regions, more targeted mechanisms should build capability, including skills, translation and alignment with existing sector strengths.

Evidence: Regional impacts are closely linked to ecosystem maturity, with the strongest effects observed in locations with sustained investment and existing research capability. In these areas, the investments acted as anchor institutions, supporting spinouts, high value employment, infrastructure investment and local ecosystem development. There is also evidence of benefits in emerging regions, where targeted activity supported commercially relevant outcomes and connections to adjacent sectors. However, impacts are not evenly distributed, with regions lacking established capability primarily benefiting through skills, collaboration and network effects rather than large scale economic growth. Stakeholder evidence highlights that returns to public investment are contingent on the presence of supporting ecosystem factors.

Rationale: A differentiated approach is required to maximise value for money, as investment generates different outcomes depending on regional context. Where critical mass exists, continued investment reinforces clusters and supports scale-up and international competitiveness. In emerging areas, targeted interventions are needed to build capacity and enable participation in the wider ecosystem. Balancing these approaches is essential. Maintaining concentration is necessary to sustain research excellence, while complementary mechanisms enable broader ecosystem development over time. A place sensitive framework will therefore improve efficiency by aligning investment with regional capability and supporting both global excellence and wider economic benefit.

Recommendation 6: EPSRC should move beyond process-level EDI activity and introduce clearer measurement, reporting and accountability for diversity outcomes

Detail: Future requirements should emphasise measurable outcomes alongside existing inclusive practices. EPSRC should:

- define a core set of EDI indicators;
- require regular outcome-based reporting;
- embed clear accountability within governance structures; and
- retain and evaluate effective inclusive practices.

Any additional monitoring requirements should be proportionate and focused on generating meaningful evidence rather than increasing administrative burden.

Evidence: Evidence shows extensive EDI activity embedded across governance, recruitment and training, including structured plans, inclusive recruitment practices and outreach activity. However, there is no systematic evidence of measurable improvements in diversity outcomes, and limited tracking of representation, progression or leadership diversity.

Rationale: Strengthening measurement and accountability will enable more effective assessment and targeted improvement.

Recommendation 7: EPSRC should retain existing governance strengths while strengthening evidence of challenge, expertise review and follow-through

Detail: Continue with the existing structures and processes, however operate with greater clarity and traceability:

- require explicit assessment of board expertise needs;
- strengthen recording of challenge, decisions and actions;
- maintain effective risk oversight and coordination mechanisms; and
- clarify expectations on accountability and follow-through.

Evidence: Governance structures provided oversight, coordination and risk management, contributing to programme direction and continuity. However, evidence is limited on how challenge translated into decisions, with no consistent evidence of formal expertise review, systematic gap identification, or clear links between challenge, decisions and outcomes.

Rationale: Targeted improvements will strengthen both programme delivery and future evaluation.

Recommendation 8: Strengthen monitoring and evidence collection to better capture longer-term, downstream and regional impacts

Detail: Future monitoring should support more consistent and longitudinal assessment of a wider range of programme impacts. EPSRC should:

- standardise monitoring of employment, progression, commercial and regional outcomes;
- strengthen evidence on adoption, procurement and sector uptake;
- ensure consistent reporting across investments; and
- establish a longitudinal evidence approach for post-programme impacts.

Evidence: The evaluation identifies gaps in the consistency and coverage of monitoring data, particularly for longer-term outcomes such as downstream adoption, sector uptake and wider system impacts, which are not yet systematically captured.

Rationale: Strengthening monitoring will improve the ability to demonstrate value, understand system effects and inform future investment design.

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