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June 2025

Impact Evaluation of ISCF Quantum Technologies

Final Impact Evaluation

Charlotte Glass, Paula Knee, Lizahn van Gend, Nadya Mihaylova, Aphra Murray, Todd Cook, Adebisi Adewusi, Advait Deshpande, Beth Whittaker, Tia J'Nae Murray

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Executive summary

This report presents the final impact evaluation of the Industrial Strategy Challenge Fund for Commercialising Quantum Technologies (ISCF QT).

The programme

The ISCF QT was funded under Wave 2 and Wave 3 of the Industrial Strategy Challenge Fund to accelerate technology commercialisation in the emerging UK Quantum Technologies (QT) sector. As announced in the 2017 Industrial Strategy, it began as a relatively small-scale £20m ISCF Pioneer programme in 2018 (under ISCF Wave 2) and was extended to a full-scale ISCF programme running for six years from 2019 to 2025 with a further £153m of funding. The programme was designed to support the UK's strategic ambition to take a lead in the growing global QT market and to accelerate the development of a critical enabling technology with the potential for large-scale cross-sectoral impact. Importantly, and unlike most other ISCF programmes, the ISCF QT was also an integral part of the second phase of the wider National Quantum Technologies Programme. This meant that the NQTP covered the full R&D and innovation pipeline, with the ISCF QT focused almost exclusively on industry-led activities.

The overarching objectives of the ISCF QT programme were to:

- Increase sales of products and services by UK companies, spanning component-level technology, systems integration and QT-enabled products and services
- Increase UK businesses' investment in QT R&D and improved R&D capability and capacity
- Increase multi/interdisciplinary research around the challenge areas
- Increase business-academic engagement on innovation activities relating to the challenge areas

While the Pioneer phase focused on three themes in QT (sensing and timing, imaging and communications) with the intention of demonstrating early benefits to showcase the technology, the full-scale ISCF was extended to include quantum computing, where there was considerable start-up and investor interest despite the longer expected time scales to commercial benefits.

The programme was managed by Innovate UK and funding was allocated via a suite of mechanisms designed to address challenges and needs in the emerging sector, targeting different stages of technology and company development and all segments of the supply chain. These were a combination of Innovate UK's well-established mechanisms to support industry-led projects (Collaborative R&D, Feasibility Studies) alongside experimentation with more novel approaches (Germinator and Technology Development Projects, an Investment Accelerator).

The programme allocated £172.3m, just under its £173m budget, to 136 projects via nine competitions for funding.

- The majority of projects by number were Feasibility Studies – 88 projects representing 65% of all projects with an average project value of £364k; while the majority of funding (79%) was allocated to the large-scale Collaborative R&D (CR&D) and Technology Projects – 32 projects with a total value of £135.5m and average project value of £414k.
- The programme supported 189 unique organisations (programme 'participants') and 573 participations in projects, with participations being higher as many organisations (48%) were involved in more than one project. Demand for the programme was high, attracting 262

applications in total, of which 70% (n=183) were of high enough quality for funding, though only 136 of these could be funded.[1]

- Of the 189 unique participating organisations, 55% were SMEs (the majority of which were micro and small businesses), 23% were large enterprises, 17% universities, and 4% were Research and Technology Organisations (RTOs). Importantly, projects were driven by SMEs. 98% of projects involved SMEs and 92% of projects were led by SMEs. The majority of projects (80%) involved collaborations between industry and universities and/or RTOs.
- Business participants spanned the QT supply chain, including those involved in the 'core' QT sector developing and manufacturing QT components and systems (39% of all participants at the time of application)[2] plus those providing highly specialised underpinning technologies (18%) and end-users and potential end-users of QT (19%).
- Key university QT research groups and RTOs were involved in multiple projects. This was particularly the case for Fraunhofer UK and NPL, who were involved in 30 and 23 projects respectively and, in most cases, these RTOs were invited by industry to participate in their projects, indicating their key role in the UK QT sector.
- The programme supported projects across five key themes in quantum technologies, with the largest share of funding assigned to quantum computing (42%), 18% to sensing and timing, 17% to communications, 13% to quantum components and 10% to imaging – with the distribution driven largely by sector demand.

Overarching conclusion

Since the launch of the ISCF QT programme in 2018, the global QT landscape has evolved rapidly, marking a significant shift from foundational research toward real-world application and commercialisation. At the time of the programme's inception, QT was largely confined to academic and theoretical research environments, with limited industrial engagement and few demonstrable use cases beyond the laboratory. Today, the market has evolved considerably. Internationally, major public and private sector investments have accelerated progress across quantum computing, communications, sensing, imaging and metrology. While a commercially available quantum computer is still several years away, applications in communications, sensing, imaging and metrology are much closer to market with initial products already available and early adopters exploring their potential. A growing ecosystem of start-ups, scale-ups, and large corporates is exploring commercial models and integrating quantum capabilities into their R&D pipelines.

This evaluation concludes that the ISCF QT programme has made a substantial contribution to the development of the ecosystem for commercialising QT, and made significant progress in realising its objectives across all the main areas of expected outcome and impact, as identified in the programme's Theory of Change:

- New knowledge, skills and capabilities
- R&D investment
- New QT technologies, products and services
- Commercially successful QT businesses
- Growing the UK's QT Sector
- Supporting a world-leading QT sector in the UK

[1] Process Evaluation of the ISCF Quantum Technologies, June 2025, Technopolis

[2] Proportions can change over time as some businesses supported are acquired by other businesses or cease trading

ISCF QT has supported the development of new knowledge, skills and capabilities

The development of new knowledge, skills, and capabilities in QT is of critical importance as it underpins the UK's ability to both generate new insights and to translate cutting-edge research into practical applications and commercial opportunities.

- The ISCF QT programme has enabled participating organisations to produce codified knowledge assets in the form of 98 patents, with more expected in the future as technologies are developed further.
- While programme participants (i.e. those funded via the ICF QT) were more likely to apply for patents than unsuccessful applicants (the counterfactual control group), both before and after their participation in the ISCF QT programme, participants experienced greater success in applying for QT-related patents after the end of their programme activities.
- The programme played a strong role in the development of participants' technical skills and knowledge, and in the skills and knowledge required to successfully translate and bring their solutions to market.

ISCF QT catalysed R&D investment

Increasing R&D investment is a core objective of the ISCF QT programme and the wider Industrial Strategy Challenge Fund. One of the driving rationales for the programme is de-risking early-stage innovation in order to encourage greater private sector investment in R&D in the QT sector. The evaluation found that the programme leveraged private sector investment and de-risked further investment into R&D, thereby catalysing increased expenditure on R&D by industry participants:

- During its lifetime, the programme leveraged £70m in matched funding from participants – almost all (99.8%) from industry.
- At the end of ISCF QT projects, the majority of participants (78%) were planning to conduct further R&D, expecting to spend, on average (median), a further £250k to continue the development of their project outputs towards commercialisation. The counterfactual analysis indicated that they would do so at a higher level than unsuccessful applicants to the programme - £252k for participants, and £22k for unsuccessful applicants.
- Participants were clear that the programme de-risked their R&D and innovation activities in QT. Firstly, by supporting their technology development activities, and validating and providing further assurance as to the viability of both their (potential) products and their organisation, so increasing their credibility with potential partners and investors. Secondly, the very existence of the programme and its clear strategy supporting commercialisation of QT provided an increased level of confidence in increasing their R&D activities.

ISCF QT enabled the development of new QT technologies, products & services

The development of new quantum technologies, products, and services was central to the ISCF QT. At the outset of the programme, many quantum technologies were still in the early stages of development, requiring intensive R&D to create reliable, demonstrable hardware or core technology platforms. The evidence shows that the programme has made a significant and measurable contribution to accelerating the development and launch of quantum technologies:

- 97% of projects increased the Technology Readiness Level (TRL) of their product by an average of 2.3 TRL levels. In the years since, many participants have been able to progress technologies critical to their business beyond the development phase and into demonstration and commercialisation. Though a considerable proportion of businesses' critical QT technologies are still in the early stages of development, reflecting the longer innovation timelines associated with deep tech sectors like quantum.

- Programme participants were significantly more likely than unsuccessful applicants to launch new QT products or services, and to develop QT-based manufacturing components, indicating that the programme catalysed both technology progression and a strong commercial orientation.

Commercially successful QT Businesses

Innovation is intended to support business growth and success. The evidence demonstrates that the ISCF QT programme has effectively strengthened the commercial positioning, investment readiness, and growth trajectories of participating businesses. The stronger performance of participants compared to unsuccessful applicants across multiple indicators highlights the programme's additionality and its value in accelerating the development of a competitive UK quantum industry.

- Participants secured a notably higher level of private investment rounds (£903m across 67 rounds) compared to unsuccessful applicants (£97m across 13 rounds) between 2018 and 2024. 26% of participating businesses had recorded at least one funding round (reported on Crunchbase) compared to 15% of unsuccessful applicants, indicating stronger external validation and investor confidence in programme-backed firms.
- Participants reported an average rise of £4m in annual revenue, compared to £1.2m for unsuccessful applicants. Turnover specifically attributed to QT activities rose substantially, and participants grew their proportion of QT-related income from 1.8% to 7.5%, suggesting a growing commercial focus within the sector.
- Employment across participating businesses grew significantly, while unsuccessful applicants from industry saw a net decline. The average number (mean) of employees increased by 67 FTE for programme participants from the baseline position, compared to an average decline of 3 FTE for unsuccessful applicants, with the largest areas of growth within engineering and general teams rather than in R&D teams.
- The programme also had a positive influence on export potential. While just over half of participants had prior export experience, 81% reported that their ISCF QT project increased the likelihood of future exports. Average export turnover rose by £2m among participants, further indicating international market opportunities catalysed by the programme.

Nevertheless, it is important to note that most QT businesses remain pre-revenue, as reflected in the median turnover of £0 across both groups. This is consistent with the emerging nature of the technology and the long timelines required for deep tech commercialisation.

Growing the UK's QT Sector

The ISCF QT programme has also played an important role in convening the emerging QT sector and supporting the development of the UK's ecosystem for commercialising QT. While the sector is still relatively small, connections and networking are not a given, and the programme supported the strengthening of collaborations and partnerships between academia and industry and across the supply chain. It provided a clear pathway for translating knowledge and technologies from world-leading universities into real-world applications and enabling key RTOs to expand their capabilities, deepen industry connections, and stay at the forefront of emerging developments.

- ISCF QT projects had an average of 4.2 partners, and nearly all (96%) planned to continue collaborations with some of their partners after their projects. In 2025, participants reported forming an average of 3.9 new partnerships, largely catalysed by the programme.

- Around 48% of participants were involved in multiple projects, often with repeat partners.
- The RTOs Fraunhofer and NPL acted as central connectors, participating in numerous projects, enhancing the sector's cohesion, and reinforcing their roles as critical nodes in the UK and global QT landscape.
- Academic engagement was a cornerstone of the programme, with two-thirds of projects including an academic partner. The programme provided a route to translate outputs from the EPSRC-funded Quantum Hubs and supported many university spin-outs. As a result, academic participants reported a marked increase in their connections with industry due to the programme, and nearly a third of academic publications included authors from industry (32%, double the national rate). The programme also served as a valuable launch pad for other major public initiatives, including the National Quantum Computing Centre.

The UK's core QT sector - that is businesses developing and manufacturing quantum-based components and systems - has been growing steadily from around 20 companies in 2000 to 195 in 2025. It has grown substantially since the baseline evaluation in 2021, with just over a third of the 195 businesses new to the sector and an increase of 10,952 staff between 2017 and 2023.

The ISCF QT programme engaged with a considerable proportion of the sector – 46% of the 195 companies in the current core QT sector applied to the programme and 35% participated. Secondary data analysis indicates that employment growth was higher for participating businesses (median of +14 between 2017 and 2023) than unsuccessful applicants (median of +6) and slightly higher for businesses that did not apply to the programme (median of +4). Programme participants accounted for 68% of investment secured between 2018 and 2023. In addition, their share of investment accelerated notably in more recent years, accounting for 83% of investment value in years 2023 and 2024, suggesting that the ISCF QT programme has played an important role in the sector's development during its lifetime.

The **size of the UK's QT sector has also grown in terms of the number of FTE employees – an increase of 10,952 staff between 2017 and 2023**. During this period, the average growth (mean) per company within the core QT sector was 63 employees and the median growth 14 employees (from an analysis of secondary data from FAME). In this pool of companies, we see an increase in the number of employees within both the programme participants and unsuccessful applicants, though the average (mean) size of programme industry participants grew by 63 FTE employees compared to unsuccessful business applicants, which saw a smaller increase of 39 FTEs. Although the median growth was lower than the means, they support the conclusion that successful business applicants have experienced a greater increase in employment than unsuccessful applicants. This growth reflects the fact that, through the programme, many programme participants took their companies from preliminary start-up through to the early phases of scale-up.

Supporting a world-leading QT sector in the UK

Overall, while the UK demonstrates strong research intensity, strong academic-industry links and strengths in quantum systems development, it hosts fewer QT companies across the full supply-chain[3] than comparator countries such as Germany, France, and Canada**.** Germany hosts the largest extended QT sector in Europe, with 1,128 companies identified across the supply chain. This aligns with its high research output, ranking just behind the US and China in QT-related publications. The UK, by contrast, hosts 513 companies[4] - fewer than France (658) and Canada

[3] Where the full supply-chain includes the core QT sector (i.e. companies developing and manufacturing QT components and systems) plus companies providing underpinning technologies and end-users.

[4] This figure is larger than the 195 reported for the QT core sector due to wider breadth in the comparative analysis.

(689) - despite having higher academic publication volumes than both. This suggests that the UK QT sector may be more research-intensive at present, with a greater share of activity concentrated in R&D rather than downstream commercial deployment.

There appears to be some difference in the structure of the UK QT sector compared to the comparator countries – though it should be noted that data was not available for all companies in the sector in each country. The UK has a higher proportion of QT systems developers, at 15%, compared to 7–10% seen in most comparator countries, indicating UK strengths in system-level innovation and quantum computing. However, the UK has a lower proportion of companies developing QT components (36% vs. 55% in Germany and 48% in France), suggesting weaker supply chain depth, while the Netherlands, Australia, and Canada have higher proportions of end-user companies (20–25%). The UK's lower end-user share (15%) and relatively small component base highlight areas for strategic development to build a more balanced and commercially mature QT ecosystem.

1 Introduction

1.1 The evaluation

Technopolis were commissioned by Innovate UK to conduct the final impact and process evaluations of the ISCF Quantum Technologies (ISCF QT).

The overarching objectives of the final evaluation are to assess the extent to which the ISCF QT (the 'programme') delivered its Intended outputs, outcomes and impact (impact evaluation) and how successful the programme processes and methodologies were in enabling the outputs, outcomes and impact to be delivered (process evaluation).

The scope of the final evaluation is to:

- Provide qualitative and quantitative evidence and insight into the outcomes and impact of the ISCF QT
- Demonstrate the value delivered for taxpayers
- Help UKRI build an evidence base of "what works" in such programmes to inform ongoing and future interventions

The final evaluation builds on earlier evaluation activity (also delivered by Technopolis) that produced an evaluation framework, baseline analysis and an initial process evaluation.[5]

The evaluation was undertaken in between September 2024 and May 2025 and, given that the programme ended in March 2025, the final evaluation aims to provide insight across the programme's lifetime, covering its theory of change (ToC) from inputs and activities to outputs, early outcomes and consider the longer-term outcomes and impacts. However, it is important to note that not all outcomes and impacts will have been delivered by May 2025 when the evaluation is completed, as some will take more time, in some cases, years, to be delivered.

1.2 This report

This report presents the impact evaluation of the ISCF QT. The process evaluation is presented in a separate report.[6]

The remainder of this introductory section presents an overview of the evaluation methodology. The rest of the report is structured as follows:

- Section 2 presents the ISCF QT programme – its context, design, and projects funded
- Section 3 presents the evaluation findings from the evaluation, structured in terms of the impact domains in the programme Theory of Change and in line with the evaluation questions
- Section 4 presents the Value for Money assessment
- Section 5 provides the summary and conclusions of the evaluation

[5] ISCF Quantum Technology Programme Evaluation; [D1] Evaluation Framework Report, February 2021, Technopolis
ISCF Quantum Technology Programme Evaluation; [D3] Phase 2.2; Baseline Report, June 2021, Technopolis
ISCF Quantum Technology Programme Evaluation; [D4] Phase 3: Process Evaluation, November 2021, Technopolis

[6] Process Evaluation of the ISCF Quantum Technologies, (Draft) Final Report, May 2025, Technopolis

1.3 Methodology overview

1.3.1 Approach

As defined in the Evaluation Framework, the evaluation employs a theory-based evaluation (TBE) approach to assess the impact of the programme using a mixed-methods design. This approach was initially developed as part of the Evaluation Framework report prepared in 2021 and was reviewed and updated at the outset of this study to reflect the evolving maturity of the programme and the availability of new data sources.

This includes a quantitative analysis comparing programme participants to unsuccessful applicants across a set of defined impact indicators. The analysis is grounded in primary data collected through a dedicated survey, supplemented by secondary data sources such as investment databases and company records. A second layer of counterfactual analysis explores how core QT companies that participated in the ISCF QT programme compare to those in the wider UK core QT sector, enabling a broader assessment of programme additionality and sector-wide impact.

As defined in the Evaluation Framework and used in the previous evaluation reports, the quantum technologies supply-chain is made up of four elements: underpinning technology, quantum technology components; quantum technology systems and end-users (Figure 1). The businesses that provide underpinning technologies supply a range of sectors, including but not limited to quantum technologies and the end-user sectors are varied, with most being well-established businesses. The businesses developing and manufacturing quantum technology components and systems comprise the emerging 'core' quantum technology sector and include many start-ups and spin-outs.

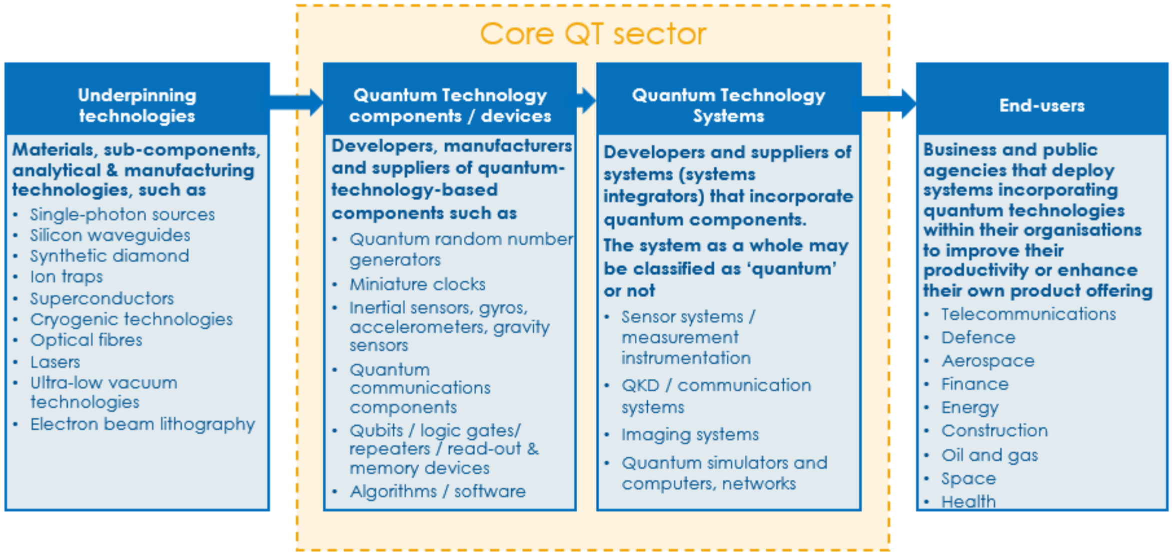
This evaluation presents data and findings across multiple units of analysis to understand both the direct effects of the ISCF QT programme on supported organisations and its broader impact on the UK's emerging quantum technology sector.

Two main units of analysis are used throughout:

- **Programme participants**: This includes all organisations that directly benefited from ISCF QT funding. However, end-users—often large multinational corporations operating across a range of sectors—are excluded from most quantitative impact analyses, as changes in their business performance (e.g. revenue, investment, jobs) are unlikely to be attributable to quantum technologies at this point in their development and would distort findings.
- **Core quantum technology sector** (core QT sector): This refers to UK-based companies focused specifically on the development of quantum technology components and systems. It excludes suppliers of underpinning technologies (e.g. photonics, microelectronics, cryogenics), which serve multiple sectors. This narrower definition enables the evaluation to provide a clearer understanding of the programme's role in supporting the growth and development of the quantum technologies sector itself.

Note that the **baseline** definition varies slightly for different kinds of reported data. For example, survey data for turnover, staff and R&D expenditure set the baseline as two years prior to a successful applicant's first project, or an unsuccessful applicant's first application (please refer to the need for re-baselining as described in our Update to the Evaluation Framework). In contrast, the baseline for bibliometric data is the four-year period prior to the launch of ISCF QT. For ease of reference, baseline definitions are clearly marked in the relevant tables and figures within this report.

Figure 1 The QT supply chain



Source: Technopolis (2025)

1.3.2 Data and evidence sources

The evaluation findings are based on the outcome of the following data collection and analysis activities:

- **Data analysis and data linking:** Which included:
  - Analysis of the programme datasets (grants and participants, project completion forms, monitoring data, ResearchFish submissions)
  - Data linking and analysis to secondary data sources (e.g., firm-level data through FAME and Crunchbase)
  - Collation of UK QT sector companies from baseline analysis, programme applicants, and Glass.ai web scraping, with identification of the company's position in the supply chain
- **Bibliometrics:** A bibliometric analysis was conducted to map the scientific publications and citations in the UK and comparator countries. The bibliometrics also provides data on collaborations (via an analysis of co-authorship) and publications cited in patents.
- **21 Interviews** with programme staff, programme participants and wider stakeholders to capture the views on wider reflections of the delivery and impact of the programme. The list of interviewees is available in the Annex Document.
- **16 Case Studies**: This report contains the final iteration of 6 longitudinal case studies to capture longer-term outcomes and impacts of the programme that have unfolded over time, and 10 new case studies developed for this final evaluation. The Annex Document contains the full-length case studies.
- **Stakeholder surveys:** Two different surveys were launched during the study, covering all the programme strands. The Annex Document shows further details on the surveys conducted, survey populations and final response rates, including further breakdowns of survey respondents. The two surveys are:

- **Survey 1 of Industry applicants,** including successful programme participants (i.e. successful applicants) and unsuccessful applicants. The sample size of the first baseline survey was 71 responses (48 successful applicants and 23 unsuccessful applicants). The final survey includes 90 industrial respondents (64 successful applicants and 26 unsuccessful applicants).
- **Survey 2 of academic applicants,** including successful programme participants and unsuccessful applicants. The sample size of the final survey is 18 responses (14 successful and 4 unsuccessful).

1.4 Impact Areas and structure of the evaluation

Our analysis of the impact of the programme follows the programme's Theory of Change, visualised in Figure 2 below. This illustrates the expected chain of events through project activities to outputs, outcomes, and eventually impact, all centred in the UK, in line with the programme's aims. The full narrative presentation and description of the Theory of Change (ToC) that articulates the implicit and explicit rationale and assumptions, and how one could reasonably expect the changes to unfold, is provided in the Evaluation Framework and the Annexes to this report.

For reasons of clarity and presentation, we have organised the presentation of outputs and outcomes emerging from the programme into six impact domains that align with the outcome and impact areas of the ToC and the set of evaluation questions. These are presented in the table below, and the evaluation findings that follow are presented for each impact domain.

Whenever possible, we provide a comparison with the baseline position to identify trends, and with a control group or benchmark to assess the extent to which the observed results can be attributed to the programme.

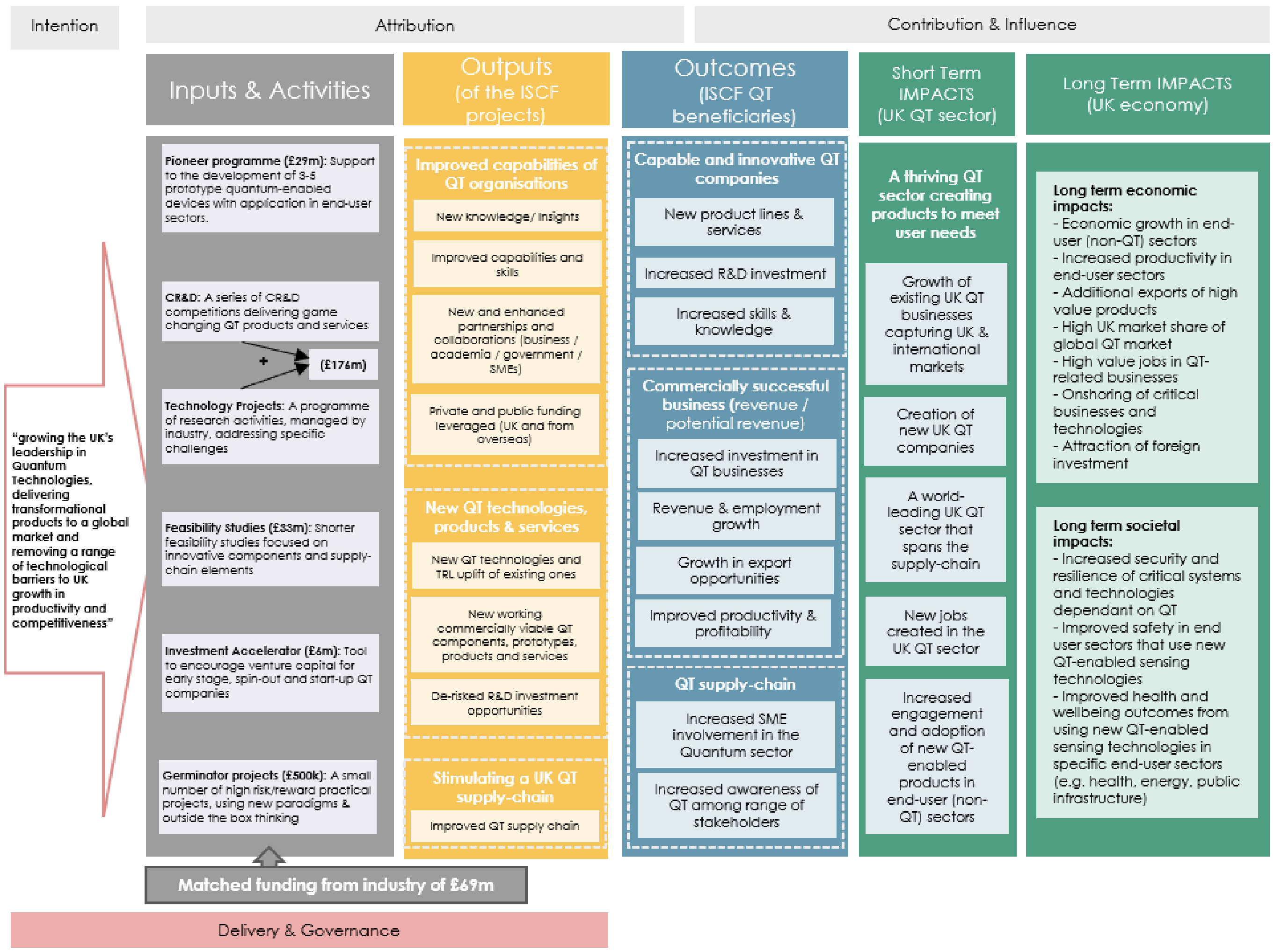
Table 1 Alignment of Evaluation Questions against Impact Areas

Impact Area	Evaluation Question
New knowledge, skills and capabilities	To what extent and how did the programme generate new knowledge and insights?
	To what extent and how did the programme lead to improved capabilities and skills?
	To what extent and how did the programme lead to increased skills and knowledge?
R&D investment	To what extent and how did the programme increase private and public Funding leveraged (UK and from overseas)?
	To what extent and how did the programme de-risk R&D investment opportunities
	To what extent and how did the programme lead to increased R&D investment?
New QT technologies, products & services	To what extent and how did the programme lead to new QT technologies, and lift the TRL of existing ones?
	To what extent and how did the programme lead to new product lines and services?
	To what extent and how did the programme lead to new working commercially viable QT components, prototypes, products and services?
	To what extent and how did the programme lead to increased investment in QT businesses?

Commercially successful QT Businesses	To what extent and how did the programme lead to increased revenue and employment growth?
	To what extent and how did the programme lead to growth in export opportunities?
	To what extent and how did the programme lead to improved profitability and productivity?
Growing the UK's QT Sector and Strengthening the UK QT supply chain	To what extent and how did the programme lead to increased SME involvement in the Quantum sector?
	To what extent and how did the programme lead to creation of new UK QT companies?
	To what extent and how did the programme lead to new jobs created in the UK QT sector?
	To what extent and how did the programme lead to new and enhanced partnerships and collaborations (business / academia / government / SMEs)?
	To what extent and how did the programme lead to increased awareness of QT among a range of stakeholders?
	To what extent and how did the programme improve the UK QT supply chain?
	To what extent and how did the programme lead to Increased engagement and adoption of new QT-enabled products in end-user (non-QT) sectors?
Supporting a world-leading QT sector	To what extent and how did the programme lead to a world-leading UK QT sector that spans the supply chain?

For each of them we have mobilised all the data sources and methods of the study, with the objective of compiling evidence of the impact of the programme, and comparison against a suitable counterfactual constructed from unsuccessful applicants (for the indicators and areas of analysis where this makes sense).

Figure 2 ISCF QT Logic Model



2 The ISCF for Quantum Technologies

2.1 Context

The UK has a long history of quantum science in the research base and pioneered concepts in quantum communications, atomic clocks and quantum computations. Building on these strong foundations, the National Quantum Technologies Programme (NQTP) was established in 2013 to support the development of second-generation quantum technologies. While the NQTP is inherently focused on quantum technologies with significant commercial potential, the second phase of the programme also included an Industrial Strategy Challenge Fund (ISCF) programme specifically dedicated to accelerating technology commercialisation and stimulating market adoption.

ISCF Challenges in general were selected for sectors and technologies on the basis of:

- Large global market opportunities, with target markets that are fast-growing and sustainable
- In areas where the UK has capabilities to meet market needs in terms of research strength and business capacity
- Where significant social and economic benefits can be expected

Quantum Technologies were therefore a clear area of opportunity for an ISCF programme. The UK had been an international leader in QT, ranking third internationally in QT patents through to the early 2010s.[7]

The ISCF QT programme was designed to support the UK's strategic ambition to take a lead in the growing global QT market and to accelerate the development of a critical enabling technology with the potential for large-scale cross-sectoral impact. These second-generation quantum technologies that harness and exploit the esoteric quantum phenomena of superposition and entanglement have the potential to create sensors, devices and computers with functionalities and performance not possible with conventional technologies. Applications of QT span data security, telecommunications, finance, energy, and environmental management.

When the ISCF QT programme started in 2018, some niche applications based on quantum sensors could clearly see routes to market, but most applications remained in the very early stages of development with long timescales to market adoption. Building on the UK's strong research heritage and early leadership in quantum science, the National Quantum Technologies Programme (NQTP) was launched in 2013, establishing the UK as an early mover in QT innovation and investment. Other nations also rapidly expanded their investments - including the EU's €1 billion Quantum Flagship, the US National Quantum Initiative (both launched in 2018) and China's $10 billion investment in quantum computing announced in 2016 - highlighted increasing global competition to capture the emerging sector. While the UK was well-connected with the global community active in QT, when the full-scale ISCF QT programme was launched in 2019, the UK's access to Horizon Europe remained uncertain, potentially reducing the UK's ability to collaborate within the EU and reinforcing the rationale for a concerted UK effort.

[7] The Quantum Age: technological opportunities, Government Office for Science, 2016

The programme's economic rationale, set out in the business case for the full-scale ISCF QT addressed key market and coordination failures common to early-stage technologies with the potential to become general-purpose technologies. These included underinvestment by the private sector due to the high risk of investing in R&D with long timelines to benefits and high economic and social spillovers, the need for coordinated development of a complex supply chain and risks from international competition. Specific threats included the dominance of global technology firms and their growing interest in QT and state-led investments in markets such as China that could limit UK market share. In parallel, the business case made a strategic case for public investment in QT to secure access to a technology critical to both economic growth and national security, particularly in data and communication security and defence – a rationale that has grown in importance since then.

2.2 Programme objectives

The overarching **objectives of the ISCF QT programme** were to:

- Increase sales of products and services by UK companies, spanning component-level technology, systems integration and QT-enabled products and services
- Increase UK businesses' investment in QT R&D and improved R&D capability and capacity
- Increase multi/interdisciplinary research around the challenge areas
- Increase business-academic engagement on innovation activities relating to the challenge areas

ISCF Challenges, such as ISCF QT, are also expected to contribute to meeting the four challenges facing UK research and innovation:

- Increasing government and private sector investment in research and innovation
- Improving the ability to commercialise world-class science and research, and innovation
- Building research and innovation excellence
- Ensuring the UK's position as a world leader in global science and innovation collaboration

All ISCF Challenges, including ISCF QT, were ultimately expected to contribute to the 2017 UK Industrial Strategy[8]'s aims of creating the 'world's most innovative economy', with higher productivity and growth.

2.3 Thematic scope

The ISCF QT programme focused specifically on second generation quantum techniques. These are defined as "those involving the generation and coherent control of quantum states, resulting in phenomena such as superposition or entanglement". The initial Pioneer programme (Wave 2) focused on three themes in QT - sensing, imaging and communications with the clear intention of demonstrating early benefits to showcase the technology, while the Wave 3 full-scale ISCF's scope was extended to include quantum computing.

The ISCF is not directed solely at the technologies developed by the Quantum Hubs, but also technologies developed independently by SMEs, start-ups and university spin-outs. These technologies have potential for application across a wide range of sectors: from defence, aerospace and automotive, to telecommunications, finance and health, and some yet to be imagined. The four application areas targeted by the programme were:

[8] https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

Quantum communications: Exploiting quantum phenomena in cryptographic systems for communications is one of the most mature applications of QT. Quantum Key Distribution (QKD) uses the concept of entangled photons to provide ultra-secure communication and was first demonstrated in real-world environments (point-to-point between trusted nodes) in the early 2000s and a QKD industrial standards group established by the European standards body ETSI in 2008. In 2017, a 2,000km QKD secured optical communications backbone was built between Beijing and Shanghai and a satellite-to-ground QKD link created,[9] and more recently, a quantum communications network was demonstrated by the University of Bristol.[10]

Quantum sensing: Quantum *superposition* creates 'objects' that are extremely sensitive to their local environment, providing the basis for highly precise sensors for the detection of light, electric fields, motion, gravity, etc. and new possibilities in for example: automation and robotics where quantum inertial sensors can detect and guide precise movements and provide resilience in the loss of GNSS[11]; in oil and gas and civil engineering, where highly sensitive gravity sensors using atomic interferometry can 'see' beneath the ground; and in healthcare, where sensitive magnetic sensors can improve MRIs and enable sensitive brain scans (magnetoencephalography) for the early detection of conditions such as dementia. Most quantum sensors are 5-10 years from market, but others such as atomic clocks are a more mature quantum device, they have underpinned global navigation systems for decades and, with increasing miniaturisation, are enabling new capabilities in defence (automation, navigation), telecoms (faster networks for 5G and beyond) and finance (accurate timestamping of micro-trades).

Quantum imaging: Single photon quantum sensors and entirely new imaging concepts such as quantum ghost imaging are improving the sensitivity and resolution of imaging technologies; offering the potential for better medical imaging by detecting small physiological changes as well as the ability to see through clouds, smoke or around corners - with applications in defence, security and health and safety. In the longer-term quantum imaging may also provide a method for data transmission and storage in quantum computers.

Quantum computing: Quantum computing is probably the most well-known use of quantum technologies. Using *qubits* based on particles or physical phenomena in *superposition,* quantum computers can perform calculations that remain intractable for even the most sophisticated conventional computers. This powerful computing power will enable complex optimisation and simulation tasks, artificial intelligence and machine learning using extremely large datasets and factorisation of large prime numbers with applications in the discovery of new materials and pharmaceutical compounds, designing complex structures such as aircraft, logistics optimisation and fully autonomous systems.

2.4 Programme strands

The nine competitions of the ISCF QT provided a range of funding mechanisms for, what was at the start of the programme, an emerging UK QT sector.

As an ISCF challenge, while the majority of the programme funding (77%) supported collaborative R&D to develop specific products and services driven by end-user needs, the

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[9] Quantum Key Distribution in-field implementations , JRC Technical Report, 2019 https://ec.europa.eu/jrc/en/publication/quantum-key-distribution-field-implementations

Qiang Zhang, Feihu Xu, Li Li, Nai-Le Liu,Jian-Wei Pan Quantum information research in China, Quantum Science and Technology, Vol 4, No. 4, Nov 2019, OP Publishing https://iopscience.iop.org/article/10.1088/2058-9565/ab4bea

[10] http://www.bristol.ac.uk/news/2020/september/quantum-breakthrough.html

[11] GNSS: Global Navigation Satellite Systems such as GPS, Galileo, GLONASS

programme also provided funding instruments to address specific barriers to the commercialisation pathway. In this particular case, ISCF QT supported underpinning technological development projects and the development of key elements of the QT supply chain, with a particular focus on SMEs, plus an investment accelerator to support and encourage venture capital investment in QT.

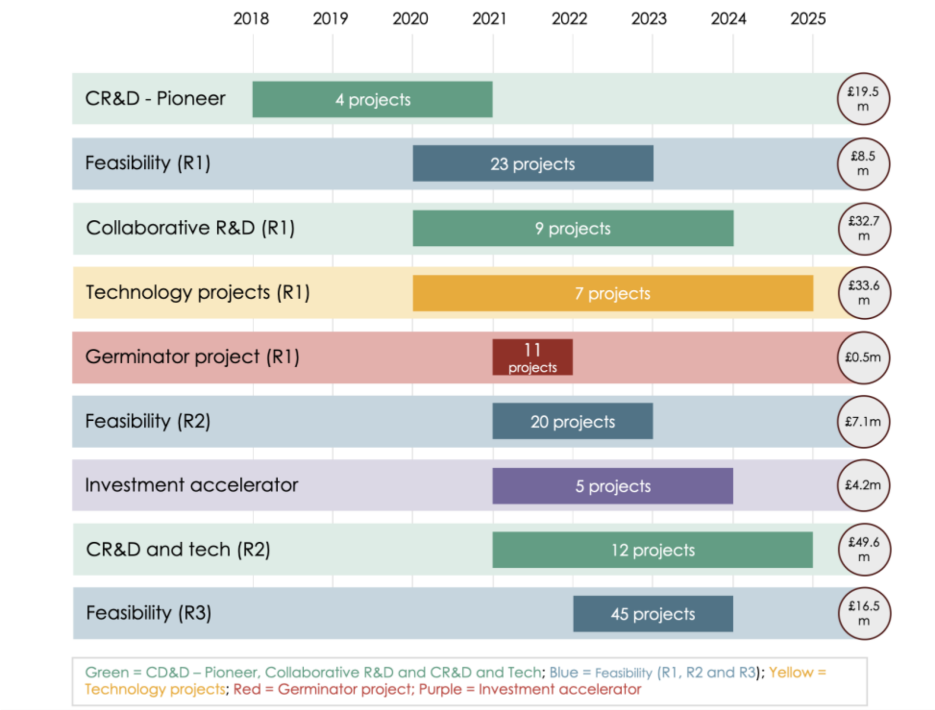
The programme deployed five different types of innovation support instruments:

- **Collaborative R&D (CR&D):** Supported commercially focused quantum product and service innovations with market-oriented proposals and clear end-user engagement.
- **Technology Projects (TP):** Funded industry-led efforts to overcome technical barriers in QT commercialisation, requiring identification of broad industry benefits to develop key technologies in the QT supply chain.
- **Investment Accelerator (IA):** A programme strand delivered in collaboration with a CV firm to attract private equity for early-stage QT companies, requiring matched investment and aiming for 3:1 private to public funding leverage.
- **Feasibility Studies (FS):** Industry-led, SME-involved projects to explore market potential for quantum products, services, or supply chain components.
- **Germinator Projects (GP):** High-risk, high-reward practical projects introduced in 2021 to explore novel QT paradigms with potential for breakthrough commercial impact.

The key features of each instrument and competition are summarised in Table 2, with further description and detail presented in the Annex Document. Figure 3 below shows the overall phasing of each competition over the programme period.

Of note, the Innovate UK Quantum programme team responsible for delivering the ISCF QT programme has also taken the lead on a number of other quantum technology competitions and programmes funded through non-ISCF sources – these interventions used a variety of mechanisms, including international R&D and Small Business Research Initiative contracts (pre-procurement). These are outside the scope of the current evaluation but are summarised in the Annex Document for reference.

Figure 3 Timeline of the Phase 2 of the ISCF QT competitions



Source: Technopolis (2025)

Table 2 Summary of ISCF QT programme strands

<table>
<tr><th>Strand</th><th>Round</th><th>Timeframe</th><th>Technical scope</th><th>Project focus</th><th>Lead applicant</th><th>RTO / academic participation</th><th>Project size</th><th>Project duration</th><th>Interview Assessment Stage</th><th>Lead Participation Limits</th></tr>
<tr><td colspan="2">Innovation R&D (Pioneer)</td><td>2018-2021</td><td>Production of prototype quantum technology devices and systems</td><td>Situational awareness, infrastructure productivity, seeing the invisible, trusted peer-to-peer communication</td><td>Companies</td><td>Max 30%</td><td>£3m-10m (max £10m grant)</td><td><30 months</td><td>Yes</td><td>Companies can lead only 1 project</td></tr>
<tr><td colspan="2">Investment Accelerator</td><td>2021-2024</td><td rowspan="2">2nd generation quantum</td><td rowspan="2">Connectivity, situational awareness, imaging and sensing, computing</td><td>Companies and UK-based investors</td><td>N/A</td><td>Companies £250k-£2m
Investors £2m-£12m</td><td><24 months</td><td>Yes</td><td>Companies can lead only 1 project</td></tr>
<tr><td rowspan="3">Feasibility</td><td>R1</td><td>2020-2023</td><td rowspan="6">Companies</td><td>Max 50%</td><td rowspan="3"><£500k (<£50k for market assessments)</td><td rowspan="2"><8 months</td><td rowspan="3">No</td><td rowspan="3">Companies can lead up to 3 projects</td></tr>
<tr><td>R2</td><td>2021-2023</td><td rowspan="5">2nd generation quantum and single photon</td><td rowspan="2">Components, supply chain elements, new application sectors</td><td>Max 30%</td></tr>
<tr><td>R3</td><td>2022-2024</td><td>Max 50%</td><td>12-18 months</td></tr>
<tr><td rowspan="3">Collaborative R&D and Technology projects</td><td>CR&D R1</td><td>2020-2024</td><td rowspan="3">Products and Services Technology Barriers and multiple beneficiaries</td><td rowspan="3">Max 30%</td><td rowspan="3">£2m-20m (max £10m grant)</td><td rowspan="3"><36 months</td><td rowspan="3">Yes</td><td rowspan="3">Companies can only lead on one project per round</td></tr>
<tr><td>Tech R1</td><td>2020-2025</td></tr>
<tr><td>CR&D and tech R2</td><td>2021-2025</td></tr>
<tr><td>Germinator projects</td><td>R1</td><td>2021-2022</td><td>Early-stage projects with commercial potential. New ideas.</td><td>Companies, RTOs, HEIs</td><td>Max 100%</td><td><£50k</td><td>6/9 months</td><td>No</td><td>Max 3 applications per organisation</td></tr>
</table>

Source: Technopolis (2025) based on client data as of March 2025

2.5 ISCF QT programme portfolio

The ISCF QT programme funded 136 projects, including four collaborative research and development (CR&D) projects under the initial Pioneer programme between 2018 and 2021 and 132 projects in the full-scale programme between 2019 and 2025. Of these 136 projects, all but one were completed as of March 2025.

Across all strands, **the programme committed a total of £172.3m in grant funding** and **leveraged £70m of matched funding** from programme participants to support the delivery of their ISCF projects (Table 3), with 99.8% of the leveraged funding from industry.

Table 3 Grants and investments per ISCF QT programme strand at the application stage

Phase	Strand	Number of projects	Total project value	ISCF QT Funding	% of Total ISCF QT	Matched funding total	Average ISCF funding per project	Average ISCF funding per participation
Pioneer	CR&D - Pioneer	4	£28,790,233	£19,510,157	11.3%	£9,280,076	£4,877,539	£390,203
Full programme	Investment accelerator	5	£8,397,781	£4,198,891	2.4%	£4,198,891	£839,778	£839,778
	Feasibility (R1)	23	£11,453,815	£8,518,972	4.9%	£2,934,843	£370,390	£404,035
	CR&D (R1)	9	£47,668,025	£32,726,812	19.0%	£14,941,213	£3,636,312	£113,586
	Technology projects (R1)	7	£48,008,352	£33,628,720	19.5%	£14,379,632	£4,804,103	£480,410
	Feasibility (R2)	20	£9,053,374	£7,085,218	4.1%	£1,968,156	£354,261	£133,683
	Germinator projects (R1)	11	£546,420	£540,470	0.3%	£5,950	£49,134	£28,446
	CR&D and Tech (R2)	12	£66,504,886	£49,621,808	28.8%	£16,883,078	£4,135,151	£533,568
	Feasibility (R3)	45	£21,682,871	£16,460,468	9.6%	£5,222,403	£365,788	£129,610
Total		136	£242,105,757	£172,291,516	100.0%	£69,814,242	-	-

Source: Technopolis (2025) based on client data as of March 2025. *Calculated per participation, not unique organisation. Participations are defined as an individual organisation participating in ISCF QT strands.

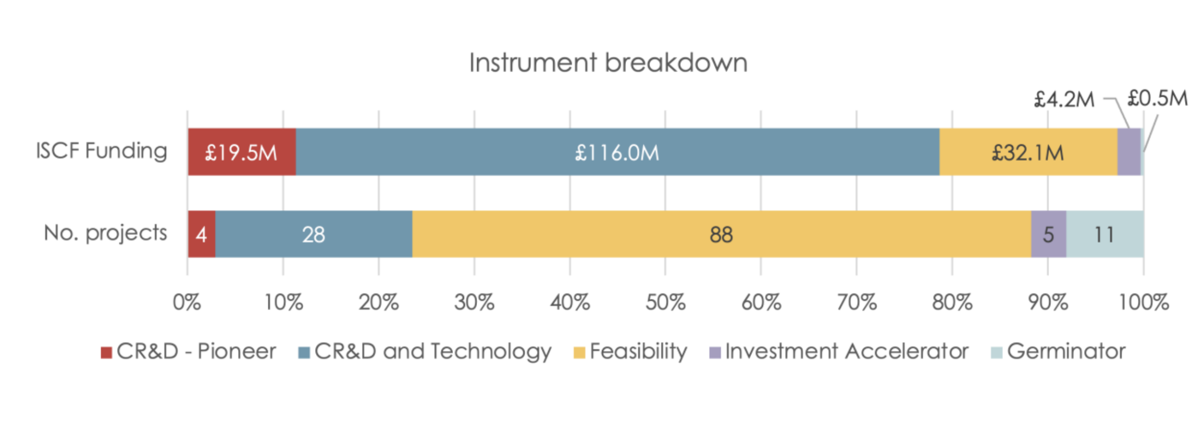
2.6 ISCF QT Projects

Across the 136 projects funded, the programme balanced large-scale investments concentrated in fewer, high-impact projects (e.g. CR&D and Technology projects) with smaller grants supporting a wider base of exploratory work (e.g. through Feasibility and Germinator projects).

The *majority of projects* by number (over 65%) were funded through the Feasibility competitions (Figure 4). Collaborative R&D and Technology projects make up the second-largest share (around 20%), while smaller programmes like Germinator, Investment Accelerator, and Pioneer account for a much smaller portion of the portfolio in terms of the number of projects.

The *majority of the programme funds* were allocated to the large-scale CR&D and Technology instruments, with these (including the four Pioneer CR&D projects) accounting for 79% of total programme funding (Figure 4). By contrast the three rounds of Feasibility projects only accounted for 19% of the funding while the Germinator and Investment Accelerator projects accounted for a small proportion of the fund at just under 3%.

Figure 4 Number of projects & funding per instrument



Source: Technopolis (2025) based on client data as of March 2025.

The Collaborative R&D and Technology projects accounted for the largest total grant funding (£135.5m – including the four Pioneer CRD projects) and provided a high average grant per project (£4.2m), reflecting its focus on large-scale, high-investment projects. The CR&D projects funded at the Pioneer phase were slightly larger, with an average grant per project of £4.9m. In contrast, Feasibility and Germinator projects had significantly smaller average grants (£364k and £49k), reflecting their focus on early-stage, lower-cost innovation activities.

Figure 5 Total and average grant size per instrument

Source: Technopolis (2025) based on client data as of March 2025.

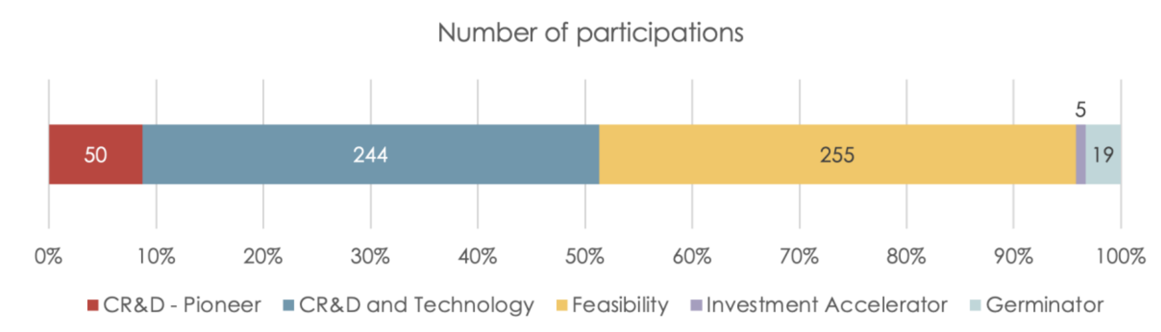
2.7 Participations and project partners

In the report, 'participants' refers to the unique organisations or entities involved in the programme, whereas 'participations' refers to the total number of instances these organisations were involved in projects. As many organisations were involved in more than one project, the total number of participations is greater than the number of participants.

Overall, a total of 573 unique participations were made over the programme.

The participation profile reflects both the size and number of projects funded, where the Collaborative R&D and Technology projects represent the largest projects in terms of funding, and so tended to have more participants per project, and the feasibility projects represent the largest number of projects within the programme's portfolio (see Figure 6).

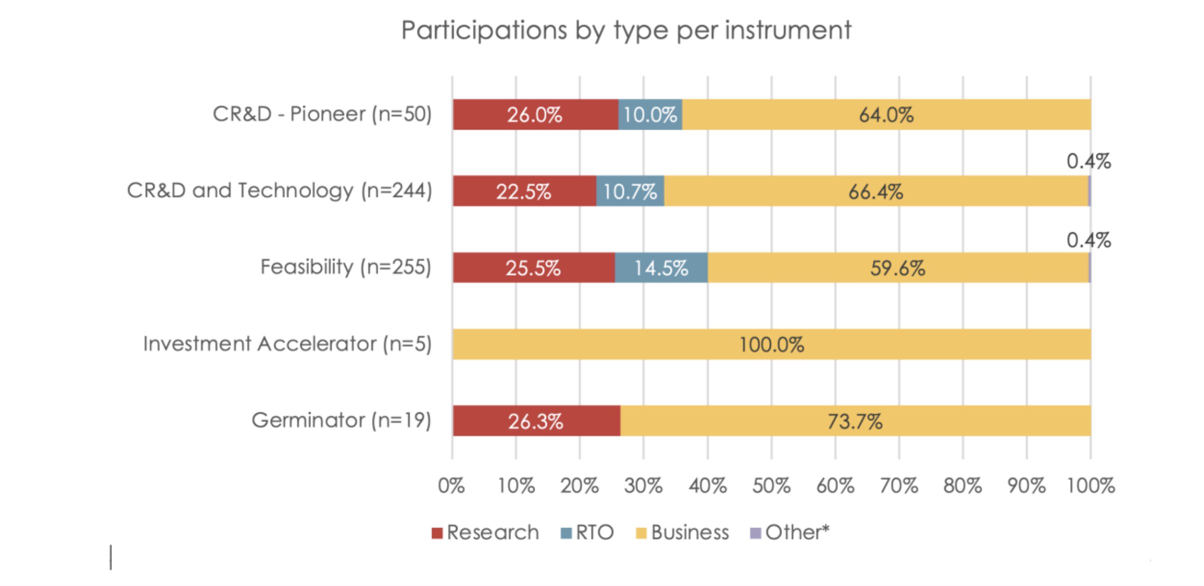
Figure 6 Participations in ISCF QT per instrument



Source: Technopolis (2025) based on client data as of March 2025.

The majority of participations (64%) are from businesses, just under a third from academic research institutes (24%) and 12% from Research and Technology Organisations (RTOs). This pattern was fairly consistent across the different instruments and competitions within the programme (Figure 7), with the exception of the Investment Accelerator, which was only open to businesses.

Figure 7 Participations in ISCF QT per competition and participant type



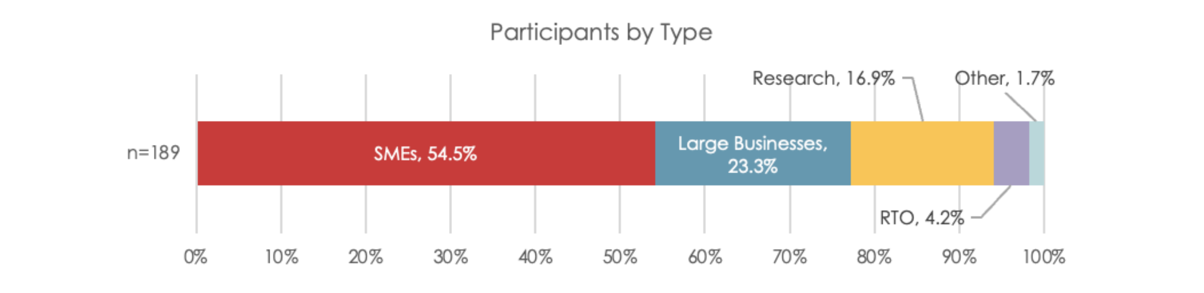
Source: Technopolis (2025) based on client data as of March 2025. Data as per the project application. *Public sector, charity or non-Je-S registered research organisations. n = the number of participations per competition.

2.8 Profile of participants

189 unique organisations participated in the ISCF QT programme.

Reflecting the objectives of the programme and requirements of the competitions, the majority (78%) of unique participating organisations were businesses and 55% of all participants were SMEs – in line with programme design. Just under a fifth of participants were from academic research institutes and 4% from RTOs. The programme also included two 'other' organisations, accounting for just 2% of the overall number of participants - Network Rail and Oxfordshire City Council. Of the 147 participating businesses, 61% were micro or small companies, 10% medium-sized, and 30% were large[12]. 98% of projects involved SMEs and 92% of projects were led by SMEs. The majority of projects (80%) involved collaborations between industry and the research community based in universities or RTOs.

Figure 8 ISCF QT participants - organisation type



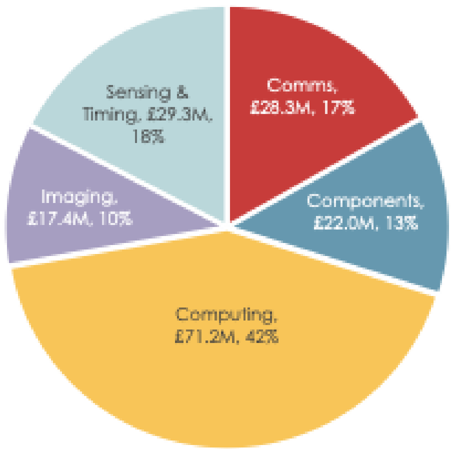
Source: Technopolis (2025) based on client data as of March 2025. *Public sector, charity or non-Je-S registered research organisations. n = the total number of participants

[12] Company size as indicated at application stage

Given the relatively small and highly specialised nature of the quantum technologies sector, it is not surprising to note that a substantial proportion of participant organisations were involved in more than one ISCF QT project. Across the whole programme, 91 organisations (48% of 189 successful organisations) were participants in more than 1 project, and 29 organisations (15%) were participants in more than 5 projects.

The **programme supported projects across the five key themes** in quantum technologies: computing, sensing & timing, communications, components, and imaging – noting that categorisation used by the programme team included an additional category (quantum components) to the four more application-focused themes. Overall, projects relating to quantum computing accounted for 42% of the overall grant allocation within the programme (Figure 9). The remaining themes accounted for between 10% and 17% of the remaining portfolio.

Figure 9 ISCF grant funding per project theme



Source: Technopolis (2025) based on client data as of March 2025. Tagging of projects as per the Innovate UK Quantum Technologies Programme Directory.

The distribution of funding according to these themes evolved over the course of the programme (Figure 10). Though not in scope for the Pioneer Programme, following its inclusion in the Full Programme in 2020, quantum computing-related projects received the most funding, and further increased its total share of funding to 42% by 2023. This is in line with the rapidly increasing national and international levels of funding in quantum computing, as countries attempt to move towards the commercialisation of quantum computing technologies.[13,14]

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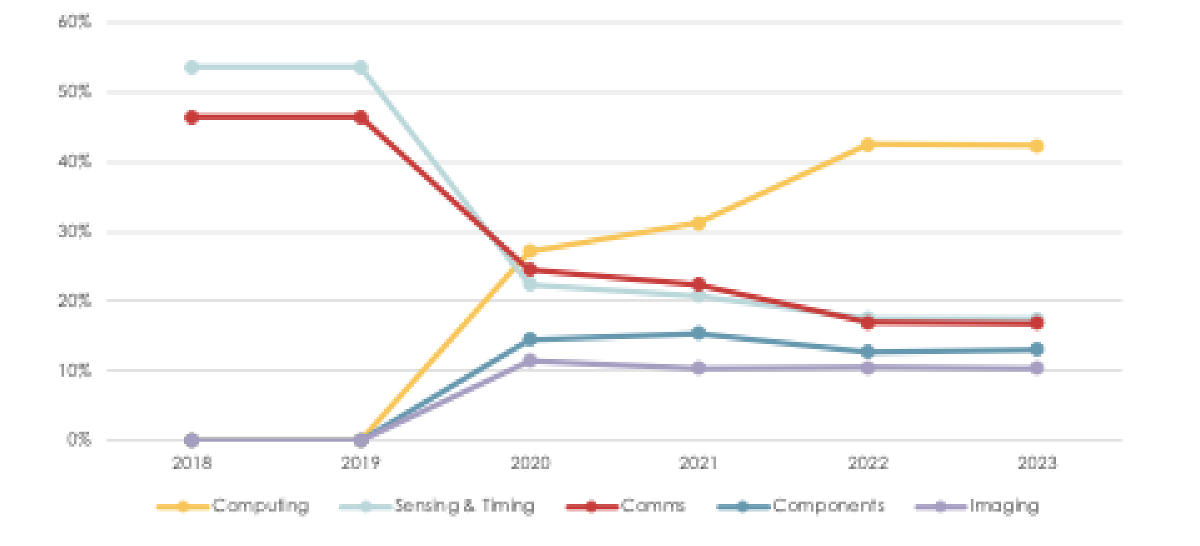
[13] https://www.ukfinance.org.uk/system/files/2023-11/Seizing%20the%20opportunities%20-%20quantum%20technology%20and%20financial%20services.pdf

[14] https://www.mckinsey.com/featured-insights/the-rise-of-quantum-computing

Figure 10 Cumulative proportion of ISCF grant funding per project theme



Source: Technopolis (2025) based on client data as of March 2025.

2.9 Additionality of ISCF QT support

Around half (42%, 11 out of 26) of surveyed unsuccessful business applicants said that they did not go ahead with their proposed project. Only 8% (2 out of 26) said that the project continued at the same scope, scale and project composition, using alternative sources. The remainder of unsuccessful business applicants proceeded with their projects with alternative sources of funding, either at reduced scale/scope (15%) or with delays to the project (8%). A further 15% said that their project proceeded, but with fewer project partners or a different project composition that excluded them from the project.

Seven unsuccessful applicants provided information on the sources of funds used to continue their projects. Most indicated that they funded projects, in part or in full, through a combination of other forms of UK public funding and/or the organisation's own resources.

Higher proportions of business participants (61%) stated in the survey that the project would not have gone ahead in the absence of funding had they not been successful. A third (34%) of surveyed successful businesses said that the activities would have gone ahead, but with a reduced scope and with delays. Only 2 out of 64 surveyed successful businesses said that the activities would have been undertaken at the same scale/scope using alternative funding.

3 Main Findings

3.1 New knowledge, skills and capabilities

This section covers the indicators to address the evaluation questions:

To what extent and how did the programme lead to improved capabilities and skills?

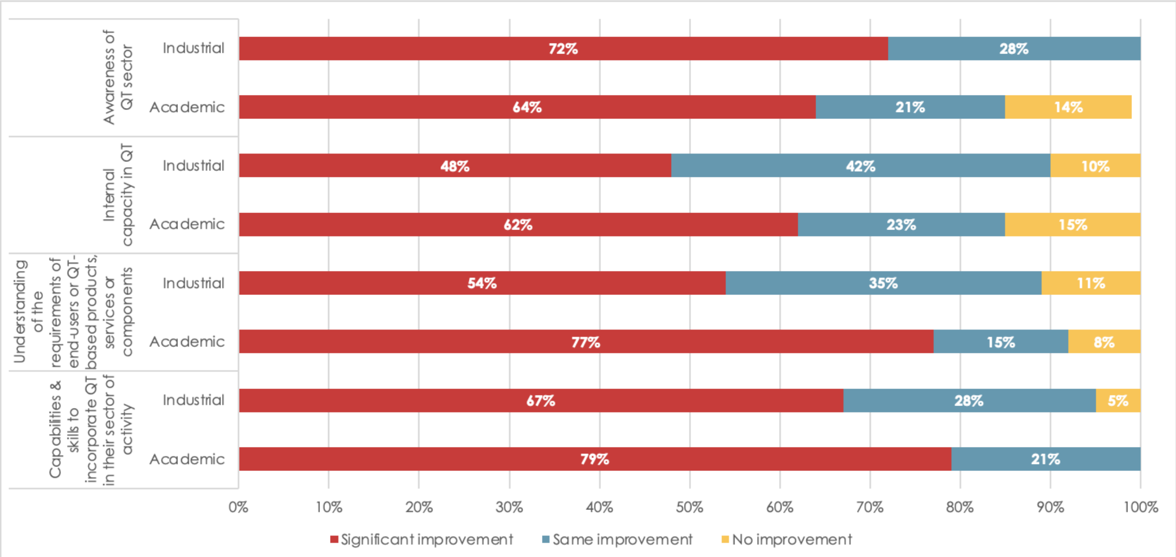
To what extent and how did the programme generate new knowledge and insights?

To what extent and how did the programme lead to increased skills and knowledge?

Participants responding to the evaluation survey consistently reported acquiring new skills and capabilities, with 85%-100% (n=60-63) reporting gains across a range of categories (Figure 11) and academic participants tend to report slightly higher gains than industrial participants for most categories.

Academic participants reported stronger gains in their internal capability in QT, with 62% noting a significant improvement, compared to only 48% of industrial organisations and 23% and 42% gains (respectively for academics and business) reporting some improvement. The majority of both academic and business participants reported significant improvements to their capabilities and skills to incorporate QT in their sector of activity (79% and 67% respectively) and increased awareness of the QT sector (64% and 72%). All academic participants reported improvements in their understanding of the needs of end-users of QT-based products, services and components, with 77% reporting a significant improvement and 89% of industrial participants reporting gains in the same category (and 54% reporting a significant improvement here.

Figure 11 Extent to which participation in ISCF QT projects led to improvements in the following areas

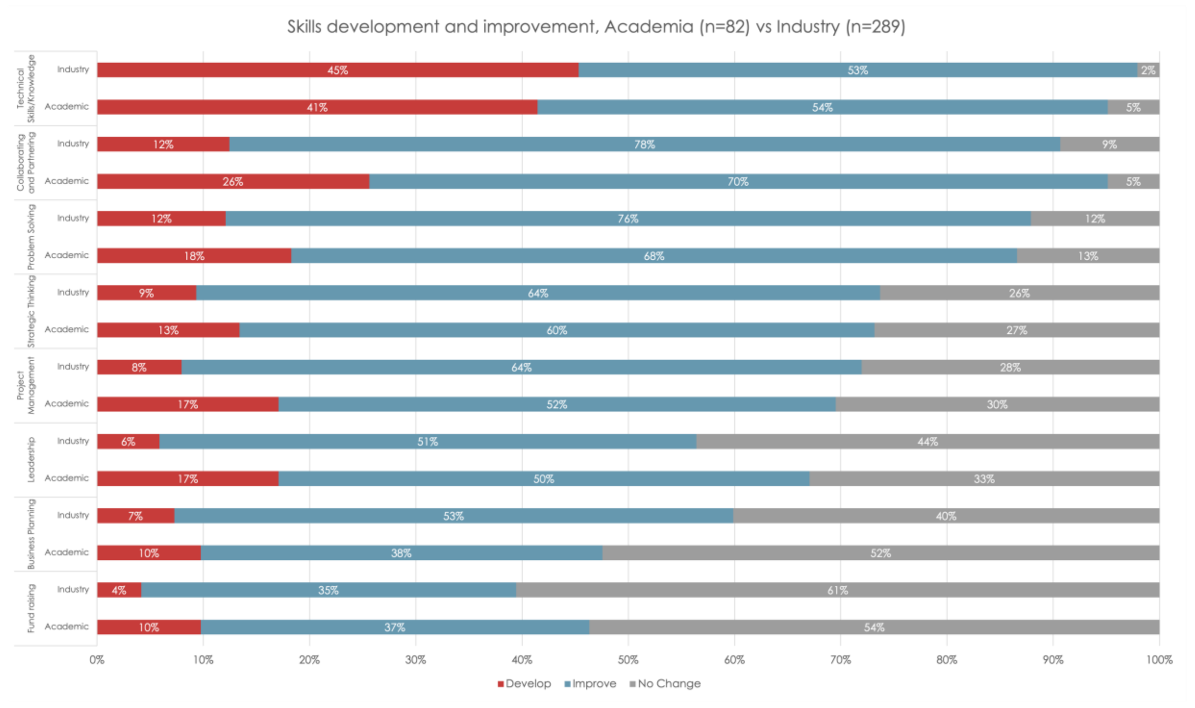


Source: Technopolis, CATI Survey, March-May 2025, Academic Survey, April 2025. Programme participants only. Industrial survey, base:60-63. Academic survey, base:13-14.

At the project completion stage, project participants were asked to report whether the project resulted in the development of new skills or improvement of existing skills (see Figure 12). Project participants most frequently cited the development of technical skills and knowledge as a result of their ISCF-funded project activities (44%, n=371). In addition, project participants also indicated reported improvements in their abilities to collaborate and partner (76%), problem solving (74%) and strategic thinking (63%). Business planning and fund-raising skills were the least frequently reported, both in terms of development and improvement.

Notably, academic participants were more likely to report having developed these skills, as opposed to having improved them, especially in the areas of developing collaboration and partnerships, leadership, strategic thinking and fund-raising. Interviews with academic researchers and representatives from RTOs also noted that in some cases, their ISCF QT projects didn't necessarily lead to the development of entirely new skills and capabilities, but rather provided them with a better understanding and skills to be able to apply this expertise to real-world industry applications. In doing so, enabling them to better translate their existing knowledge and collaborate with industry partners more effectively.

Figure 12 Skills developed and improved through ISCF QT projects – PCF data



Source: Technopolis analysis of PCF (January 2025). n=82 (academia) and n=289 (business and RTO).

Interviews with programme participants and the impact case studies highlighted various examples of these new skills, knowledge and capabilities developed. Overall, interviewees largely referred to technical knowledge and skills relating to their products or services. This included examples of companies working more closely with manufacturers to better understand their own products and requirements for future supply chains, as well as examples of companies working more closely with end-users to better understand the downstream product-market fit. A small number of interviewees also mentioned that they had developed a new process through the delivery of their ISCF QT projects, which they had subsequently applied to other internal R&D projects. The box below presents a summary of one ISCF QT project and the new skills and capabilities developed by some of the participants.

Box 1 Impact Vignette - AIRQKD project

In response to the threat of quantum decryption, the **AIRQKD** project aims to explore the possibilities of integrating quantum key distribution (QKD), a quantum-era cybersecurity tool, with 5G/6G networks. In particular, the project focuses on free-space use cases where QKD occurs through the atmosphere (like satellite signals and Wi-Fi) rather than through fibre cables.

The project is led by BT, a key end-user in the communications industry, and the consortium was built by Nu Quantum, a Cambridge University spin-out specialised in quantum network architecture. To explore the technology from end-to-end, a large consortium of more than a dozen members was assembled. In addition to BT and Nu Quantum, the consortium consists of several businesses (some micro businesses included), national labs and facilities (NPL and the Compound Semiconductor Catapult), research organisations (Fraunhofer UK) and university research groups (many of whom were involved in the EPSRC Quantum Hubs).

Two communications use cases – one between two buildings, and one between a connected car and roadside units – were successfully demonstrated, proving that the possibility exists. However, a key finding from the project was that the single-photon source and detector technologies are not mature enough for commercial applications of secure free-space communications. These findings are important for directing future efforts as quantum computers improve and quantum decryption becomes a reality.

Project participants have benefited from their participation in several ways. For example:

- Arqit developed software that, with additional investment, now forms the foundation of one of their flagship products, SKA-Platform. Their project solution led them to abandon the satellite infrastructure aspect of their business in favour of cybersecurity software development.
- NPL improved their single-photon measurement capabilities and protocols, which form part of their service offering and may be incorporated into future testbed facilities.
- BT has pivoted its attention toward free space optics, and has grown the quantum contingent of its R&D team due to internal validation provided by this and other QT projects

While much new knowledge generated is tacit in nature and embodied within the knowledge and skills of individual people and teams, some knowledge is codifiable and protectable as intellectual property (IP), to help secure competitive advantage. The programme had an impact of the likelihood of participating companies to produce **patents.** Overall, at the end point of their ISCF-QT projects, 38 companies reported in their PCFs that they had either submitted or secured a total of 98 patents. At the point of project close, 12% of companies (a subset of participants) had been granted patents, 15% had applied for patents and a further 25% were considering patenting(n=268). The majority of companies indicated that they were not yet formally protecting technology developments through formal IP protection routes, although this may increase as the technology is developed further and those considering IP protection take action to do so. At the end of projects, only a small number of participants (between 1% and 6%) reported using other forms of IP protection in the form of trademarks, registered designs, copyright material (between 1 and 6%) and fewer than 16% of companies were considering these types of knowledge protection (n=215). Notably, project participants also noted that they had developed open-source software and know-how that wouldn't necessarily be captured through traditional IP measures.

Overall, programme participants were more likely to apply for patents than unsuccessful applicants, both before and after their participation in the ISCF QT programme (Table 4 and Table 5), though this has increased for both groups since the baseline stage. However, programme participants surveyed have experienced more success in applying for QT-related patents after the end of the programme – 39% of business participants had applied for a patent and 25% had secured a patent, compared to 14% and 5% of unsuccessful business applicants, respectively. This trend also holds true for the academic researchers involved in the programme, though the proportion of respondents who had applied for, and registered, IP related to QT remained the same.

Table 4 Patents and IP rights, programme participants and unsuccessful applicants (businesses)

Indicator	Programme participants			Unsuccessful applicants		
	Baseline*	Since applying to ISCF	Change in percentage points (ppt)	Baseline*	Since applying to ISCF	Change in percentage points (ppt)
% respondents who applied for patents related to quantum technologies (Business)**	18%	39% ▲	21ppt	9%	14% ▲	5ppt
% respondents with granted patents related to quantum technologies (Business)**	10%	25% ▲	15ppt	0%	5% ▲	5ppt
% respondents who registered other IP related to quantum technologies (e.g., trademarks, designs or material protected by copyright) (Business)**	10%	16% ▲	6ppt	5%	14% ▲	9ppt

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the period five years prior to applying to the ISCF quantum technologies programme. **Excluding end-users. Programme participants, base:51 unsuccessful applicants base:22.

Table 5 Patents/IP rights, programme participants and unsuccessful applicants (researchers)

Indicator	Programme participants		Unsuccessful applicants	
	Baseline*	From 2023/2024	Baseline*	From 2023/2024
% respondents who applied for patents related to quantum technologies (Universities and RTOs)	57%	64% ▲	25%	25% ■
% respondents with granted patents related to quantum technologies (Universities and RTOs)	43%	57% ▲	25%	0% ▼
% respondents who registered IP related to quantum technologies (Universities and RTOs)	20%	20% ■	0%	0% ■

Source: Technopolis, Academic Survey, April 2025. Programme participants, base:14, 14, and 10 respectively (for each sub-question). Unsuccessful participants, base: 4, 4, and 3 respectively (for each sub-question). Note: * The baseline is defined as the five years prior to applying to the ISCF quantum technologies programme.

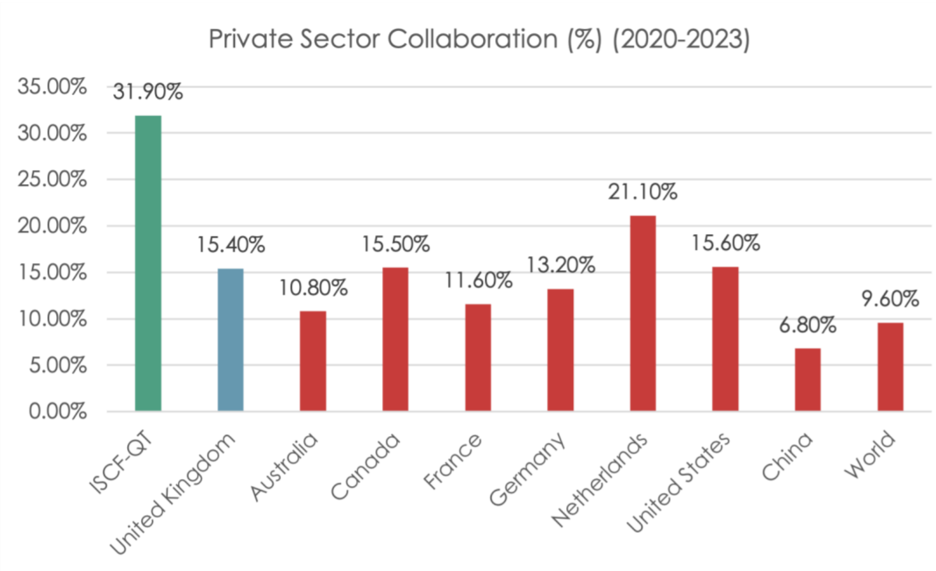
Knowledge and insights generated by R&D activities can also be codified and shared more openly via publications. While publications were not the main target output of the ISCF's activities, the scale of academic participation ensured that some knowledge outputs were published.

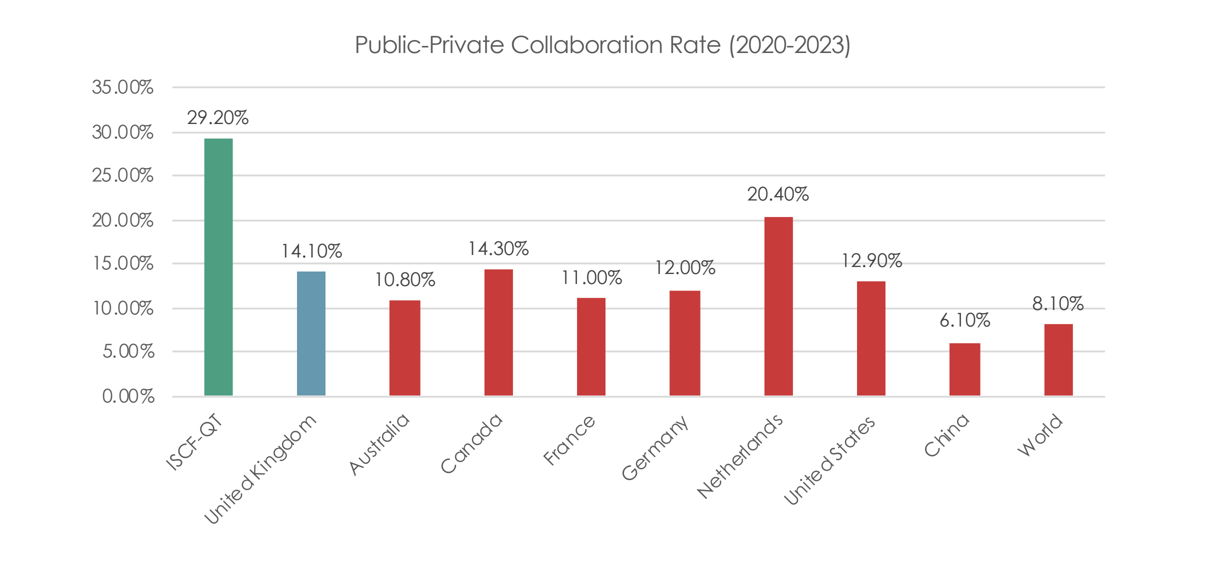
At project close, academic participants reported a total of 119 publications produced over the course of the programme. After validating this list of publications in Scopus and a further search for publications funded through the ISCF QT, a total of 73 unique publications were identified as a result of ISCF-QT funded research. In line with the timeline of the programme and typical time between research activity and publication, no publications were identified before 2019. The number of publications can be expected to increase as more ISCF-QT projects come to an end and research is completed.

73 publications is fairly small, representing just 0.95% of the 7,686 UK publications in quantum technologies between 2019 and 2023. However, as described above, academic publications were not a target output and, furthermore, industrial partners would prefer that key results are not published in order that the knowledge might be protected as IP in the future. Nevertheless, the fact that the R&D undertaken by academics and industry working together yielded publication-worthy outputs is a positive finding. That these were true collaborative partnerships is indicated by the high proportion of publications with industry as authors or co-authors. Nearly a third of all ISCF QT papers involved the private sector (31.9%) (determined in terms of publications with at least one author from the private sector) (Figure 13). This is double the share than at the UK national level (15.4%). A significant proportion of ISCF QT publications (29.2%) also involved public-private collaboration (determined in terms of publications with co-authors from both the public and the private sector). Comparing ISCF-QT publications nationally and internationally, the outputs of the ISCF QT-supported research have higher levels of collaboration between the public-private sector than the UK (14.1%) and all international comparators.

The high levels of public-private collaboration (co-authorship) evidence two central objectives of the programme. Firstly, the aim to support industry-academic collaboration to facilitate commercialisation of a technology only just coming 'out of the lab'- indicating that collaborations are in place. Secondly, to support and encourage industry to invest in cutting-edge R&D activities, as evidenced by the generation of high-quality publication-worthy knowledge and ideas.

Figure 13 Bibliometrics – Private Sector Collaboration (2020-2023)





Source: Science-Metrix.

ISCF QT projects have played a foundational role in building the capabilities and positioning companies to effectively support other programmes and investments across the UK. For example, ISCF projects have laid the groundwork for early-stage technology development and demonstration of quantum computing components, many of which are now being advanced through the National Quantum Computing Centre's (NQCC) test-bed programme. Of the seven companies participating in the SBRI: Development and Delivery of Quantum Computing Testbeds for the NQCC, six were also funded by the ISCF QT programme. Interviews with senior stakeholders indicated that the NQCC test-bed programme has put the UK at the forefront of quantum computing globally, and that the underpinning support provided by the ISCF QT programme was invaluable for preparing both the NQCC and the participating companies to take on this next challenge. The two boxes below present examples from the impact case studies as to how the ISCF QT underpinned the development of the NQCC.

Box 2 Impact Vignette - NISQ.OS project

The aim of the **NISQ.OS** project was to develop the first universal operating system for all kinds of quantum computers. Such a system has the potential to drive an open standard in the quantum computing sector, which could rationalise the supply chain, and accelerate adoption of quantum computing. The project was funded from the ISCF QT under the Technology Projects Round 1. The project consortium consisted of Riverlane, Arm, Oxford Ionics, Oxford Ionics, Universal Quantum, SEEQC, NPL, Oxford Quantum Circuits , Duality Quantum Photonics and Hitachi Europe. A unique feature of the consortium was that it was made up of mainly of companies in their start-up phase and dependent on seed funding. NISQ.OS ran for three years, from August 2020 to July 2023.

Close collaboration within the consortium, which included quantum software and hardware partners, enabled the development of a Quantum Hardware Abstraction Layer (QHAL) – a hardware/software interface that is compatible with all the quantum computer types represented in the consortium. From the QHAL, a quantum operating system was successfully developed and tested on hardware partners' hardware emulators.

The project led to the development of Deltaflow OS, which formed the bases for Riverlane's commercial offering and is now being used in the NQCC test bed. The Deltaflow OS contributed to Riverlane to attracting £56m in series C funding. The project also led to product commercialisation, company growth, demonstrators, and the securing of contracts for partners in the consortium such as Oxford Ionics, Oxford Quantum Circuits and Duality Quantum Photonics.

The technologies and learnings from the project enabled partners in the consortium such as Riverlane, Oxford Ionics, Universal Quantum and SEEQC to win additional funding from subsequent ISCF QT competitions for follow on projects to continue the development of the outputs initiated by the project. These include the development of quantum computing applications. Similarly, the learnings from the project have been used by partners in the project to adapt their R&D strategies to align with the quantum computing sector's needs, specifically concerning FTQC.

Box 3 Impact Vignette - Quantum Computing Platform for NISQ Era Commercial Applications project

Quantum Computing Platform for NISQ Era Commercial Applications is a collaborative project that was delivered by Rigetti Computing, Oxford Instruments, Phasecraft, University of Edinburgh and Standard Chartered Bank. The project received a total funding of £6m under the CR&D strand and ran from August 2020 to December 2023. The aim of the project was to advance quantum computing in the UK by addressing hardware, infrastructure, and supply chain challenges, accelerating industrial applications, and developing the broader quantum ecosystem. The project was expected to help position the UK as a global leader in the field of quantum in the future. The project has led to the development and deployment of a 32-qubit Aspen class quantum computer, the development of quantum machine learning techniques that have been taken up by end-users, new collaborative projects between quantum hardware providers and financial institutions to leverage NISQ-era computing, and the creation of new products. It is expected that in the long term, the project will contribute to facilitating advancements in quantum computing applications and contribute to the UK's leadership in this technology sector.

3.2 R&D investment

This section covers the indicators to address the evaluation questions:

To what extent and how did the programme increase private and public funding leveraged (UK and from overseas)?

To what extent and how did the programme de-risk R&D investment opportunities

To what extent and how did the programme lead to increased R&D investment?

Organisations invested in the ISCF QT-funded project either as part of their grant commitments (matched/co-funding) or beyond. The programme leveraged £69,814,242 in matched funding from participants[15] - an internal programme leverage of 0.41 (i.e. as proportion of grant funding) and representing 29% of total project costs (i.e. grant plus matched funding).

The majority of this matched funding was provided by industry partners (Table 6), particularly suppliers of QT components and those developing underpinning technologies, which received greater proportions of the ISCF QT grant funding.

Notably, though there are 35 end-users involved in ISCF QT projects, often they did not receive grant funding or contribute matched funds to the projects but were partners in an advisory or observing role, both providing important input on user needs and as a route to keep themselves informed on technological developments. Of the 42 participations of end-users in ISCF QT projects, two thirds (28) did not seek ISCF QT funding and 24 of which contributed their own matched funds to the project.

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[15] As committed by applicants at the proposal stage

Table 6 Value of matched funding per position in the supply chain

Position in supply chain	Total ISCF funding	Total matched funding	% of total matched funding	Median matched funding (per project)	Leverage ratio
Academia / RTO (n=41)	£55,847,756	£167,163	0.2%	£0	0.00
Underpinning technologies (n=32)	£26,823,535	£16,095,379	23.1%	£90,200	0.60
Quantum technology components (n=39)	£40,138,123	£25,292,703	36.2%	£99,905	0.63
Quantum systems (n=35)	£43,728,633	£24,568,639	35.2%	£105,262	0.56
Quantum end users (n=35)	£4,605,296	£3,209,884	4.6%	£59,576	0.70
Other (n=7)	£1,148,172	£480,474	0.7%	£24,177	0.42

Source: Programme data. Supply chain classifications have been through business survey, Glass.ai, KTN, and manual input

Interviewees noted that participation in the ISCF QT programme provided some organisations with a clear technical roadmap and tangible project outcomes, de-risking their investment. These, alongside the development of strategic partnerships, gave companies the confidence to move forward with their next round of investment. Case study interviews reinforced this view, highlighting that the government-backed nature of the programme played an important role in validating early-stage quantum projects and demonstrating their potential viability to prospective investors. This support helped reduce perceived risk and positioned companies more strongly for future fundraising efforts.

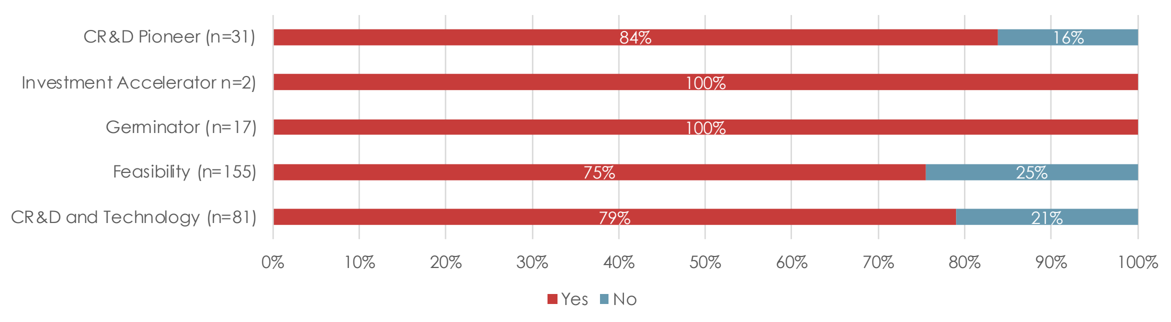
At project close, project participants were asked whether their organisations had been able to raise further funds, in addition to the match funding requirements. Around two thirds of project participants (68%, n=306) reported that they had not raised further funding. Where companies indicated that they had secured additional funding, this was leveraged from a variety of sources, including internal funding (31%, n=98), existing investors (27%, n=98) and venture capital funds (24%, n=98). Those 25 participants that had secured further investment from non-public sources reported that they had, even at the point of project close, secured at least £158m of further investment due to their ISCF QT project. This is heavily skewed by three investments over £30m for Quantum Motion Technologies Ltd (£42m), Riverlane (£208m) and Oxford Ionics Ltd (£30m). On average (median), companies reported that they had successfully secured £300,000. For Riverlane, for example, the NISQ.OS project led to the development of Deltaflow OS, which formed the basis for Riverlane's commercial offering and is now being used in the NQCC test bed and enabled them to secure £56m in series C funding (see Box 2 Impact Vignette - NISQ.OS on page 35 for more details). Further analysis of Crunchbase indicates the further investment secured by programme participants in the years following their ISCF QT projects is over £700m - this is presented and discussed in more detail in Section 3.4.1 below.

3.2.1 *Increased R&D Expenditure*

Increased R&D investment is expected among beneficiaries, which includes any additional funding dedicated to advancing QT-enabled technologies, devices, products and services in beneficiaries. This increase in R&D investment is expected to come from companies increasing their own internal R&D budgets, as well as being more competent in accessing additional public funding and external private investment.

At project close, the majority (78%) of project leads reported that they planned on conducting further R&D to continue their recently closed ISCF QT projects (n=283). On average (median), projects anticipate spending an additional £250k on R&D. The majority of projects (64%, n=246) reported that they expected to spend between £0 and £500k on R&D activities.

Figure 14 Plans for further R&D to commercially exploit project outputs – PCF data

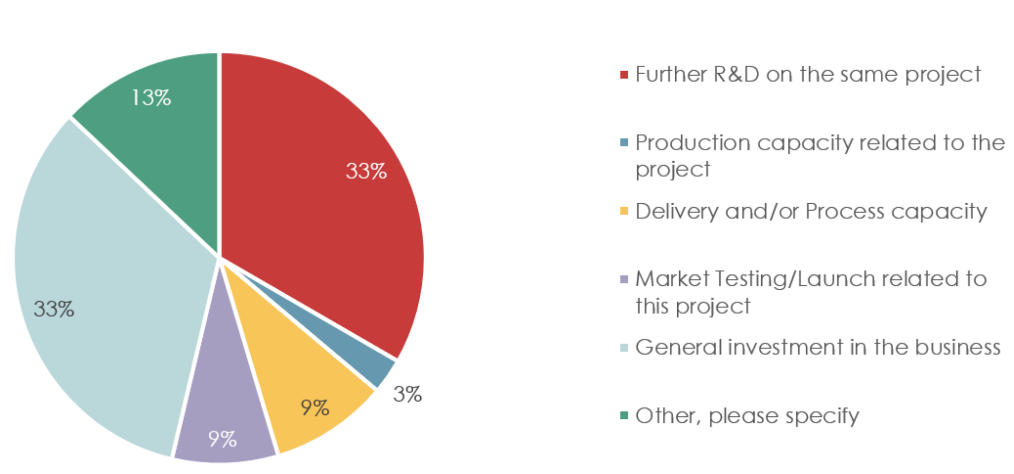


Source: Technopolis analysis of PCF data (January 2025). All project participants

In addition to their expectations about additional R&D to further develop the technology, project participants were also asked whether they had plans for further R&D to commercially exploit the technology outputs from ISCF QT project activities. A large majority (79%, n=283) of participants reported that they are planning further R&D to commercially exploit the project. Additionally, project participants were asked to reflect on what further funding would be used towards (see Figure 15), with almost a third reporting further R&D on the same project and another third (33%, n=108) on general investment in their companies.

Participants expected the funding for this R&D activity to come from a variety of sources, including Innovate UK support (68%, n=273) and EU support (30%). SBRI quantum-focused challenges and SMART grants were also frequently cited as sources of additional public funding that project participants expected to apply to following the end of their ISCF QT projects. Around half of project participants (52%) also reported that they anticipated accessing increased R&D investment from business funds.

Figure 15 Spend of further funding – PCF data



Source: Technopolis analysis of PCF data (January 2025). Business and RTO participants only.

Participants have seen a marked increase in their levels of R&D expenditure, well above those of the unsuccessful applicants. All groups have experienced an increase in R&D expenditure from baseline to the financial year 2022/23. On average, for successful applicants, the increase in QT R&D since the baseline is £252k, compared to a slightly smaller increase for unsuccessful applicants at £22k. The difference indicates that businesses participating in the programme are able to spend larger sums of money on QT R&D. However, successful businesses reported spending more on R&D at even at baseline than unsuccessful applicants, and this difference could be related to factors such as company size or access to multiple grants. That said, the allocation of spending for QT R&D in proportion to general R&D expenditure has risen between baseline and 2023/24, suggesting that businesses participating in the programme are intensifying their R&D efforts into QT.

Table 7 R&D expenditure, Businesses, programme participants and unsuccessful applicants

Indicator		**Successful applicants**			**Unsuccessful applicants**		
		Baseline*	2023/24	Change	Baseline*	2023/24	Change
R&D expenditure (Business) **	Mean	£2.9m	£3.3m ▲	£400k	£44k	£144k ▲	£100k
	Median	£155k	£1m ▲	£845k	£25k	£75k ▲	£50k
R&D expenditure into quantum technologies (Business)**	Mean	£56k	£308k ▲	£252k	£14k	£36k ▲	£22k
	Median	£0	£150k ▲	£150k	£0	£25k ▲	£25

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the position two years prior to their first application (for unsuccessful applicants) or first project (for successful applicants). **Excluding end-users. Programme participants, base:21, unsuccessful applicants base:9. If R&D expenditure reported as zero, expenditure on quantum R&D assumed to be zero.

Interviews with wider stakeholders and programme participants noted that the programme had played a valuable role in de-risking the investment into quantum technology R&D. Interviewees noted that this took place on two levels. Firstly, companies noted that securing ISCF QT funding helped to validate and provide further assurance as to the viability of their (potential) product and organisation, increasing their credibility with potential partners and investors. Secondly, interviewees also noted that the existence of the programme and its clear strategy and phasing for investing the commercialising of quantum technologies provided greater confidence for companies to pursue their next rounds of investment. In this sense, companies were better able to plan their future activities, and to communicate the opportunity to investors.

Academic participants also increased the number of projects and R&D expenditure overall and in quantum technologies specifically. Academic participants reported a slight increase in the number of R&D grants / projects they secured (3 to 5, median) and an increase in those relating to quantum technologies (3 to 4, median), whilst unsuccessful academic applicants remained the same (see Table 8).

Table 8 R&D activity, Research, programme participants and unsuccessful applicants, rounded to nearest whole number

Indicator		**Successful applicants**		**Unsuccessful applicants**	
		Baseline*	2023/24	Baseline*	2023/24
	Mean	6	8 ▲	3	3 ■

Indicator		Successful applicants		Unsuccessful applicants	
R&D grants/projects (Universities and RTOs)	Median	3	5	4	3
R&D grants/projects in quantum technologies (Universities and RTOs)	Mean	5	5	1	1
	Median	3	4	1	1

Source: Technopolis, Academic Survey, April 2025. Programme participants, base: 13. Unsuccessful participants, base: 4. Note: * The baseline is defined as the two years prior to 2023/2024

All groups have experienced an increase in R&D expenditure from baseline to the financial year 2023/24 (see Table 9). Unsuccessful academic research groups reported a greater increase in non-QT R&D expenditure (235%) than programme participants (162%) from baseline, though the participating research groups reported a significantly greater increased in their R&D expenditure in quantum technologies (201% vs 45%). The difference indicates that those research groups participating in the programme are more specialised in QT R&D – echoing the conclusion above in which these research groups have seen an increase in the number of grants and projects since the baseline position.

Table 9 R&D expenditure, Research, programme participants and unsuccessful applicants

Indicator		Successful applicants			Unsuccessful applicants		
		Baseline*	2023/24	Change	Baseline*	2023/24	Change
R&D expenditure (Universities and RTOs)	Mean	£873k	£2.3m	£1.4m	£354k	£1.2m	£885k
	Median	£250k	£500k	£250k	£307k	£745k	£438k
R&D expenditure into quantum technologies (Universities and RTOs)	Mean	£692k	£1.9m	£1.2m	£84k	£100k	£16k
	Median	£175k	£300k	£125k	£38k	£75k	£37k

Source: Technopolis, Academic Survey, April 2025. Programme participants, base: 13. Unsuccessful participants, base: 4. Note: * The baseline is defined as the two years prior to 2023/2024.

3.3 New QT technologies, products & services

This section covers the indicators to address the evaluation questions:

To what extent and how did the programme lead to new QT technologies, and lift the TRL of existing ones?

To what extent and how did the programme lead to new product lines and services?

To what extent and how did the programme lead to new working commercially viable QT components, prototypes, products and services?

The majority of ISCF QT participants indicated in their PCFs that prior to starting their projects they were seeking to develop new products (64%, n=286) or to improve existing products (13%, n=286).[16] Fewer participants, around 11%, indicated they were primarily aiming to develop a new or improve an existing process, and 5% looking to develop a new service. The majority of

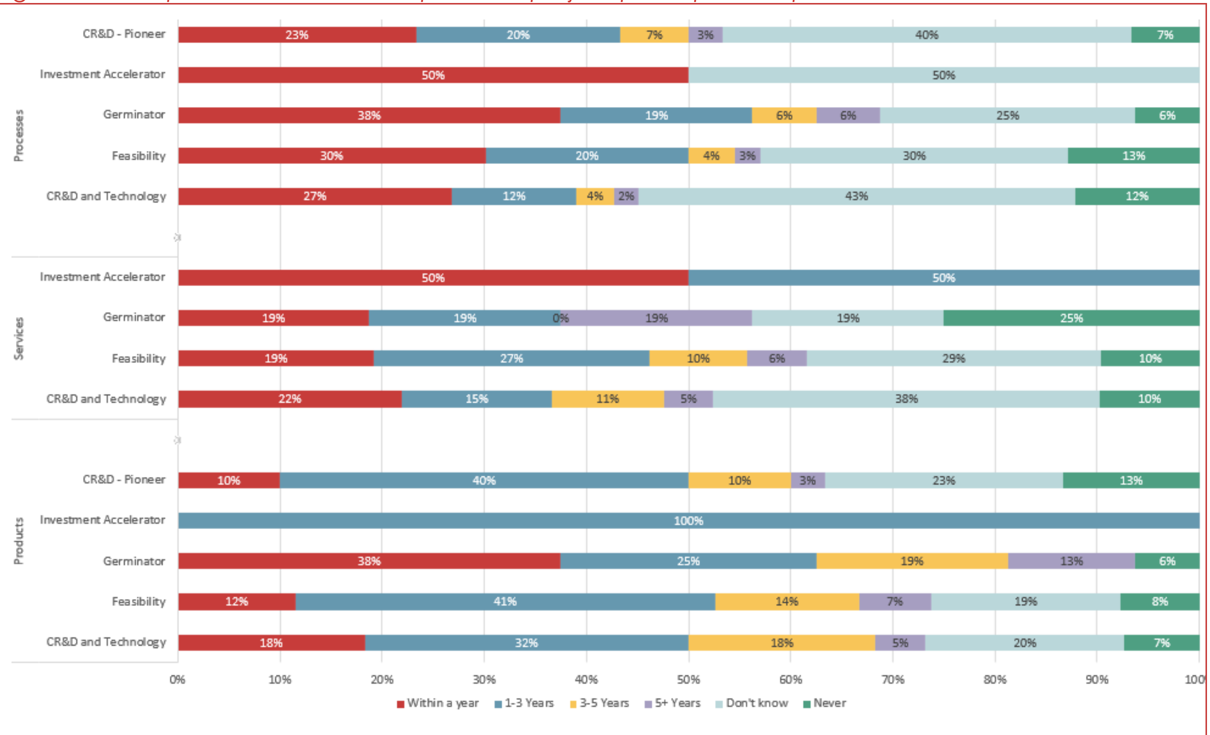
[16] Full responses to project aims: New product (64%), new service (5%), new process (5%), improved process (6%), improved product (6%), improved service (13%), other (2%, including improved organisational method and new organisational method)

the products, services and processes that organisations sought to tackle through ISCF-funded projects were new to market (78%) (i.e. something created by an organisation that has not already been done by organisations) rather than new to firm (22%). This reflects the relatively early stage of maturity of the technologies in this space – in that most products to be developed would be entirely new - and the positioning of the programme to take QT from research and ideation through demonstration and into application and commercialisation.

At the point of project close, the majority of participating businesses (74%) expected to introduce new products into their offering as a result of their ISCF QT projects (n=286, see Figure 16), though the timescales vary considerably across participants and projects. Around half of the participating businesses expected to introduce new products in the 3 years following their ISCF QT project (53%). Taken by instrument, the Investment Accelerator shows the highest proportion of participants expecting projects (100%, n=2), followed by Germinator (94%, n=16). The remaining (notably including feasibility studies, which typically start at a lower TRL) instruments all show similar expectations (63%-74%) of releasing products.

Fewer participants expected to introduce new processes or services. A third of participating businesses expected to introduce new processes within the year, though 47% either didn't expect to or didn't know if they would do so. Just under half expected to introduce new services within 3 years, A further 21% indicated they expected to introduce new products in more than 3 years' time following project close.

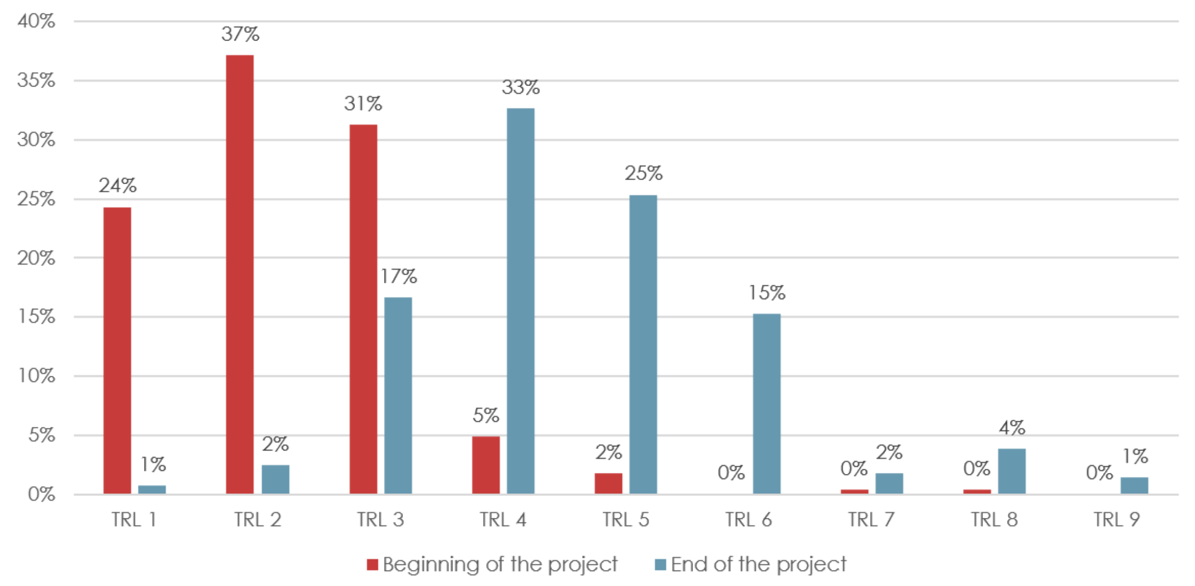
Figure 16 New processes, services or products project participants expect to introduce – PCF data



Source: Technopolis analysis of PCF data (January 2025). Business and RTO participants only. Processes n=286, services n=286, products, n=286

In terms of **Technology Readiness Level** (TRL) development, almost all (97%) participants reported they had increased their TRL by at least one level by the end of their project. Participants reported that the TRL of their product at the start of projects was at TRL3 or lower (92%, n=286, see Figure 17). The median was a TRL of 2, though the highest TRL that a project reported was a TRL 5, corresponding to basic validation in a relevant environment. Following the end of their ISCF QT projects, 80% of project participants reported a TRL of 4 or greater, with a small proportion (5%) reporting a TRL of 8 or 9, indicating that the new product developed is close to market. Four projects (two feasibility participants and 2 CR&D participants) reported the largest TRL uplifts from 1 to 8.

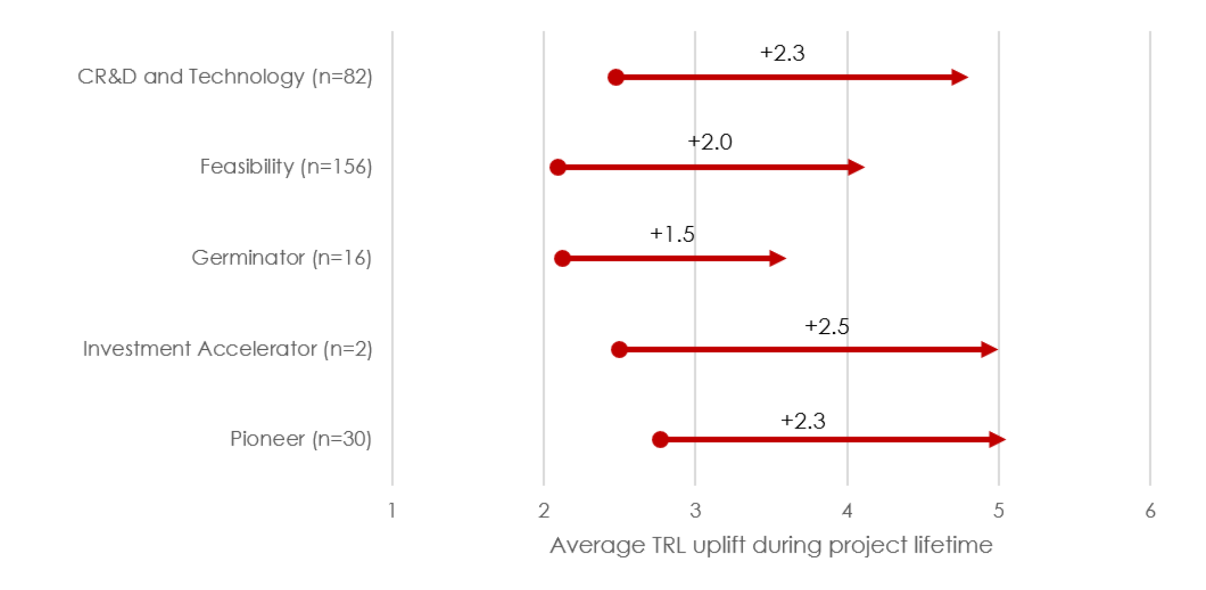
Figure 17 Distribution of TRL at the beginning and the end of the project – PCF data



Source: Technopolis analysis of PCF data (January 2025). Business and RTO participants only.

On average, ISCF QT projects increased the TRL of their products by TRL by 2.3 levels. There is some variation according to the different instrument types (see Figure 18), where Pioneer projects, Investment Accelerator and CR&D and Technology projects reported the largest average (mean) TRL uplift, reflecting the larger scale and longer-time frames of the projects as opposed to the Germinator and Feasibility projects.

Figure 18 Average TRL uplift during project lifetime – PCF data



Source: Technopolis analysis of PCF data (January 2025). Business and RTO participants only.

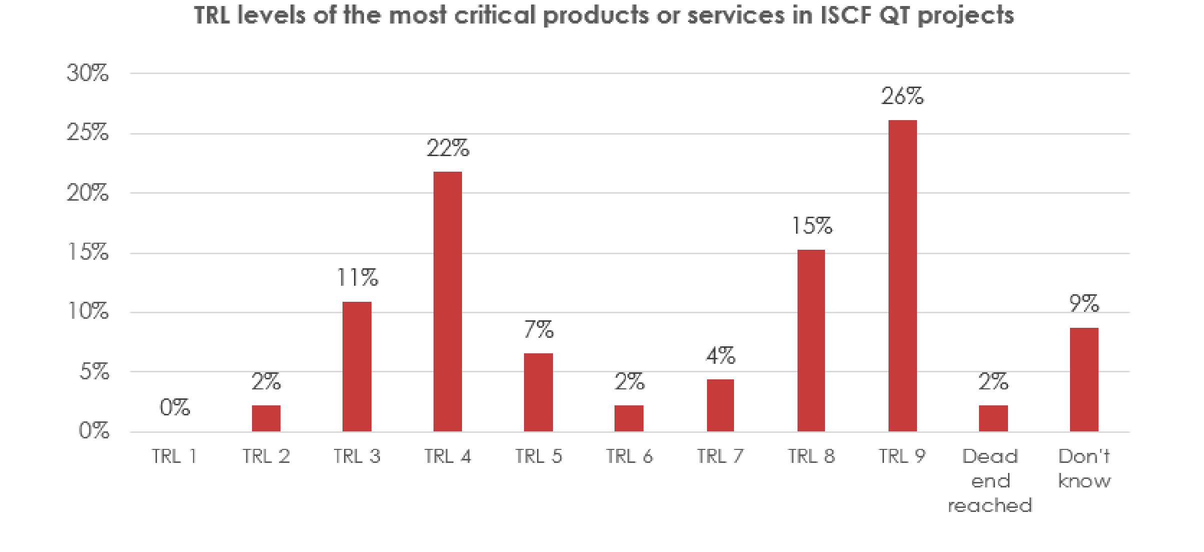
As of early 2025, participants' ISCF QT supported products and services have continued to be developed and are reaching commercialisation. The development of these technologies continued beyond the end of participant's ISCF QT projects. As noted in Section 2.7, there are numerous instances in which programme participants are involved in more than one project, and some of the technologies developed in Feasibility or Pioneer projects have continued to be developed in subsequent ISCF QT projects. Furthermore, as highlighted in Section 3.2, participants have also secured further investment, most of which they intended to spend on further R&D activities.

In the survey, business participants provided further details on the products or services linked to their ISCF Quantum Technology project(s), which they viewed as most critical for growing their business. From the 64 successful applicants who responded to the survey, 44 (72%) have provided details on 46 products or services associated with their ISCF QT projects, with the remaining 20 respondents (28%) indicating that they 'didn't know'. Most of these products/services were indicated as 'Hardware components' (76%), while the remainder were categorised as 'Software' (13%) or 'Other' (11%).

For the 46 products or services identified through the survey, around half (46%) of products have moved beyond the 'development' phases and have, at a minimum, started the process of validation and deployment namely TRLs7-9 (see Figure 19). A fifth of products (26%) have already reached commercialisation (TRL9). From the 12 products that have reached TRL9, 5 are developed by companies classified as 'underpinning technology' companies, 4 products are from companies developing QT components and 3 products are reported by companies developing QT systems.

There remains however a not insignificant proportion (41%) of critical technologies still in the early stages of development (TRL3-6). This reflects the fact that whilst some quantum technologies are market ready, a substantial proportion are not and will require further development. Notably, just one company reported that one of their critical technologies had reached a 'dead end' and would not be likely to progress further. Given the early stage of the TRLs reported by participants in the PCFs at the outset of the project, this represents a positive signal that for most participants, they have been able to identify alternatives routes or technologies to develop even if their ISCF QT project output itself was not successful.

Figure 19 TRL levels of the most critical products or services in ISCF QT projects



Source: Technopolis, CATI Survey, March-May 2025. Business participants. n=46

Overall, successful business applicants were more likely than unsuccessful business applicants to have launched a new QT product or service since the baseline period. Though both programme participants and unsuccessful applicants report an increase, this was substantially higher for programme participants than unsuccessful applicants (32 ppt vs 5 ppt, see Table 10). Similarly, the proportion of both programme participants and unsuccessful applicants that had manufacturing components or QT based products increased since the baseline period, though this was greater for participants (16ppt vs 10ppt).

Table 10 Launched products/services or manufacturing components, successful and unsuccessful business applicants

Indicator	**Successful applicants**			**Unsuccessful applicants**		
	Baseline*	Since applying to ISCF	Change in percentage points (ppt)	Baseline*	Since applying to ISCF	Change in percentage points (ppt)
% respondents who have launched a new QT product/service (Business)**	7%	39% ▲	32 ppt	0%	5% ▲	5 ppt
% respondents who have manufactured components or products based on QT (Business) **	14%	30% ▲	16 ppt	5%	15% ▲	10 ppt

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the position two years prior to their first application (for unsuccessful applicants) or first project (for successful applicants). **Excluding end-users. Programme participants (business), base:44, unsuccessful business applicants base: 20.

The impact cases present a wide range of products and services developed as part of the ISCF QT projects:

- QT Assemble (see Box 10) enabled the development of several advanced quantum technologies, such as a new PPLN waveguide package, the compact NX Micro laser platform, and a functioning single-photon platform. Some project outcomes have already been commercialised and are available for purchase.
- AIRQKD (see Box 1) successfully demonstrated two use cases for integrating quantum key distribution (QKD), a quantum-era cybersecurity tool, with 5G/6G networks. A key finding from the project was that the single-photon source and detector technologies are not mature enough for commercial applications of secure free-space communications. Among other benefits, the project resulted in the development of a software which formed the foundation of Arqit's flagship product, the SKA-Platform. NPL also improved their single-photon measurement capabilities and protocols, which now form part of their service offering and may be incorporated into future testbed facilities.
- CompaQT (see Box 4) supported Delta.g to develop of a prototype quantum gravity gradiometer. The fully integrated prototype was completed shortly after the close of the project, advancing the technology to TRL6. As a result of the project, Delta.g now have the process and specifications to manufacture the technology themselves, following further refinement of the technology in collaboration with end-users.
- The NISQ.OS project (see Box 2) enabled the development of a Quantum Hardware Abstraction Layer (QHAL) – a hardware/software interface that is compatible with all the quantum computer types represented in the consortium. From the QHAL, a quantum operating system was successfully developed and tested on hardware partners' hardware emulators. The project also led to the development of Deltaflow OS which formed the basis for Riverlane's commercial offering and is now being used in the NQCC test bed.

3.4 Commercially successful QT Businesses

This section covers the indicators to address the evaluation questions:

To what extent and how did the programme lead to increased investment in QT businesses?

To what extent and how did the programme lead to increased revenue and employment growth?

To what extent and how did the programme lead to growth in export opportunities?

To what extent and how did the programme lead to improved profitability and productivity?

3.4.1 Increased investment in QT businesses

At the point of project close, 25 companies reported further investment secured as a result of their ISCF projects, amounting to a sum value of £158m in further investment from private investment sources, i.e. excluding further grant funds.

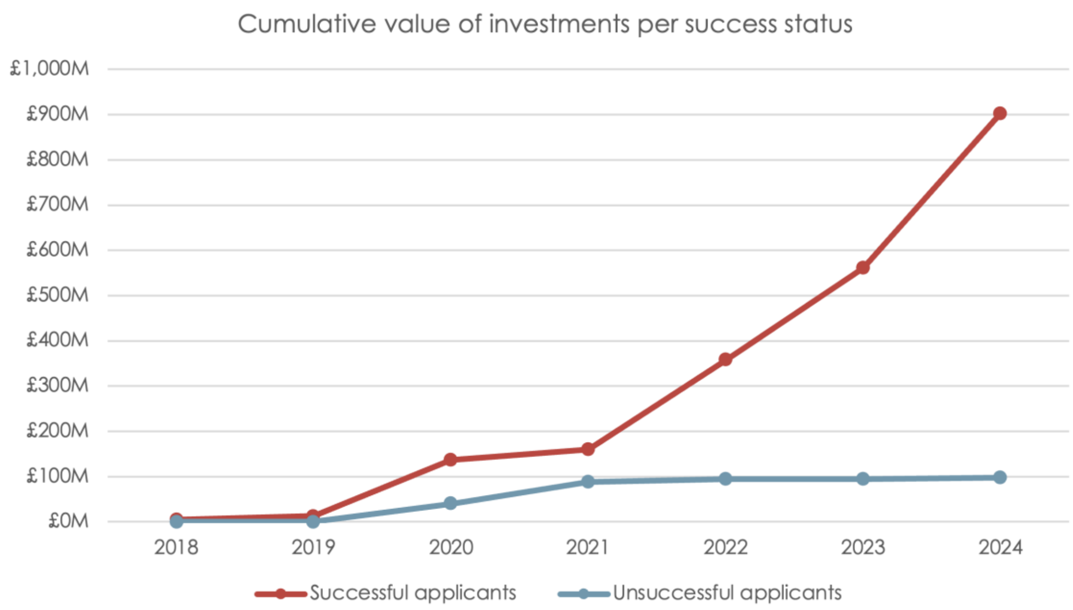
Further analysis of Crunchbase also shows that ISCF QT participants have been very successful in securing further funding.

Of the 113 companies participating in the ISCF QT programme, excluding end-users, we have identified 29 (26%) as having at least one funding round listed on Crunchbase after they made their first application to the programme. This is indicative of the strength of these companies. This is especially true when compared to the unsuccessful applicants, of which only 15% of the 52 companies are listed in the database.

These 29 programme participants have secured a total of 68 rounds of funding between 2018 and 2024 whilst unsuccessful applicants secured 13. More than half (56%) of these funding rounds were secured by programme participants between 2022 and 2024. The total value of the investment secured by programme participants amounts to £903m (excluding organisations categorised as end-users) compared to £97m secured by unsuccessful applicants (see Figure 20). Of the investment secured by ISCF QT participants, 15% was secured by companies developing underpinning technologies and 85% developing QT components or systems.

The strength of attribution to the ISCF QT programme is further validated by analysis conducted by the ISCF QT team, who through analysis of Beauhurst investments and assessment of the attribution to the ISCF QT programme identified £771m in further investment secured by programme participants.

Figure 20 Cumulative value of funding rounds for ISCF QT participants and unsuccessful applicants



Source: Technopolis (2025) based on Crunchbase data. Note: Organisations labelled as end-users have been excluded. Debt, IPO/liquidity and grant investments have been excluded

Box 4 Impact Vignette - CompaQT project

The **CompaQT** project, funded under the Feasibility competition of the ISCF QT programme, began in October 2022 and concluded in April 2024. The project aimed to develop a quantum gravity gradiometer – a cutting-edge device that passively detects subsurface density anomalies by measuring minute variations in gravitation fields. Building on over a decade of research at the Sensing and Timing UK QT Hub at the University of Birmingham as well as previous ISCF-funded projects, CompaQT sought to transition the technology from academic prototype to a commercial-grade field-deployable sensor. The project was led by the University of Birmingham spin-out Delta.g, with support from the engineering consultancy firm STL Tech. While the fully integrated prototype was completed shortly after the project's formal end in 2024, the work within the project has enabled Delta.g to advance the sensing capability towards commercialisation, secure additional funding and partnerships. Key outcomes from the project include a £1.5 million private equity investment, creation of new QT jobs, and the development of a UK-based supply chain for critical components. The project has also led to field trials with end users and follow-on funding via a successful SBRI grant with the

Department for Transport. The quantum gravity gradiometer has potential future applications in infrastructure, reducing survey costs by a factor of 50, and accurate navigation without the use of GPS.

Box 5 Impact Vignette - Quantum Motion

Quantum Motion is a quantum computing company founded in 2017 by researchers from UCL and the University of Oxford. They are developing a scalable array of qubits based on silicon technology that already exists in the manufacturing of chips for conventional computers. They received £4.6m in ISCF QT funding across 5 projects, each addressing a unique aspect of the quantum stack. They are one of seven companies tasked with deploying a functional full quantum stack to the NQCC, as part of the UKRI Quantum Testbed Competition. Since the start of their first ISCF project in 2020, they have grown from 8 employees to over 100 and have leveraged £50m of VC funding from national and international partners.

3.4.2 Increased revenue and employment growth

Increased revenue

Programme participants from industry reported greater commercial success than unsuccessful applicants from industry in terms of both turnover and employment.

At project close, the majority of business and RTO participants (89%, n=283) reported that their commercial opportunities had either moderately or greatly increased as a result of participation and no companies suggested that participation had negatively impact their commercial opportunities.

On average (mean and median), annual turnover increased for both successful and unsuccessful applicants, though programme participants experienced greater increases when compared to unsuccessful applicants. Programme participants have, on average (mean), seen their annual turnover increase by £4m since baseline, compared to a slightly smaller amount of £1.2m for unsuccessful applicants.

Turnover specifically related to QT also increased to a greater extent for participants than for unsuccessful applicants, indicating that the programme increased opportunities to commercialise their products and services. Programme participants have experienced an increase in the proportion of their QT-turnover, growing from 1.8% to 7.5% of total turnover, compared with a decrease from 6.8% to 1.9% in the unsuccessful group.

Table 11 Turnover and turnover from QT technologies, Businesses, programme participants and unsuccessful applicants

Indicator		**Successful applicants**			**Unsuccessful applicants**		
		Baseline*	2023/24	Change	Baseline*	2023/24	Change
Value of annual turnover (Business) **	Mean	£5.8m	£10m ▲	£4m	£278k	£1.5m ▲	£1.2m
	Median	£300k	£1.25m ▲	£950k	£46k	£163k ▲	£17k
Value of annual turnover, attributed to QT (Business)**	Mean	£177k	£976k ▲	£799k	£19k	£29k ▲	£10k
	Median	£0	£26k ▲	£26k	£0	£0 ■	£0

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the position two years prior to their first application (for unsuccessful applicants) or first project (for successful applicants). **Excluding end-users and outliers. Programme participants (business), base: 34, unsuccessful (business) applicants base: 12. If turnover reported as zero, turnover from quantum technologies is assumed to be zero.

Box 6 Impact Vignette - Agile Quantum Safe Communications (AQuaSec) project

The **Agile Quantum Safe Communications (AQuaSec)** project began in November 2018 and concluded in June 2021. The project received £5,798,747 funding for this duration. It was aimed at supporting the development of the entire supply chain to support a robust quantum manufacturing sector to sit alongside the world class quantum research taking place in the UK. This required the integration of skills and capabilities of a wide range of partners to design, develop, test, and ultimately prepare prototypes for commercialisation entirely within the UK.

In 2021, when the Baseline Evaluation of the ISCF QT programme was delivered the devices and the cryptography development phases of the project had been completed. Software testing had been completed, and the hardware and chip platforms were undergoing testing and validation. Since the baseline study, the technology developed during the AQuaSec project has informed the basis of new product streams for Toshiba (the project lead) and the other partners. Many partners have joined together on multiple other successful bids for other projects such as SPIDAR and QFoundry**.** Partners in the project have acquired new customers and seen increases in revenue due to improved processes and services derived from AQuaSec research.

Increased employment

Programme participants have increased the number of FTE employees since the start of their first ISCF QT project whereas the unsuccessful group have largely stayed the same.

At the point of project close, project partners were asked to consider the total number of FTEs retained and created during the project, as well as projections for the following three and five years after the project is completed. A summary of the median FTE retained and created is presented by funding instrument type in the tables below (Table 12 and Table 13). On average (median) participants retained 1.35 FTE but did not create any new FTE during their ISCF QT projects. Looking forward, participants expected to retain 2 and create 1 FTE three years after the end of their ISCF QT projects, and to retain 2 and create 2 FTEs five years after the end of the projects.

Table 12 Median FTE retained during the project and expected – PCF data

Project Instrument	**During Project**	**3 years after project finished**	**5 years after project finished**
Whole programme	**1.35**	**2**	**2**
Wave 2 / Pioneer (n=31)	1	0.3	0.5
CR&D and Technology (n=80)	1	1.6	2
Feasibility (n=165)	1	1	1
Germinator (n=12)	0.3	0.1	0.5
Investment Accelerator (n=2)	4.5	4.5	4.5

Source: Technopolis analysis of PCF data (January 2025)

Table 13 Median FTE created during the project and expected – PCF data

Project Type	**During Project**	**3 years after project finished**	**5 years after project finished**
Whole programme	**0**	**1**	**2**
Wave 2 / Pioneer (n=31)	0	0	0
CR&D and Technology (n=80)	1	1	1.6

Feasibility (n=165)	0	0.25	1
Germinator (n=12)	0	0	0.5
Investment Accelerator (n=2)	1.5	3	7.5

Source: Technopolis analysis of PCF data (January 2025).

As of 2023/24, business participants surveyed increased their employees by 67 and quantum R&D employees by 3 on average (mean). R&D employees remain a small, but growing, proportion of their workforce at 3.9% from 3.5%. Compared to the unsuccessful business applicants who on average (mean) have decreased by 3 employees and had no change in quantum R&D employees.

Based on these figures, the proportion of staff employed in quantum R&D roles within these organisations is larger for unsuccessful applicants, though this is likely driven in part by the relatively smaller size (on average) of the unsuccessful applicants. On average, programme participants saw a greater increase in the number of staff employed in quantum R&D roles. Furthermore, interviews with programme participants also noted that the largest areas of growth within their teams (due in part to the support provided by the ISCF QT projects and resulting benefits) has more often been in areas of engineering and general operations, rather than in their core QT R&D teams.

Table 14 Employees and employees in Quantum R&D, Businesses, participants and unsuccessful applicants

Indicator		**Successful applicants**			**Unsuccessful applicants**		
		Baseline*	2023/24	Change	Baseline*	2023/24	Change
Business employees (FTE) **	Mean	86	153 ▲	67	22	19 ▼	-3
	Median	5	17 ▲	12	3	5 ▲	2
Business employees in quantum R&D (FTE) **	Mean	3	6 ▲	3	1	1 ■	0
	Median	2	4 ▲	2	1	1 ■	0

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the position two years prior to their first application (for unsuccessful applicants) or first project (for successful applicants). **Excluding end-users. Programme participants (businesses), base:43, unsuccessful applicants (businesses) base:15.

3.4.3 *Growth in export opportunities*

Programme participants increased their export opportunities as a result of their involvement in the ISCF QT programme.

In their PCFs, around half of business and RTO participants (53%, n=286) reported that their organisation had previously exported goods or services prior to involvement in the project, and a majority (81%, n=233) reported that they believed their organisation was more likely to export goods and services after participation in the project. This is higher than reported by participants in other ISCFs, in part a reflection of the highly specialised nature and relatively small number of companies globally with sufficient capabilities, but is also indicative of the position and global connectedness of the UK's QT sector even at the outset of the programme.

On average (mean), for businesses, both programme participants and the counter-factual group have generated an increase in turnover from general exports (increase of £2m and £791k respectively). Notably though, most applicants (successful and unsuccessful) reported no export turnover – the median turnover derived from all exports remained £0 for both groups between the baseline year and 2023/24. This reflects the fact that the majority of QT companies are likely to be pre-revenue, given the readiness of the technology.

Though on average (mean) unsuccessful applicants appear have realised an increase in exports as a proportion of turnover, this is largely driven by the small sample size and a small number of companies that reported substantial increase in their exports. The majority of unsuccessful applicants realised no change. For successful applicants, although export sales have risen alongside total turnover, the more rapid growth of domestic sales has led to a decline in exports as a percentage of total turnover (decline of 14 percentage points compared to baseline).

Table 15 Turnover derived from exports, Businesses, participants and unsuccessful applicants

Indicator		Successful applicants			Unsuccessful applicants		
		Baseline*	2023/24	Change	Baseline*	2023/24	Change
Turnover derived from exports**	Mean	£3.6m	£5.6m	£2m	£27.5k	£818k	£790.5k
	Median	£0	£0	£0	£0	£0	£0
Turnover derived from exports in QT**	Mean	£8k	£92k	£84k	£19k	£8k	-£11k
	Median	£0	£0	£0	£0	£0	£0
Exports as a % of turnover λ	Mean	43%	29%	-14 ppt	8%	23%	15 ppt
	Median	32%	10%	-22 ppt	0%	0%	0
% of exports in QT λ	Mean	21%	20%	-1 ppt	28%	10%	-18 ppt
	Median	0%	0%	0	5%	0%	-5 ppt

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the position two years prior to their first application (for unsuccessful applicants) or first project (for successful applicants). **Excluding end-users and outliers. Programme participants, base: 29, unsuccessful applicants base: 12. For organisations reporting no turnover in 2017/18, the value of exports and value of exports in QT is assumed to be zero. λ Counting only those organisations with reported turnover.

3.4.4 *Improved profitability and productivity*

Overall, both successful and unsuccessful applicants to the ISCF QT programme have realised increased profit and profitability. On average (mean), the surveyed programme business participants report a higher value of profit (EBDITA) compared to the unsuccessful group for the 2023/24 year. Though the average (mean) value of profit has increased to a greater extent for unsuccessful applicants (a 379% increase compared to 2%), this is skewed by the success of two companies and the small sample. The median profit for these unsuccessful applicants did not increase, whilst it did for the programme participants – an average increase of £25k.

Productivity (turnover per FTE) among programme participants remains higher than the unsuccessful group, growing by £60k (65%) from baseline, compared to £11k (17%) among the unsuccessful group. This reflects the difference rates of profits of each group.

Table 16 Profitability and productivity, Businesses, participants and unsuccessful applicants

Indicator		Successful applicants			Unsuccessful applicants		
		Baseline*	2023/24	Change	Baseline*	2023/24	Change
Value of profit (EBDITA) **	Mean	£314k	£321k ▲	£7k	£63k	£301k ▲	£238k
	Median	£0	£25k ▲	£25k	£0	£0 ■	£0
Productivity (Turnover per FTE) in £ **	Mean	£93k	£153k ▲	£60k	£63k	£74k ▲	£11k
	Median	£53k	£119k ▲	£66k	£50k	£75k ▲	£25k

Source: Technopolis, CATI Survey, March-May 2025. Note: * The baseline is defined as the position two years prior to their first application (for unsuccessful applicants) or first project (for successful applicants). **Excluding end-users. Programme participants, base: 28, unsuccessful applicants base: 10.

3.5 Growing the UK's QT Sector

This section covers the indicators to address the evaluation questions:

To what extent and how did the programme lead to new and enhanced partnerships and collaborations?

To what extent and how did the programme lead to increased SME involvement in the Quantum sector?

To what extent and how did the programme lead to creation of new UK QT companies?

To what extent and how did the programme lead to new jobs created in the UK QT sector?

To what extent and how did the programme lead to increased awareness of QT among a range of stakeholders?

To what extent and how did the programme improve the UK QT supply chain?

To what extent and how did the programme lead to Increased engagement and adoption of new QT-enabled products in end-user (non-QT) sectors?

To map the UK's emerging QT sector, the evaluation grouped organisations according to the four categories. Given the unique position of end-users within the programme, they have been excluded from the analysis presented below. The more detailed listed of these categories is presented in Appendix A. We also introduce an "other" supply chain category, for companies that are QT-aligned, but have no clear position in the supply chain.

Position in the supply chain	Description
Underpinning technologies	Developers and suppliers of underpinning technologies and capabilities that underpin R&D in quantum technologies and underpin manufacturing/ production of quantum technologies
Quantum-technology components	Developers, manufacturers and suppliers of quantum-technology-based components – that will be incorporated in larger systems that themselves might be classified as 'quantum' (e.g. quantum computers) or not (e.g. instrumentation and control systems using quantum sensors)
Systems (using quantum technologies)	Developers and suppliers of systems (systems integrators) that incorporate quantum components. The system as a whole may be classified as 'quantum' or not. Systems may be sold/used by customers as products or as services

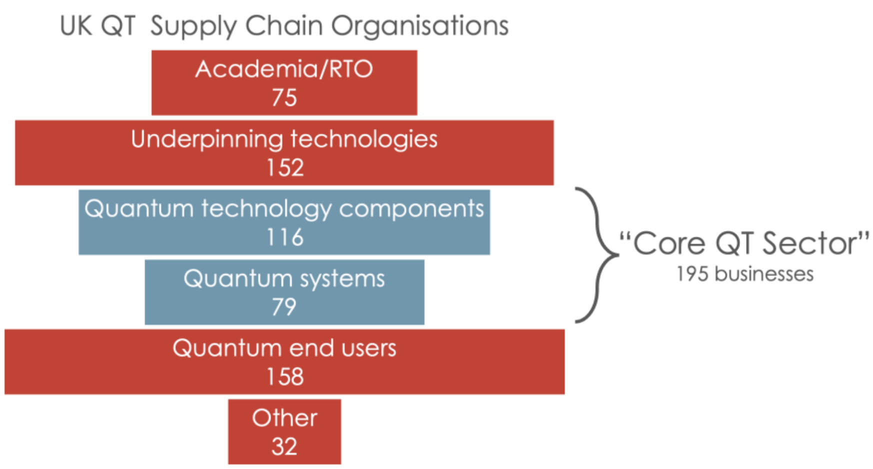
End-users	Business and public agencies that deploy systems incorporating quantum technologies within their organisations to improve their productivity or enhance their own product offering (e.g., accelerating drug development, ensuring secure communications)

The QT sector mapping analysis builds on the list of the ISCF QT applicants (successful and unsuccessful) and wider organisations in the sector as identified from a range of sources (Innovate UK database of calls relating to QT, KTN landscape database, previous analysis conducted by the ISCF QT team). This list was further expanded with the use of Glass.ai's web scraping techniques to identify QT related activity recorded on company websites. The list of organisations identified were then manually reviewed and cleaned by the evaluations study team. A full description of the methodology is presented in the Appendix Document.

Through this approach, we have identified a total of 612 organisations as being active in the quantum technologies ecosystem in the UK. The distribution of these organisations across the different categories is presented in Figure 21 below. The 158 end user organisations consist of 19 public sector or charity organisations and 139 businesses that deploy systems incorporating quantum technologies within their organisations.

The 195 businesses that are developing quantum technology components or quantum systems we defined as the **Core QT Sector** within the UK.

Figure 21 Number of organisations in UK QT sector mapping per supply chain category



Source: Technopolis (2025) based on ISCF UK QT application data and web scraping (Glass.ai)

Table 17 Number of organisations by position on QT supply chain and ISCF QT application status as of 2025

	Academia/RTO	Underpinning technologies	Quantum technology components	Quantum systems	Quantum end users	Other
Participant	40	32	39	35	35	7
Applicant	49	47	46	43	60	11
Whole sector	75	152	116	79	158	32

Source: Technopolis (2025) based on ISCF UK QT application data and web scraping (Glass.ai).

Though this mapping indicates that 26 RTOs / research groups are non-applicants to the ISCF QT programme, this also includes research hubs and centres that though somewhat independent, are comprised of researchers and research groups that are participants in the programme. The proportion of academic research groups and RTOs that are participants in the programme is therefore likely to be higher that 65%.

Only around a third of underpinning technology companies identified in our sector mapping applied to the programme. This may be because firms developing or providing key components for quantum technologies that can be purchased 'off the shelf' for integration into quantum technology systems, and which may not require further R&D investment to support quantum technology development directly. Alternatively, it may also be because they were not, at the point of ISCF QT competitions, actively targeting the development of quantum technologies. What is valuable to note however is that there is a strong cohort of UK based companies providing various aspects of underpinning technologies necessarily for the continued growth of the sector in the UK.

Around a third (185 or 36%) of companies in our mapping of the extended UK QT sector were not identified as part of the QT sector at the baseline stage of the evaluation (see Table 18). Of these, 59 of companies are categorised as underpinning technologies, 51 as providers of quantum components and 23 as providing QT systems. This indicates that the overall QT sector is growing, with both new companies being founded and existing companies moving into the sector. A third of these companies (55 of 185) were applicants to ISCF QT competitions run after 2021 (and are therefore captured under the programme participants). Notably, a further 29 companies that did not apply to any ISCF QT competition did apply to subsequent non-ISCF quantum programmes and competitions run by the Innovate UK Quantum team.

As part of this mapping, two companies had been through mergers and acquisitions and 25 companies identified in the baseline sector mapping have since dissolved.

Table 18 Number of companies identified in baseline vs final evaluation sector mapping

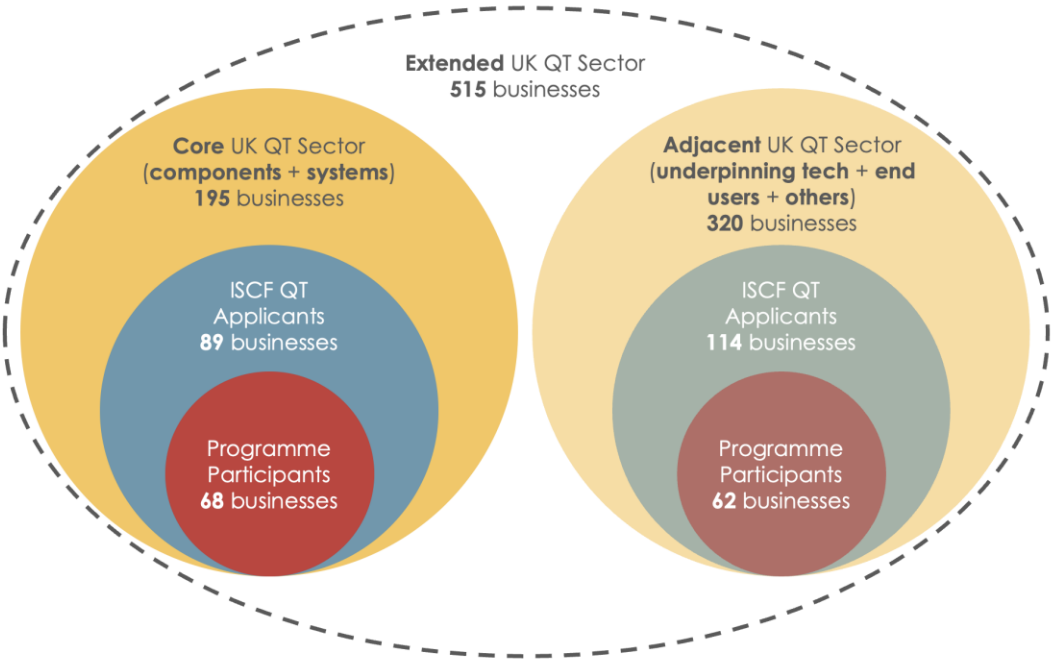
	Baseline sector mapping (2021)	New companies identified for sector map (2025)	Total as of 2025
Total	**330**	**185**	**515**
Underpinning tech	93	59	152
Components	65	51	116
Systems	56	23	79
End-users	93	46	139
Other*	23	6	29

Source: Technopolis (2025) based on ISCF UK QT application data and web scraping (Glass.ai). *QT-affiliated companies, including consultancies/innovation support

The ISCF QT programme has engaged a substantial proportion of the UK's Core QT sector (see the left panel of Figure 22). Of the 195 unique businesses identified in the UK's core QT sector, 46% (89) have applied to the ISCF programme, and 35% (68) are programme participants. Of the 106 unique businesses in the core QT sector that did not apply to the ISCF QT programme, 9 of them were identified through applications to other quantum-related InnovateUK competitions. Of the other 97 companies, 43 were identified in the baseline mapping and 54 were identified by GlassAI's web-scraping.

The programme also includes a breadth of companies in the adjacent UK QT sector, providing underpinning technologies and end-users, shown in the right panel of Figure 22. We find that 36% of the companies within the adjacent UK QT sector applied to the programme.

Figure 22 The number of businesses identified in the core UK QT sector and the adjacent UK QT sector, and the number of programme applicants and participants within each

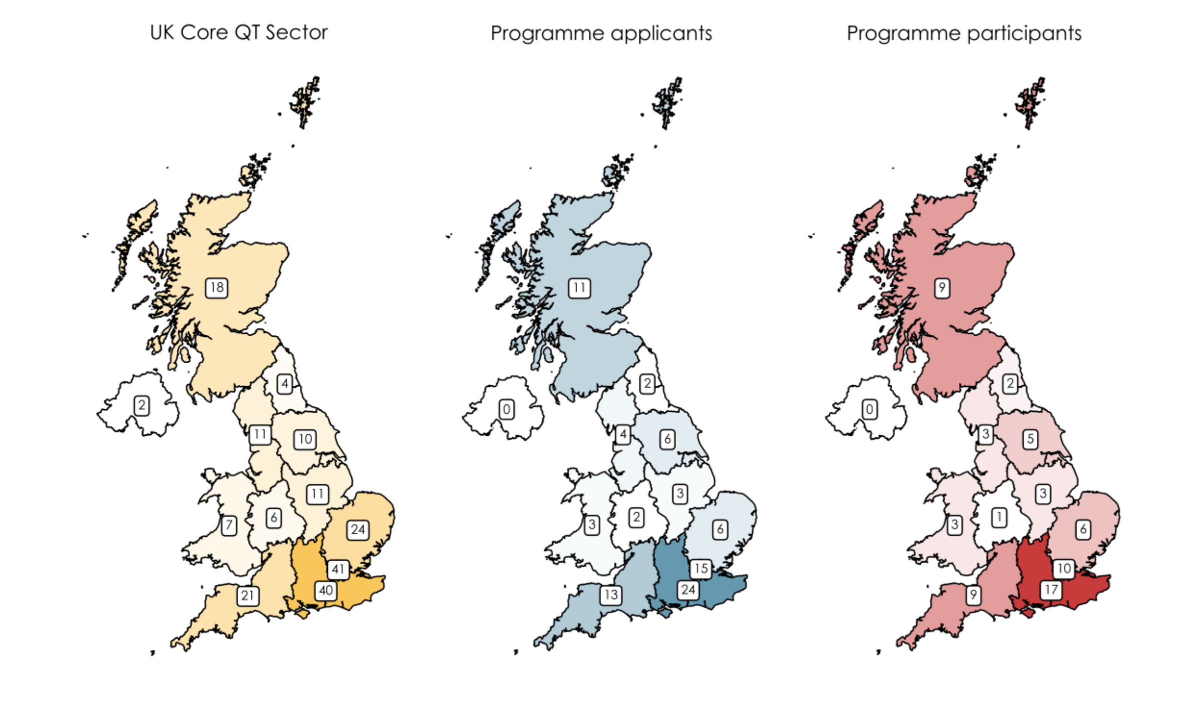


Source: Technopolis (2025) based on ISCF UK QT application data and web scraping (Glass.ai).

The regional[17] distribution of participants in the ISCF QT mirrors that of the wider QT sector (see Figure 23). Of the 195 businesses within the core UK QT sector map, 41 (21%) are located in London, and a further 40 (21%) are located in South East England. This is compared to 17% of programme applicants from London and 27% from South-East England. The largest regional discrepancy between the core QT sector and the programme applicants was in the East of England, which has 12% of the businesses in our core QT sector map, but only accounts for 7% of the programme applicants. One the other end of the spectrum one of the most over-represented regions was Scotland, which accounts for 9% of the businesses in the sector, but 13% of the programme participants. Outside of the 'golden triangle', regional clusters can be seen in Bristol (Kets Quantum Security, QLM Technology, University of Bristol), Sheffield (Aegiq, Supercore, University of Sheffield), and Cardiff (IQE, Compound Semiconductor Centre, Cardiff University).

[17] The regional data for applicants is derived from the post code associated with their application to the programme. Similarly, for the QT sector map, the region is derived from the post code associated with their Companies House data extracted through FAME. It's worth noting that the post code associated with the organisations' application/Company House data may not represent the full geographic activity of the company, e.g. if the post code given is the company's UK head office.

Figure 23 Regional distribution of UK QT businesses, and ISCF QT applicants and participants



Source: Technopolis (2025) based on ISCF UK QT application data and web scraping (Glass.ai). *Core QT sector, ISCF QT programme applicants, and ISCF QT programme participants

3.5.1 Increasing engagement and collaboration across the sector

Collaboration and engagement within ISCF QT projects

One of the intended outputs of the ISCF Quantum Technologies programme was to develop new and enhanced partnerships and collaborations between business and academia, as a result of co-participation in the ISCF QT projects across all sectors (and that continue beyond the lifetime of project funding).

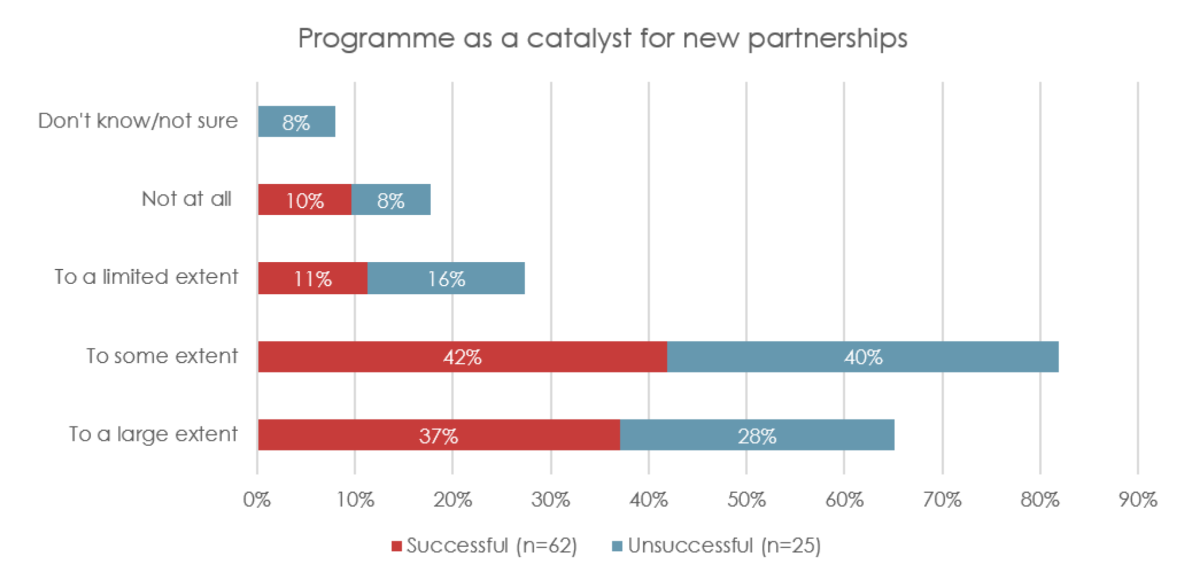
Importantly, projects were driven by SMEs. 98% of projects involved SMEs and 92% of projects were led by SMEs. The majority of projects (80%) involved collaborations between industry and the research community based in universities or RTOs.

Across all partner types, many projects reported that they had previously collaborated on other projects, pointing to the relatively dense and well-connected quantum ecosystem within the UK. To support this finding, over half of project participants (56%, n=348) reported that they had collaborated with competitors, either through the ISCF project or in previous R&D work.

On average, ISCF QT projects have 4.2 partners per project, ranging from 12.5 for its CR&D Pioneer projects through to 1.7 for Germinator projects. Nearly all project participants (96%, n=354) indicated that they intended to continue the collaborations beyond the project lifetime, again pointing to the connectivity of the UK quantum ecosystem.

In addition to building on existing relationships, the programme was an important catalyst for the creation of new collaborations, with programme participants reporting 3.9 new partnerships on average, mostly within the QT sector and end-users (Table 19). Almost all successful applicants responding to the survey reported the ISCF QT programme as the catalyst for these new partnerships (Figure 24) and both successful and unsuccessful applicants reported that opportunities for collaboration was one of the most attractive aspects of the programme (84-85% reporting that the opportunity to collaborate with others and/or work in consortia with others was extremely or very attractive.

Figure 24 Extent to which application to the ISCF QT led to new partnerships



Source: Technopolis survey (2025).

Table 19 Number of new partnerships reported by participants and unsuccessful applicants

Partner type		Participants (successful applicants) (n=67)	Unsuccessful applicants (n=25)
Businesses who are end-users (or potential end-users) of QT	Mean	2.9	1.5
	Median	1	0
Businesses within the QT sector who are not end-users of QT	Mean	3.8	1.9
	Median	2	1
Academic research groups or Research Institutes (such as a Catapult Centre, NPL)	Mean	1.2	0.9
	Median	1	1
Charity or public sector organisation	Mean	0.75	0.25
	Median	0.5	0
Other	Mean	6	4
	Median	6	4
Overall	**Mean**	**3.9**	**2.2**
	Median	**1**	**1**

Source: Technopolis survey (2025).

Participants consulted consistently expressed that collaboration was a key strength of the programme and many participants felt that their projects were successful in establishing new relationships and, importantly, shaping future relationships and future technical and/or commercial pathways. Even in cases without immediate outputs, the groundwork for longer-term partnerships was laid. This was especially true for participants' first ISCF QT projects, which often helped them gain expertise in working with large corporate end-users, understanding their technical needs and commercial drivers in more depth. The case studies provide several examples such as Photon Force continuing to work with the oil and gas sector and Quantum Dice with partners in the banking and space sectors.

Around half (48%) of participants were involved in more than one ISCF project with some of these being follow-on activities from previous projects in collaboration with some of the same partners. Wider stakeholders were also united in viewing the programme as instrumental in increasing collaboration and as a result helping to generate cohesion across the QT sector.

Collaboration between academic research groups and the QT sector and end-users

While QT R&D has tended to be conducted within physics departments, the programme has supported inter / multi-disciplinary R&D in terms of both the breadth of end-user applications and the shift from QT as a largely physics-based R&D endeavour to a technology scale-up and manufacturing endeavour based on high-tech engineering skills and capabilities.

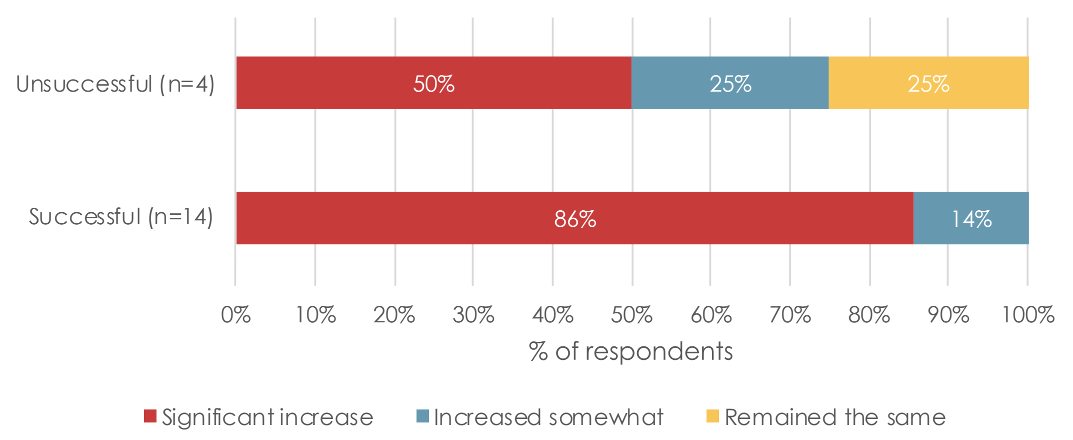
All participating research groups surveyed indicated that their involvement in the programme had led to new collaborations and partnerships with UK based industrial groups (n=18). Indeed, 47% of research groups found the opportunity to collaborate with new organisations and 61% found the possibility of working in a consortium to be extremely attractive aspects of the ISCF QT programme (n=18).

Participating research groups reported that their engagement with the ISCF QT programme led to significant increases in engagement with industrial developers and providers of QT, with 86% reporting a significant rise and the remaining 14% noting some increase (see Figure 25). This is stronger than the unsuccessful applicants, only half of whom reported a significant increase following their application to the programme, while a quarter reported no change. Engagement with QT end-users has also improved among participating research groups, with 43% noting some increase and 29% noting a significant increase (n=14).

Interviews with programme beneficiaries from both business and academia reported though that, in the area of quantum technologies, many research groups already have some connections and collaboration with industry partners. Interviewees noted that, given the maturity of quantum technologies in general and the relatively small pool of experts in the area, many research groups already have close relationships with at least some businesses. In some cases, these were even companies that had been spun out from the research groups themselves, whilst others noted the EPSRC Hubs as a key focal point for collaborations (discussed further in the next sub-section below). Interviewees did however go onto to explain that their participation in the programme had expanded their networks beyond their existing collaborators or partners, and/or had allowed them to increase the intensity of their engagement with their existing partners.

A third (36%) of research groups also reported they had formed new collaborations with academic institutions overseas and 21% engaged new industrial partners outside the UK. Examples of these new partnerships include collaborations with D-wave systems, the Migal Institute in Israel and new projects with organisations such as ESA, M Squared, RAL Space and UK Space Agency. Others noted continued work with ISCF partners on separate follow-on projects and involvement with initiatives like the IUK Quantum Preparedness Project.

Figure 25 Engagement levels with industrial commercial developers/ providers of QT.



Source: Academic survey (2025), base: successful applicants: 14, unsuccessful applicants 4.

Collaboration with EPSRC QT Hubs

Interviews with wider stakeholders, EPSRC Hub leads and industry participants highlighted that the ISCF QT programme has provided a valuable route for continuing collaborations bet established through the EPSRC Quantum Technology Hubs.

The Universities that sit at the centre of the EPSRC Quantum Technology Hubs are partners in a number of the ISCF QT projects (see Table 20).

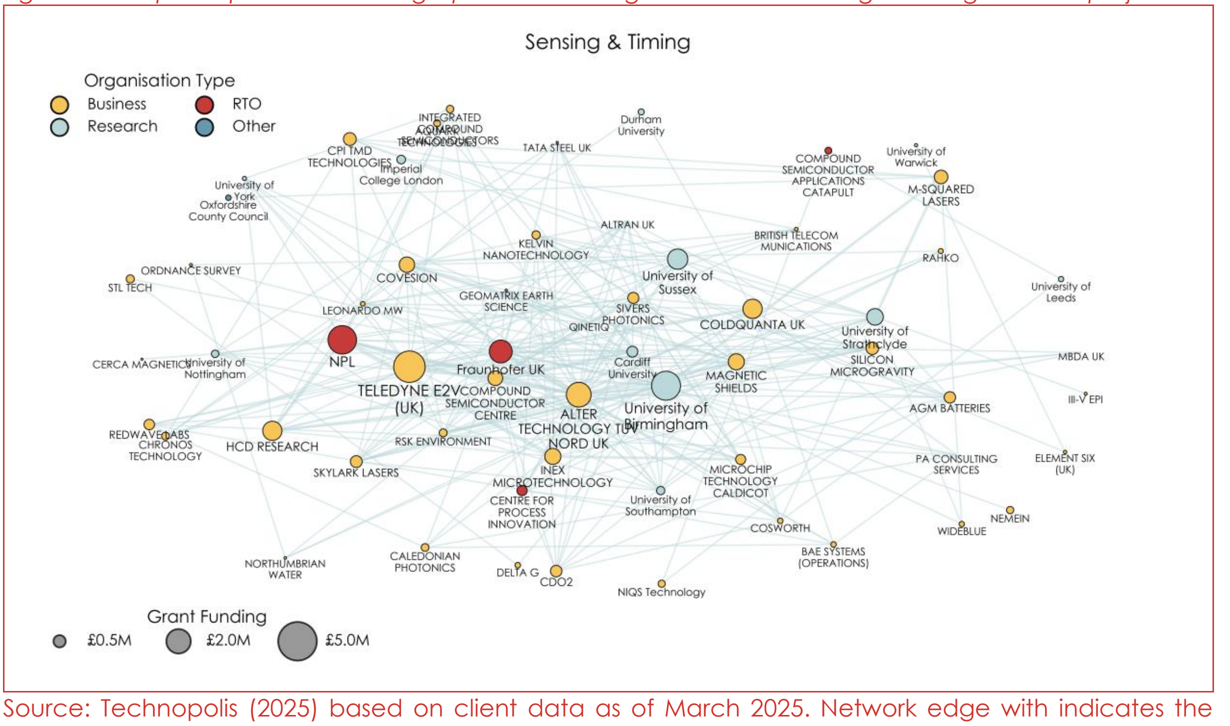
Table 20 ESPRC Quantum Technology Hub Lead University participation in ISCF QT

ESPRC Hub	Hub Lead	Scope of Hub	Number of projects	ISCF QT funding
Quantum Technology Hub in Sensors and Metrology	University of Birmingham	Aimed to develop quantum sensors for applications in fields such as navigation, healthcare, and environmental monitoring.	10	£3,015,390
Quantum Technology Hub in Quantum Enhanced Imaging (QuantIC)	University of Glasgow	Focused on creating advanced imaging systems capable of visualising phenomena beyond the capabilities of classical imaging technologies, with applications in medical imaging, security, and manufacturing.	12	£4,276,119
Quantum Communications Hub	University of York	Worked on developing secure communication technologies based on quantum key distribution (QKD) to ensure ultra-secure data transmission.	3	£614,745
Networked Quantum Information Technologies Hub (NQIT)	University of Oxford	Aimed to develop scalable quantum computing technologies by networking multiple quantum processors, with the goal of creating a small but scalable quantum computer demonstrator.	9	£2,557,597

Source: Technopolis (2025) based on client data as of March 2025

As a result, university research groups involved in the EPSRC Hubs are centrally located in the maps of co-participation in the ISCF QT programme (as presented above, see Figure 13), though the central position of these universities is more strongly in line with their respective thematic areas. For example, the University of Birmingham which led the QT Hub in Sensing and Metrology is centrally placed in the mapping of co-participation of sensing & timing themed projects (see Figure 26 below), whilst other participating universities in the Hub also feature including Imperial College London, University of Sussex, and the University of Strathclyde.

Figure 26 Co-participation network graph between organisations in Sensing & Timing-themed projects.



Source: Technopolis (2025) based on client data as of March 2025. Network edge with indicates the number of collaborations between organisations. Node size and colour indicate ISCF grant funding and organisation type respectively. Size of organisation circle indicates grant funding received through projects tagged to that thematic area.

Interviews with the Hub leads also indicated that they viewed the ISCF QT programme as a valuable route for exploring and continuing the partnerships with business beyond what the Hubs can support. Though the EPSRC Hubs had access to the Partnership Resource Fund to provided further funding for specific industry collaborations, this resource could only cover the academic commitment required companies to provide matched funding. Interviews with Hub leads also noted that the ISCF QT programme was especially helpful for enabling collaboration with SMEs, who without dedicated resource, had otherwise struggled to engage with Hub researchers to a greater extent. As noted in Section 3.5.1 above, the ISCF QT has provided a valuable pathway to support spin-outs from the Hubs to enable their success.

Enabling RTOs in supporting the UK's QT landscape

The ISCF QT programme strengthened the role of Fraunhofer and NPL as key nodes in the UK quantum ecosystem. Both organisations have played a significant role in the programme, participating in a high number of projects and securing funding to support their work. Interviewees noted that their inclusion in project consortia was often driven by their specialist expertise, infrastructure, and technical capabilities. Other programme participants also indicated they benefited from these organisations' wider existing network within the QT landscape – see for example, Box 7 below.

Box 7 Impact Vignette - HYDrogen sensoR for Industry – HYDRI

The aim of the **HYDrogen sensoR for Industry – HYDRI** project was to develop and demonstrate two kinds of optical hydrogen sensors; a high-spec, long-distance sensor for permanent installation, and a lower-spec, hand-held sensor for mobile inspection. The project was led by end-user BP, who intend to purchase the devices and roll them out as part of their future hydrogen operations. The consortium was assembled by Fraunhofer, which leveraged their links with industry both large and (very) small to bring the right capability to the project. HYDRI ran for three years from March 2022 to February 2023. Agile management enabled the consortium to quickly detect unforeseen requirements for the industrial sensing use case, and pivot their designs accordingly. The sensor devices were successfully demonstrated at BP's headquarters and at specialist testing facilities for fire and explosive events.

The technologies and learnings from the project have led to some key outcomes and next steps. Fraunhofer is facilitating a process to identify and contract an industrial partner for the commercial manufacture of the devices. The technical partners from the HYDRI consortium will benefit from the arrangement by supplying components or licenses. The consortium has gained a competitive advantage of up to four years, especially since the unforeseen requirements mentioned above will be a factor for any group attempting to solve the challenge of hydrogen sensing in an industrial setting.

The project has led to a major impact on the technical specifications for one of the technical partners' components, leading them to develop a first-to-market single-photon detector which has applications beyond hydrogen sensing. The unusual combination of large corporates and technical SMEs has enabled enduring partnerships and network expansions, leading to potential new markets and collaborations.

Senior stakeholders and representatives from both RTOs emphasised that the ISCF QT programme has helped to further consolidate their positions as critical infrastructure within the UK's quantum landscape. The programme supported the development of internal capabilities, expanded their collaborative networks across academia and industry, and positioned them as trusted partners in the development and delivery of quantum research and innovation. In the case of NPL, its involvement in ISCF QT also strengthened its position in terms of international standards setting for quantum technologies, see Box below.

Box 8 Impact Vignette - NPL and setting standards in quantum technologies

NPL has played, and is playing, a central role in international activities focused on measurements and standards to support the adoption of quantum technologies[18]. It led and chaired an international workshop of metrology organisations in October 2024. Working with its peers in countries including USA, Germany, Japan, Italy, Canada and Australia and international standards bodies (IEC, ISO, etc.) it is establishing an internationally a coordinated activity to develop industry-relevant measurements and standards for quantum technologies.

Through its involvement in the NISQ.OS project, the NPL has established itself as a key contributor to the global standardisation of quantum computing. Leveraging insights from the project, NPL participated in the ISO Quantum Computing standardisation working group, where it influenced the development and revision of key definitions and specifications. This work positioned NPL, and the UK more broadly, as a leading voice in shaping international quantum computing standards. NPL's release of the open-standard Hardware Abstraction Layer (HAL) specifications developed under NISQ.OS aims to support wider adoption of HAL standards across the industry, helping to drive the adoption of hardware-agnostic quantum operating systems. In this way, NPL supports UK companies and the broader

[18] https://www.bipm.org/documents/20126/263196968/PARTNERS24-05-Accelerating+Quantum+Technologies_JTJ_V2/05a2148b-3d5c-ddd8-5d3f-8f6b2e873fd1

quantum ecosystem in avoiding market fragmentation, strengthening the UK's international influence and competitiveness in quantum technologies.

3.5.2 *Creation of new QT companies*

Participants established start-ups

The ISCF QT programme has supported and enabled the creation of new quantum technology companies in the UK.

Five academic collaborators reported that they had created an **academic spin out** due to their ISCF QT project and a further nine collaborators reported that they planned to do so in the near future. In the longer term, almost half of all academic collaborators reported that they might form a spin out in the future (46%). Of these five academic spin outs created, three companies listed subsequently received ISCF QT funding in later calls.

As noted in Section 3.3, the ISCF QT has played an important role in supporting innovations and start-ups emerging from the EPSRC QT hubs to move toward commercialisation. The selection of case studies prepared for this evaluation contain numerous examples of companies that have emerged from the EPSRC Hubs and received valuable, if not vital, support to their start-up. This includes companies like Delta.g, Quantum motion, Phasecraft, and Oxford Ionics – details of which are summarised in the box below. Beyond these examples, almost all EPSRC Hub spin-outs received ISCF QT funding to enable their translation and continued development. Interviews with senior stakeholders from across DSIT and UKRI, the EPSRC Hub Leads and with beneficiaries who has worked with the Hubs previously all noted that the ISCF QT was highly complementary to the ISCF QT and provided the pathway for researchers and nascent technologies to be translated out of research groups and into application.

Box 1 Impact Vignette - Spinouts from EPSRC Quantum Technology Hubs

The University of Birmingham spin-out **Delta.g** led the CompaQT project, a Feasibility study that ran from October 2022 to April 2024. Building on over a decade of research at the **Sensing and Timing Hub** at the University of Birmingham as well as previous ISCF-funded projects. The project enabled Delta.g to secure additional funding and partnerships, including a £1.5 million private equity investment, creation of new QT jobs, and the development of a UK-based supply chain for critical components. The project has also led to field trials with end users and follow-on funding via a successful SBRI grant with the Department for Transport. The quantum gravity gradiometer has potential future applications in infrastructure, reducing survey costs by a factor of 50, and accurate navigation without the use of GPS.

Quantum Motion is a quantum computing company founded in 2017 by researchers from UCL and the University of Oxford and is a spin-out from the **Quantum Computing and Simulation Hub**. They are developing a scalable array of qubits based on silicon technology that already exists in the manufacturing of chips for conventional computers. They received £4.6m in ISCF QT funding across 5 projects, each addressing a unique aspect of the quantum stack. They are one of seven companies tasked with deploying a functional full quantum stack to the NQCC, as part of the UKRI Quantum Testbed Competition. Since the start of their first ISCF project in 2020, they have grown from 8 employees to over 100 and have leveraged £50m of VC funding from national and international partners.

Oxford Ionics is a spin-out from the University of Oxford and the **Quantum Computing and Simulation Hub** that is developing quantum computing systems based on trapped ions. The company has secured funding to advance its technology.

Phasecraft is a UK-based quantum software start-up founded in 2019 by academics from University College London (UCL) and the University of Bristol. The company specialises in developing software that enables current and near future quantum hardware to solve complex scientific and industrial problems more efficiently than classical computers.

Cerca Magnetics, a spin-out from the University of Nottingham established in 2020 in partnership with Magnetic Shields Ltd secured a Germinator Project which ran from 2021 to 2022. The technology and the partnership with Magnetic Shields Limited were supported by the Sensing and Timing Hub, as well as other funds under the umbrella of the NQTP. The project enabled the company to further accelerate the development of their product, the world's first "wearable" magnetoencephalography (MEG) system, allows patients to move freely during the scan and offering unprecedented insights on brain development and function and severe neurological illnesses, such as epilepsy. The company has since secured £1.7m of public funding through the Quantum Catalyst Fund to take it closer to approval for use in hospitals19 and was awarded the Institute of Physics' qBIG Prize for quantum innovation.[20] Cerca Magnetics is also a project partner for the UK Quantum Technology Hub in Sensing, Imaging and Timing (QuSIT) that runs from 2024 to 2029.

In the survey of businesses, six companies indicated that their participation in the ISCF QT programme led to new spin-outs or start-up. When asked to provide an estimate of the current value of spinouts or start-ups, two respondents provided a combined value of £120m.

Creation of new ISCF QT companies in the wider QT sector

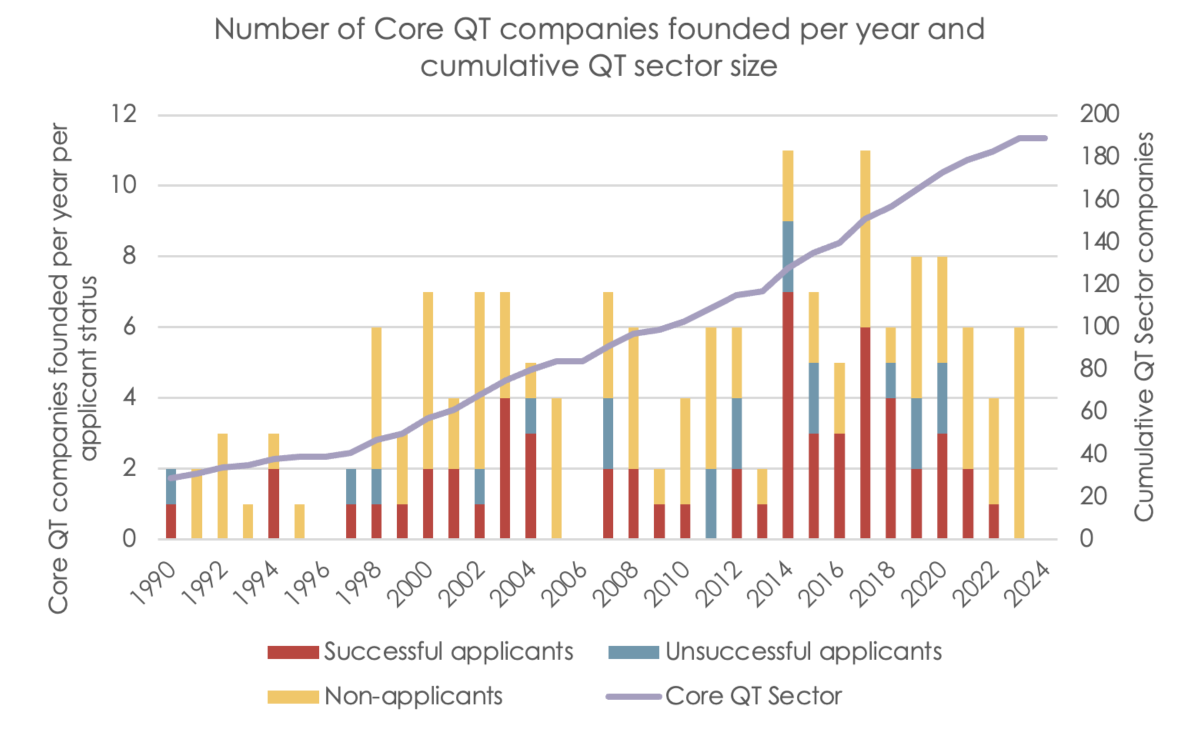
In our mapping of the UK QT sector, we see a steady increase in the number of QT companies with an office in the UK between 1990 and 2014 at an average growth rate of 15% per year. Around half (52%) of the 48 startups that applied to the ISCF QT were incorporated between 2014 and 2019, compared to 30% for the 1990-2013 period.

As noted above, since the baseline period, we have identified a further 74 companies working in the core QT sector as of 2025. Just 12 of these businesses were founded after 2021, when the baseline evaluation was delivered, indicating an increase of movement into the QT sector by existing firms. Just under a fifth of these 74 business (14) were applicants to subsequent ISCF or non-ISCF competitions (6 and 8 respectively).

[19] https://www.nottingham.ac.uk/news/1.7m-funding-for-wearable-brain-imaging-system-brings-it-closer-to-patient-use

[20] https://physicsworld.com/a/cerca-magnetics-bags-qbig-prize-for-quantum-innovation/

Figure 27 Number of companies founded in the UK Core QT Sector between 1990 and 2024*



Source: Technopolis (2025) based on Crunchbase and FAME data, with FAME taking priority in cases of contradiction. Coverage = 97% (187 of 195 core QT businesses with founding dates). 27 businesses were founded before 1990. *Core QT sector, successful ISCF QT programme applicants and non-applicants to the programme.

Interviewees and case studies also indicated that the ISCF QT programme had played an important role in attracting international companies to establish an office in the UK. In several cases, companies noted that the strength of the UK's national programme, combined with the potential for engagement with a dynamic ecosystem of universities, start-ups, and testbed infrastructure, was a key factor in their decision to open UK offices or laboratories.

Box 9 Impact Vignette - Infleqtion

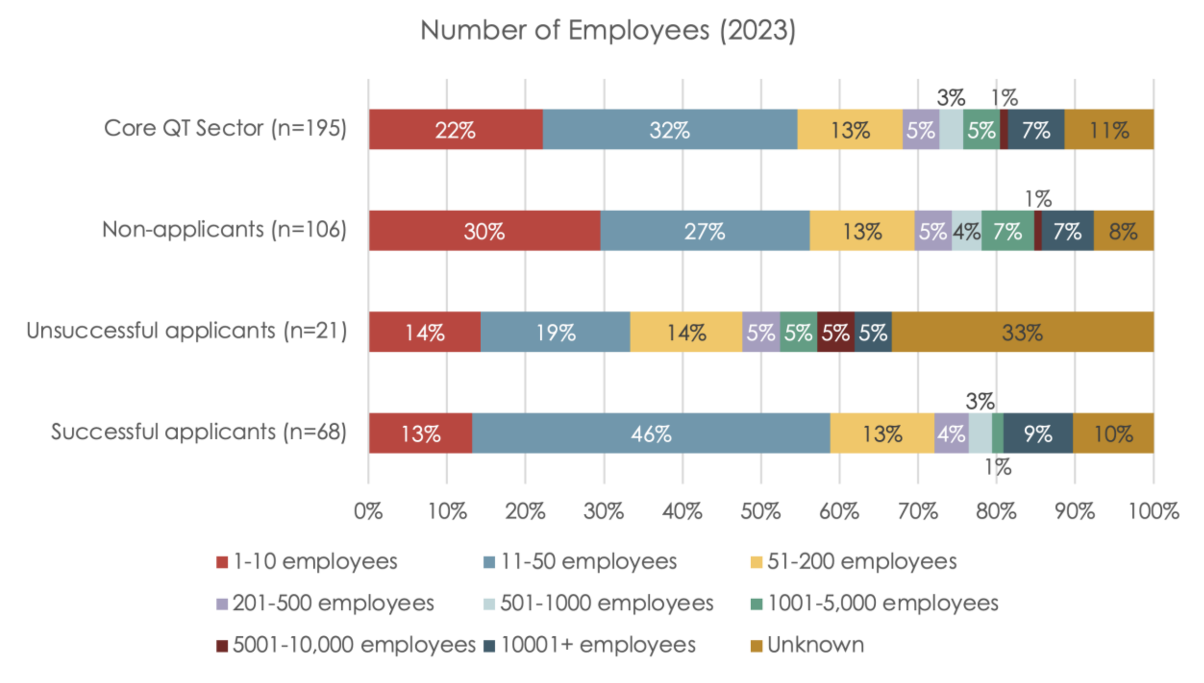
Infleqtion UK is a wholly owned subsidiary of Infleqtion (formerly ColdQuanta), a US-based quantum company established in 2007. The UK branch was set up in 2014, recognising the potential of the UK's National Quantum Technology Programme. Infleqtion operates as a platform technology company, using its precision atom control expertise to develop applications across multiple verticals. Its UK operations are heavily involved in both the development of enabling technologies and direct applications. At the point of joining the ISCF QT programme in 2020, Infleqtion had 15 employees. The company's UK operations have now grown to be around 50 in total, due in large part of their portfolio of ISCF QT projects

3.5.3 *Turnover and jobs in UK QT sector*

In the mapping of the UK's core QT sector, we find a total of 1.2M total employees working for businesses. Of these, 458k (38%) work for successful programme participants, 48k (4%) work for unsuccessful programme applicants and 694k (58%) work for non-applicants to the programme. It should be noted that it is difficult to attribute these employees to the QT sector as many organisations operate in many sectors, thus only a fraction of these employees can be attributable to the QT sector.

Overall, the programme supported slightly more SMEs than are present in the wider core QT sector (72% vs 67%). The prevalence of SMEs in the core QT sector overall is in line with the National Quantum Strategy's finding that the "typical UK quantum technology company in 2023 is small, with less than 50 employees."[21] Micro organisations are underrepresented among successful programme participants of ISCF QT, with only 13% having 1-10 employees, though this is likely a reflection of either the age of the micro company and its eligibility for IUK funding.

Figure 28 Number of businesses within the UK by number of employees*



Source: Technopolis (2025) based on Glass.ai web-scraping of LinkedIn. *Core QT sector, successful ISCF QT programme applicants, unsuccessful ISCF QT programme applicants and non-applicants to the programme

In terms of the growth number of employees within the core UK business sector, we see an increase in the total number of employees across the sector and in each sub-group i.e. programme participants ('successful' in the table below), unsuccessful applicants and wider sector (Table 21), with a total growth of 10,952 people in core QT companies in the UK between 2017 and 2023.

The median increase in employment is greater for programme participants than for unsuccessful applicants and non-applicants (+14 for participants versus +6 and +4 for unsuccessful applicants and non-applicants respectively). However, while the mean increase is considerably greater for programme participants than for unsuccessful applicants (+63 versus +39), non-applicants have a higher mean growth than both (+73). Though we note that there are several outliers in non-applicant group and, in addition, that this analysis is based on a sub-set of businesses, in all three groups, for which employment data is available in FAME.

[21] National Quantum Strategy (2023) additional evidence

Table 21 UK QT company employment at 2017 (baseline) and 2023*

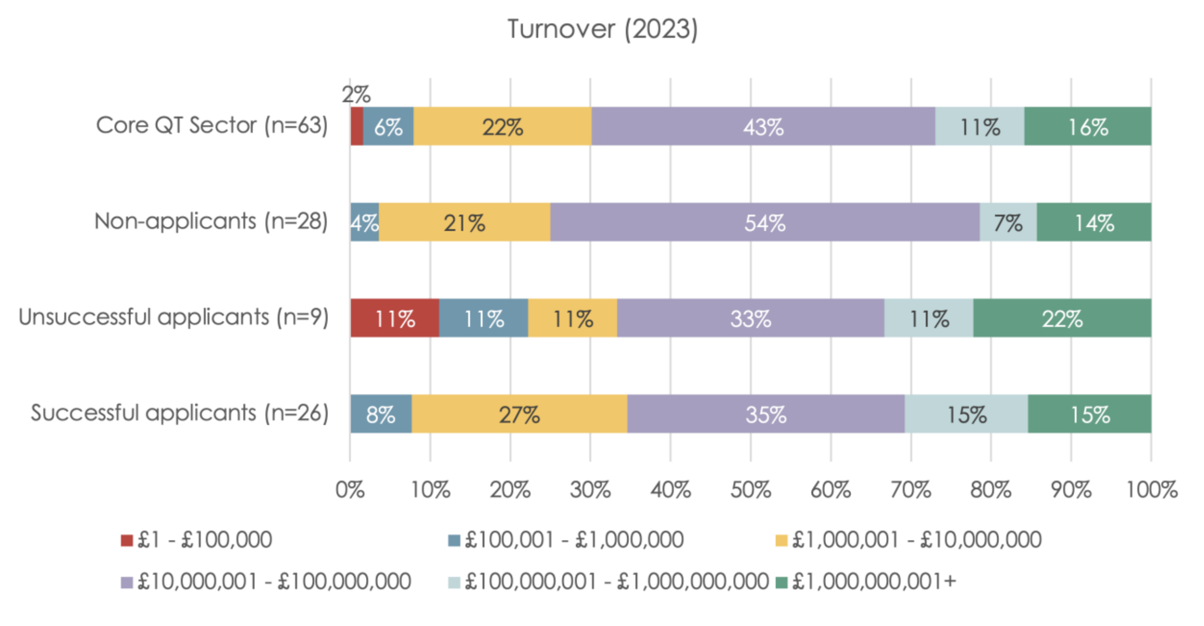
	No. companies	FAME coverage	2017 (baseline)			2023**			Change***		
			Sum	Mean	Median	Sum	Mean	Median	Sum	Mean	Median
Core UK QT Sector											
Successful	65	96%	19,749	304	3	23,863	367	27	+4,114	+63	+14
Unsuccessful	20	95%	2,437	122	6	3,208	160	6	+771	+39	+6
Non-applicant	83	78%	12,479	150	6	18,546	223	12	+6,067	+73	+4
All sector	168	86%	34,665	206	5	45,617	272	17	+10,952	+65	+8
Underpinning technologies companies											
Successful	31	100%	4,384	141	2	4,464	144	8	+80	+3	+5
Unsuccessful	14	88%	589	42	5	798	57	9	+209	+15	+2
Non-applicant	89	85%	17,381	195	9	14,332	161	12	-3,049	-34	+2
All sector	134	88%	22,354	167	5	19,594	146	11	-2,760	-21	+2

Source: FAME. *Companies which were successful and unsuccessful to the ISCF QT programme, as well as additional companies within our sector mapping for the core UK QT sector (defined in Section 8 of the appendix) and companies labelled as developing underpinning technologies. **2023 is chosen due to much greater coverage in FAME data compared to 2024 (~90% compared to ~30%). ***Change is measured on an individual company basis, e.g. the mean column refers to the mean of individual changes in employment. Note: Coverage refers to the % of businesses within each category that have FAME data for both 2017 and 2023. Note: Companies that are incorporated in year x are given 0 employees for year x and all prior years. Note: Companies with more than 100,000 employees have been excluded from the analysis e.g. B.T

The profile of business' turnover in the core QT sector is largely the same whether they are project participants or not, though these figures should be taken with caution. Of the 195 businesses within our sector map, only 63 (32%) have reported turnover data in 2023. In particular, the coverage for SMEs is only 16% and therefore strongly underrepresented.

Of the 63 businesses within our sector map with turnover data in 2023, 70% had a reported turnover greater than £10m. This is compared to 65% of successful programme participants, and 66% of unsuccessful applicants. We find that the turnover profile of applicant businesses is largely representative of the core sector as a whole. 70% of programme participants had a less than £10M of turnover in 2023, compared to 73% of businesses in the core sector. Businesses in the sector that did not apply to the programme tend to have less turnover, with 79 of businesses having less than £10M in 2023.

Figure 29 Number of businesses within UK by 2023 turnover range*



Source: Technopolis (2025) based on FAME data. Coverage = 32%. *Core QT sector, successful ISCF QT programme applicants, unsuccessful ISCF QT programme applicants and non-applicants to the programme.

Increased size of research groups

Programme participants have increased the number of FTE employees since their first project. On average, our sample of participants report a 79% increase in total employees and an 82% increase in quantum R&D employees. Similarly, unsuccessful applicants have seen a 150% rise in overall employees, but a 32% decline in quantum R&D employees.

Table 22 Employees and employees in Quantum R&D, Research Groups, programme participants and unsuccessful applicants

Indicator		**Successful applicants**		**Unsuccessful applicants**	
		Baseline	2023/24	Baseline	2023/24
Research group employees (FTE) *β* (Universities and RTOs)	Mean	5.5	9.9 ▲	4.3	10.6 ▲
	Median	4	7 ▲	2.5	8.3 ▲
Research group employees in quantum R&D (FTE) *β* (Universities and RTOs)	Mean	3.5	6 ▲	0.8	0.5 ▼
	Median	3	4.5 ▲	0	0.5 ▲

Source: Technopolis, Academic Survey, April 2025. Programme participants, base: 13. Unsuccessful participants, base: 4. Note: * The baseline is defined as the two years prior to the first project (successful) or first application (unsuccessful).

Programme participants have also increased the number of PhD students since their first project. The samples participants reported an 82% increase in total PhD students and a 66% increase in PHD students working in QT. However, unsuccessful applicants report a 50% decline in overall PhD students and a 50% decline in PhD students in QT. Reasons were not provided in the survey for the lower number of PhD students, but note that the small number of responses from unsuccessful research group applicants may not fully represent the population.

Table 23 PhD students and PhD students in Quantum R&D, programme participants and unsuccessful applicants

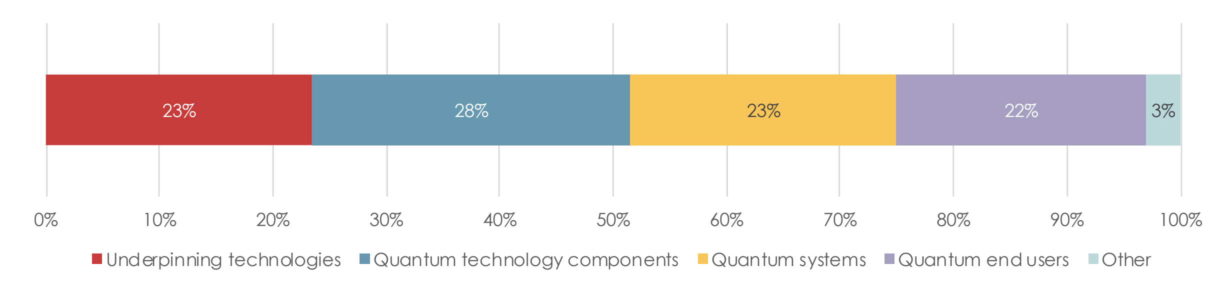
Indicator		Successful applicants		Unsuccessful applicants	
		Baseline	2023/24	Baseline	2023/24
Number of PhD students (Universities and RTOs)	Mean	4.3	7.3 ▲	0.5	0.5 ■
	Median	3	4 ▲	0.5	0 ▼
Number of PhD students in QT (Universities and RTOs)	Mean	2.9	4.5 ▲	1	0 ▼
	Median	1	3 ▲	0.5	0 ▼

Source: Technopolis, Academic Survey, April 2025. Programme participants, base: 13. Unsuccessful participants, base: 4. Note: * The baseline is defined as the two years prior to the first project (successful) or first application (unsuccessful).

3.5.4 *Improving the UK QT supply chain*

The ISCF QT programme was designed to increase collaboration across the supply chain. Of the 132 non-academic programme participations, they are fairly evenly distributed across the supply chain (see Figure 24), creating ample opportunities for programme participants to build new partnerships. As noted above, most participants reported at least one new partnership with organisations at different points in the supply chain.

Figure 30 Position of programme participants within the supply chain



Source: Programme portfolio data (2025).

Overall, there was agreement amongst interviewees that the programme contributed to improving the QT supply chain by enabling collaborations across the QT supply chain, the development of QT components, and support for market research which have led to identifying new markets and products.

In addition to enhancing collaboration with academic partners as detailed above in Section 3.5.1 above, the ISCF QT programme has also played an important role in building collaborations and partnerships across the QT supply chain. Indeed, some ISCF QT projects were specially aimed at developing supply chain lines. See for example Box 10 below. Beyond this, there are numerous examples of where ISCF QT projects have supported the development of collaboration and capabilities indicative of a strengthened supply chain, see boxes below.

The programme enabled early-stage engagement with 35 end-users, mostly large businesses, though commercial adoption remains a longer-term prospect. Interviewees noted that the ISCF QT programme facilitated increased interaction with end-users, either directly, through their involvement as project partners, or indirectly, through the outputs and visibility generated by project activities. In many cases, however, the primary end-users identified were other quantum technology companies, rather than businesses applying quantum solutions to existing products or services.

Overall, interviewees emphasised that for most non-QT end-users, participation in ISCF QT projects served as an initial step toward understanding the longer-term potential of quantum technologies, rather than being focused on immediate application or adoption. As such, broader sectoral impacts are expected to materialise gradually over time, rather than in the near term.

Given the low TRLs of many of the technologies being developed, interviewees acknowledged that commercialisation across the majority of wider sectors remains some way off though they did expect this to be uneven, with some sectors more prepared to engage in the near-term. Interviewees reflects that these sectors were likely to be those already engaged and investing in cutting edge sensing and computing technologies, seeking to further enhance their existing capabilities. More widely, significant ongoing work will be needed to build awareness, develop demonstration opportunities, and secure future investment.

Box 10 Impact Vignette - QT Assemble project

The **QT Assemble** project funded under the ISCF QT began in August 2020 and concluded in February 2025. The primary goal of the QT Assemble project was to develop cutting-edge assembly and integration processes to support emerging quantum technology markets, including navigation, situational awareness, communications, and computing. A key focus was enabling broader adoption of quantum technologies by creating compact, integrated devices—such as lasers, photon sources, detectors, and cold atom sources. To tackle challenges related to size, weight, power, and reliability, the project employed advanced techniques like waveguide writing, nanoscale alignment, and monolithic integration.

By 2021, the project team had identified 11 integrated product lines, including laser platforms, photon sources, photon detectors, and an ultra-cold atom source. They had also mapped these products to key quantum technology themes, associated market applications, and the necessary sub-systems. At that stage, the team was also developing various outputs for demonstration to end users. Infleqtion (previously ColdQuanta) had created a technology capable of continuously generating cold matter and had built an apparatus to demonstrate its transport. While Covesion was working with partners to integrate their PPLN crystals with other components to develop more efficient detectors and lasers.

Progress update: Since the baseline study, the project team has employed waveguide writing, nanoscale alignment, and monolithic integration to achieve new levels of performance in robust, reliable platforms. They have demonstrated high-performance, highly integrated components and systems—including lasers, photon sources, detectors, and ultra-cold matter setups. This work has enabled the development of several advanced quantum technologies, such as a new PPLN waveguide package, the compact NX Micro laser platform, and a functioning single-photon platform. Some project outcomes have already been commercialised and are available for purchase. The project has also fostered new collaborations with organisations both within the UK and internationally.

By minimising the size, cost, and complexity of quantum subsystems, the QT Assemble project helps remove key barriers to adoption for industries previously hindered by bulky, lab-based technologies. As a result, the project is in the long term expected to spur the growth of new quantum businesses by making quantum devices practical for real-world applications such as navigation, communications, and computing. It will also lower entry barriers for startups aiming to commercialise quantum solutions and strengthen the UK's supply chain resilience by reducing reliance on foreign suppliers and fostering a self-sustaining domestic quantum industry.

Box 11 Impact Vignette- Reliable, high throughput production and characterisation of coherent superconducting devices

An internationally competitive quantum computing sector in the UK depends on developing nationally capability in fabricating chips and advanced testing facilities to prove reliability and reproducibility of these components. To address this, the **Reliable, high throughput production and characterisation of coherent superconducting devices (FABU)** ISCF QT Technology project began in September 2020 ran until March 2025. The project sought to support the development of both the production and testing capabilities in the UK and aimed to develop an advanced production capacity in the UK that can be purchased as a commercial solution by the wider QT supply chain. The development of these commercial offerings in the UK will ensure that a wider range of firms, particularly SMEs, will have clear pathway to produce, test, and sell their products in the UK and around the world, thereby supporting the growth of the UK QT sector. Given the size, cost and complexity of the project, it is unlikely that any of the project partners would have been able to contribute the capital required. Moreover, the complementary expertise and capabilities of the consortia partners, the project provides better economies of scale for the wider sector.

Progress update: Since the baseline evaluation in 2021, the FABU project has concluded, with the industry partners completing their project activities in 2023, whilst the two university partners continued their work packages until 2025. The project not only advanced the technical capabilities but also helped sustain OQC through critical early funding gaps. The project led to new and strengthened partnerships for the main industry partners, OQC and SEEQC, with OQC continuing to utilise RHUL's SuperFab facility for their R&D and manufacturing of their superconducting quantum components.

Box 12 Impact Vignette - Pioneer Gravity

Pioneer Gravity: Gravity sensors for infrastructure productivity, situational awareness and seeing the invisible

The Pioneer Gravity project, funded under the Pioneer of the ISCF QT programme, began in November 2018 and concluded in September 2021. The overall goal of the project was to demonstrate advancements in the field of quantum gravity sensing; to measure gravity with better sensitivity and speed than existing technologies. Although technology to detect and identify objects on land, sea and in space has improved, there remains a gap in the ability to detect objects buried underneath the ground. Existing techniques for investigating the ground include classical microgravity and ground penetrating radar, but these are often limited in sensitivity, depth of penetration and cost. When it comes to locating old mineshafts or buried infrastructure, the most common approach is still digging or drilling holes. This presents large economic costs as road networks are dug up or land is left undeveloped, requiring the development of new sensing technologies.

In 2021, when the Baseline Evaluation of the ISCF QT programme was delivered, the Pioneer Gravity project had successfully refined the gravity instrument developed by the University of Birmingham after taking the instrument into the field. There was, however, further work planned to optimise the performance (e.g. become less sensitive to noise and vibrational interferences), with field tests scheduled for summer 2021. Additionally, project partners working on further laser systems that underpin quantum sensing instruments have developed and products with applications outside of the gravity measurement sphere. This includes a new prototype quantum sensor developed by Teledyne E2V and new laser technologies developed at partner sites (including Fraunhofer's site). Alter Technologies and Southampton University spin-out Covesion have both released laser technologies currently available on the market, and for Alter Technologies, this represents another step towards developing their expertise in component manufacture that complements their expertise and existing business activity as a service provider.

Progress update: Since the baseline study, the field tests have since taken place, although at a more limited scale. The University of Birmingham, in collaboration with the project lead RSK, have continued to develop the sensor. There are currently plans to test the updated prototype on client sites and benchmark it to existing technology. In the long-term, many project partners have noted that the skills that they developed under this project has enabled organisations to secure further work developing the quantum ecosystem. The project was also uniquely designed to mimic the future quantum gravity supply chain, which means that funding has helped the supply chain mature in anticipation of a commercial prototype on the market in the coming years.

Box 13 Impact Vignette - Developing UK Industrial Supply to Commercial Quantum Computing

DISCOVERY: Developing UK Industrial Supply to Commercial Quantum Computing

Quantum computers have the potential to solve complex problems that are currently intractable for classical computers, such as simulating molecular interactions for drug discovery or optimising large-scale systems. Their ability to process and analyse large datasets with quantum parallelism could revolutionise fields like cryptography, materials science, and artificial intelligence. As a result, quantum computing is seen as a strategic technology with transformative implications across various industries and national security. The challenge for quantum computers is that the technology remains at a low Technology Readiness Level (TRL) in the UK due to the limited availability of testbeds for testing and development. This limited infrastructure is largely a consequence of two fundamental technological challenges: the scalability of qubits and the maintenance of high qubit fidelity.

Through the ISCF QT Technology programme strand, the DISCOVERY project ran from 2020 to 2024 with the main objective of establishing a multidisciplinary consortium of industry and academic researchers in quantum computing to tackle the challenges of scalability of qubits and high qubit fidelity. The project aimed to facilitate the transition from low-TRL research to scalable, commercially viable cold-matter quantum information systems. The project resulted in advancements in quantum hardware, including microfabrication and vacuum systems, as well as the development of essential photonics components, including lasers and all consortium members reported an increase in the TRL of their technologies throughout the project lifetime.

The project developed a coordinated UK-based capability to support the manufacture of quantum components through the system. In the longer-term, the impact of the project is expected to create spillover benefits for wider society. Quantum computing is expected to have transformative impacts in areas such as drug discovery, materials science, climate modelling, financial optimisation, and cybersecurity. By fostering early-stage innovation and partnerships, the project contributes to building a resilient and competitive quantum technology landscape in the UK.

3.5.5 *Raising awareness of QT amongst stakeholders*

Interviewees consistently highlighted that the ISCF QT programme played a pivotal role in raising awareness and visibility of the UK's quantum landscape. This was achieved not only through the formal mechanisms of funding competitions and project delivery (as detailed above), but also through a suite of engagement activities led by the programme team. These included major events and strategic communications that significantly enhanced sector coherence and public profile. Notably, the establishment of the UK Quantum Technology Showcase, initiated and delivered annually by the ISCF QT team, was cited as a particularly impactful intervention. Now recognised as one of the first and largest events of its kind globally, the Showcase has grown in scale and prominence each year, providing a visible platform for UK quantum research, start-ups, and industry to demonstrate progress and engage with new audiences. While the event itself falls formally outside the scope of this evaluation, its success illustrates the wider convening and ecosystem-building role played by the ISCF QT team.

Similarly, interviewees also highlighted the Quantum Programme Project Directory, produced by the ISCF QT team, as a particularly valuable resource prepared by the ISCF QT team. It served to map the breadth of organisations and actors involved in the UK quantum ecosystem, providing clarity on who was active in the space, what areas they were working in, and where future collaboration opportunities might lie.

3.6 Supporting a world-leading QT sector

To what extent and how did the programme lead to a world-leading UK QT sector that spans the supply chain?

There are numerous countries that are now also investing in quantum technologies. The UK's most appropriate comparator countries of Australia, Germany, the Netherlands, France and

Canada, all have national quantum strategies and programmes, though most of these were launched after 2018, following the launch of the ISCF QT. The financial commitments to development quantum in these countries also vary considerably, from €2.8 billion in Germany to C$360 million in Canada, though the overall size of the commitment in the UK as part of the NQTP, let alone the commitment to the ISCF QT, is world-leading in this regard. Though of course, the US and China are investing more heavily in QT, they are not necessarily appropriate comparators to the UK given the difference in economic scale and resources available.

To put the scale and profile of QT companies within the UK into context, we compare them with the above comparator countries. This approach will better illustrate the relative impact of the programme and the value for money of the public investment.

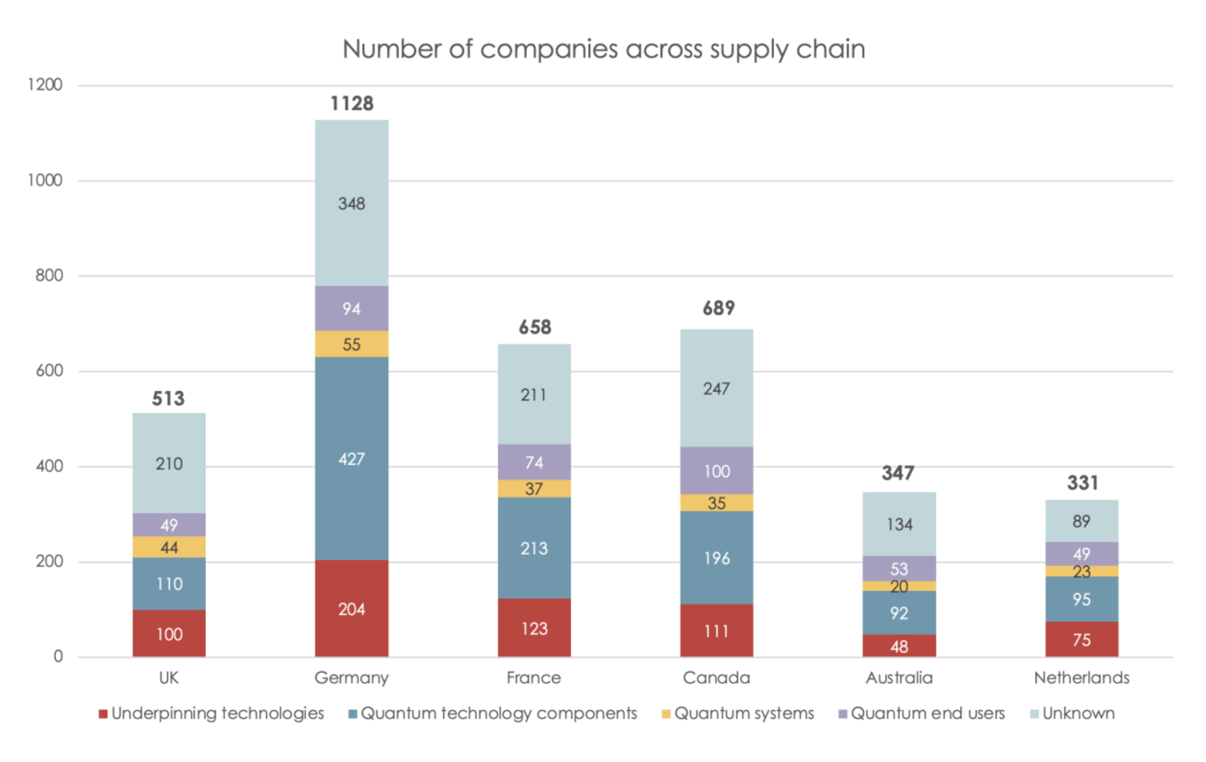
The approach for capturing the profile of the QT sectors in these comparator countries differs slightly from that applied to the analysis of the UK's QT sector, as presented in Section 3.5 above. This approach relies more heavily on the web-scraping methodology applied by Glass.ai to identify companies and position them within the supply chain. In this approach, the preliminary mapping of the UK's QT sector and categorisation was applied to train the search approach for the comparator countries. Given the number of companies identified, manual validation of each company identified in all five comparator countries was not feasible in the scope of this evaluation. The output for the mapping of the UK presented here has not been manually cleaned, to ensure consistency in reporting, and should therefore not be compared to the analysis presented above.

3.6.1 Number of companies involved in quantum technologies

Germany have been identified as having the largest extended QT sector, hosting 1,128 companies. This is in line with their position in Table 24 as publishing the most QT-related papers only behind the US and China. The UK hosts 513 companies across the entire QT sector using this methodology, comparable to 658 in France and 689 in Canada, this is despite publishing more QT-related papers than both, potentially indicating that more activity in the UK QT sector is engaged in research and development. Australia and the Netherlands host the fewest companies in the sector map, with 347 and 331 companies respectively. When controlling for each country's population, the number of organisations for comparator countries lie within ~50% of the UK.

The UK has a broadly similar distribution of companies across the supply chain to comparator countries, with a relative emphasis on developers and suppliers of quantum systems. When removing companies with an unknown position on the supply chain, we find that quantum systems companies account for 15% of the extended sector, compared to between 7% and 10% of comparator countries. The UK hosts a relatively small number of organisations focused on developing quantum technology components, with 36% of labelled organisations within the extended sector. This is compared to 55% from Germany and 48% from France, suggesting stronger supply chain development. The Netherlands, Australia and Canada have the highest percentage of end users, potentially indicating that companies that develop quantum technologies in these countries have access to a relatively larger proportion of downstream companies within the local sector that act primarily as adopters of the technologies rather than competitors, with 20%, 25% and 23% of organisations respectively, relative to 15% from the UK and 10% from Germany.

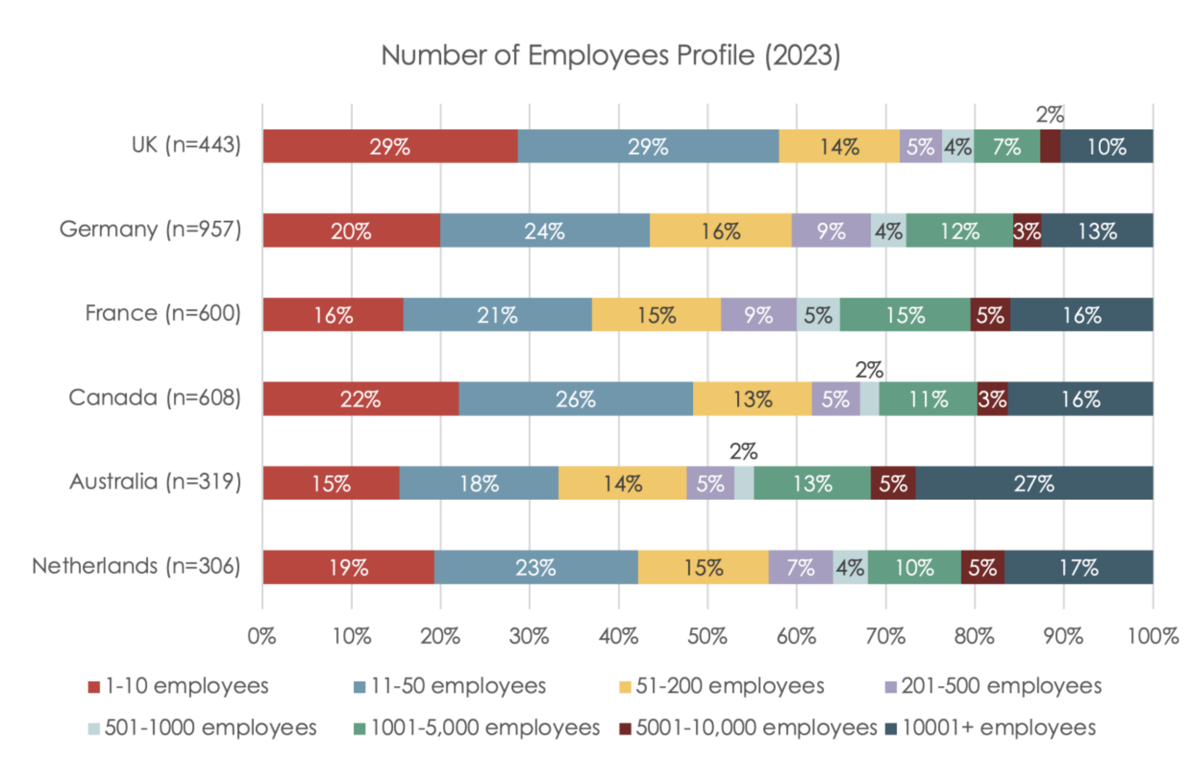
Figure 31 Number of companies identified in the QT sector of the UK & each comparator country



Source: Technopolis (2025) based on Glass.ai web scraping. Note: methodology in identifying companies and supply chain classification differs from Section 3.5.

Based on the number of employees within these firms, the UK hosts a greater proportion of small companies than comparator countries. Just under two thirds (58%) of businesses within the extended UK QT sector have less than 50 employees, compared to 44% or organisations in Germany, 37% of businesses in France and 48% of businesses in Canada. This indicates a strong presence of start-ups within the UK QT sector relative to other countries.

Figure 32 Profile of number of employees identified in the UK and each comparator country

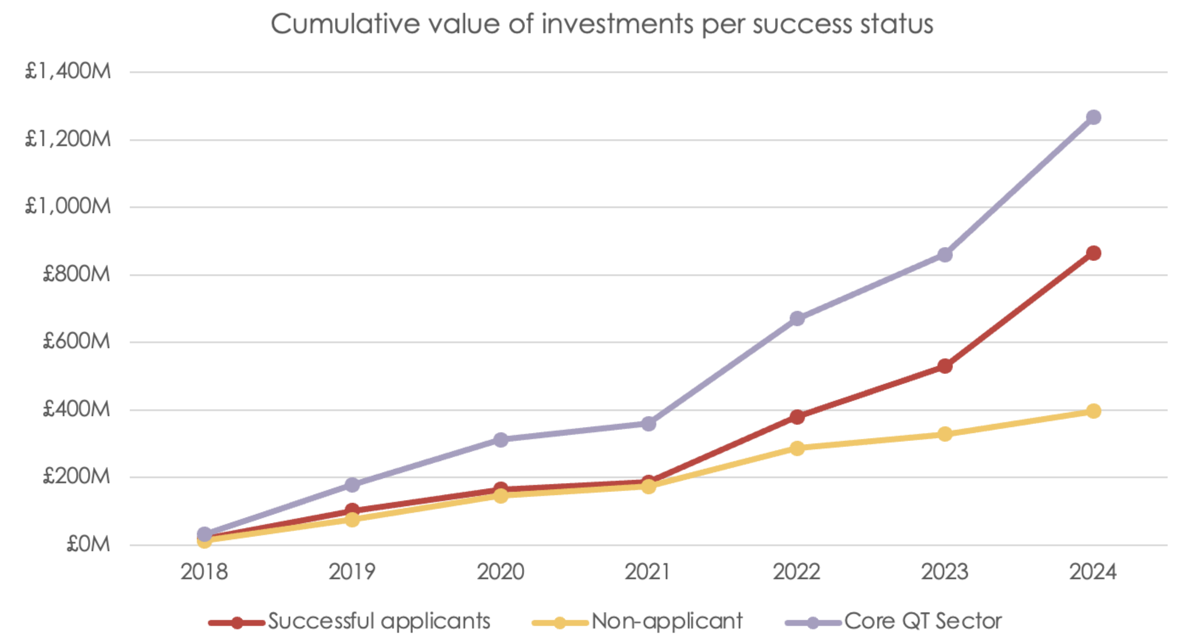


Source: Technopolis (2025) based on Glass.ai web scraping of LinkedIn data. Note: companies with no LinkedIn employee data have been removed. Coverage rate of LinkedIn employee data = 87% - 92%. Methodology in identifying companies and supply chain classification differs from Section 3.5.

3.6.2 *Investment in the Core QT sector*

Across the UK, companies working in the Core QT sector received £1.3bn in investments between 2018 and 2024 (see Figure 33). Of this £1.3bn, successful applicants to the ISCF QT programme account for £866m (68%) and non-applicants account for £396m (31%). Unsuccessful applicants account for less than 1% of private investments in the core QT sector between 2018 and 2024. There is also a notable increase in investments for successful applicants relative to non-applicants between 2023 and 2024, in which successful programme participants account for 83% of the value of investments. As with the PCF data however, this is driven by large rounds of Series B and C funding in large quantum computing companies such as Oxford Quantum Circuits ($100m), Riverlane ($75m) and Quantum Motion (£42m).

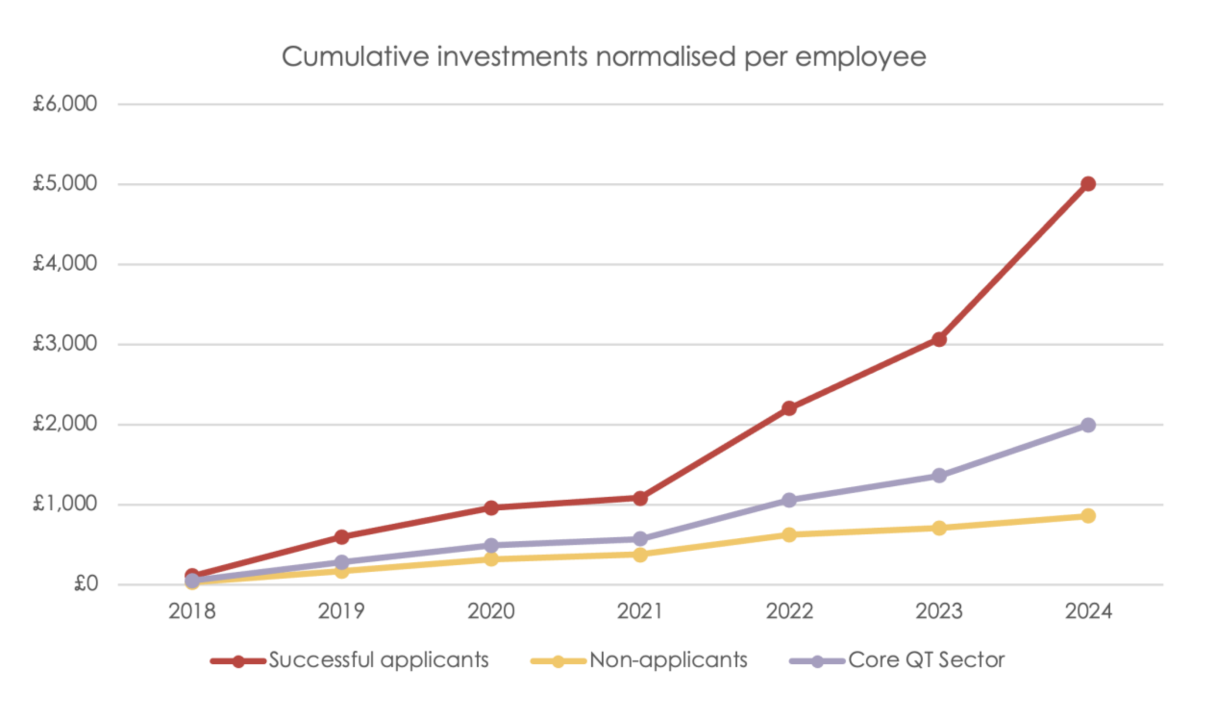
*Figure 33 The cumulative value of funding rounds for organisations within the UK**



Source: Technopolis (2025) based on Crunchbase data. Note: Debt, IPO/liquidity and grant investments have been excluded. The core UK QT sector is defined in Section 3.5. *Core QT sector, successful ISCF QT programme applicants and non-applicants to the programme

The cumulative value of investment raised by programme participants is greater than the wider QT sector and non-applicants, even when controlling for organisation size (see Figure 34). The programme participants securing more investments per employee than non-applicants. Between 2018 and 2024, programme participants have received cumulatively £5.0k of VC funding per employee, compared to £857 of non-applicants and £2.4k for the core QT sector as a whole.

*Figure 34 The cumulative value of funding rounds normalised by number of employees**



Source: Technopolis (2025) based on Crunchbase and Glass.ai collection of LinkedIn data. Note: Debt, IPO/liquidity and grant investments have been excluded. The core UK QT sector is defined in Section 3.5. *Core QT sector, successful ISCF QT programme applicants and non-applicants to the programme

3.6.3 *The UK's research output*

Bibliometric analysis was conducted to assess the research landscape and impact of quantum technologies within the scope of the ISCF QT programme. We examine key indicators such as publication trends, citation patterns, and co-authorship networks, and provide insights into the scientific advancements, leading contributors, and the overall positioning of the field within the global research community.

Scientific output

In terms of total number of QT papers, the UK ranks 5th behind China, the United States, and Germany (full counting), and Japan (fractional counting).

Table 24 Bibliometrics – International Comparators – Number of papers & % of world total (2008-2023)

	Full Counting		**Fractional Counting**	
	No. of papers	**% of world total**	**No. of papers**	**% of world total**
World	236,920		236,920	
China	66,014	28%	58,852.7	25%
United States	54,624	23%	40,665.9	17%
Germany	25,232	11%	15,758.1	7%
United Kingdom	**18,411**	**8%**	**10,873.4**	**5%**
Japan	16,906	7%	12,927.8	5%
France	12,469	5%	7,512.5	3%
Italy	12,267	5%	8,150.6	3%

	Full Counting		Fractional Counting	
	No. of papers	% of world total	No. of papers	% of world total
India	10,625	4%	9,041.5	4%
Canada	10,520	4%	6,249.7	3%
Russia	9,212	4%	6,805.6	3%
Spain	8,129	3%	4,603.0	2%
Australia	7,533	3%	4,468.0	2%
Switzerland	6,605	3%	3,530.1	1%
Rep. of Korea	6,182	3%	4,524.3	2%
Poland	5,073	2%	3,272.1	1%
The Netherlands	4,503	2%	2,403.2	1%
Brazil	4,307	2%	3,047.6	1%
Austria	4,234	2%	2,274.6	1%
Singapore	4,133	2%	2,101.2	1%
Israel	3,477	1%	2,146.8	1%

Source: Science-Metrix. The number of papers is presented in both full and fractional counting. In full counting, a paper co-published by multiple countries will be counted as 1 paper for each country. In fractional counting, each author is attributed an equal fraction of the paper that is then aggregated at the level of countries. This enables a fair comparison with total papers worldwide.

Overall, UK academic publications have become increasingly collaborative in terms of both international collaboration and public-private collaboration.

Table 25 Bibliometrics - UK collaboration (co-authorship) 2008-2017

Indicator	**Definition**[22]	**UK QT Publications**		
		2016-2019	**2020-2023**	**Δ (p.p)**
Private (%)	This indicator is the share of publications involving at least one author from the private sector, regardless of the other authors' sectors.	11.3%	**15.4%**	**+4.1**
Public-private collaboration rate **(Public-Private) (%)**	This indicator shows the proportion of an entity's (a country in this case) papers that are published in collaboration (i.e. co-published) between the public and private economic sectors. The public–private co-publication rate of a given entity is a measure of how many articles involved both sectors, as a proportion of the entity's total output. Note that the measure does not discriminate between authors on a single paper from different countries	10.9%	**14.1%**	**+3.2**
Private-private collaboration rate **Private-Private (%)**	The private-private collaboration rate measures the share of papers published in collaboration between two different entities belonging to the private sector. In the current case, different institutions were considered to be those that were assigned different address lines on the papers	1.6%	**3.2%**	**+1.6**

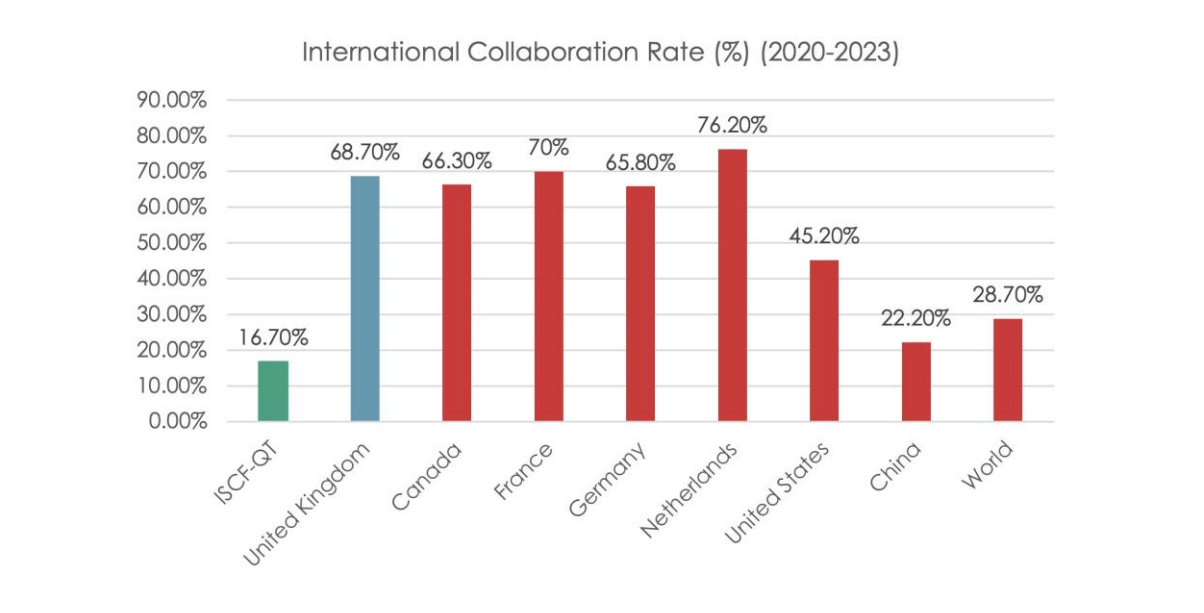
[22] Full definitions are provided in **Error! Reference source not found.**

Indicator	Definition[22]	UK QT Publications		
		2016-2019	2020-2023	Δ (p.p)
international collaboration rate (ICR) (%)	The ICR of a country is a measure of how many articles are co-published with international partners (from any type of organisation) as a proportion of the given country's total output	66.6%	**68.7%**	**+2.1**

Source: Technopolis / Science-Metrix

The rate of international collaboration for the UK is 68.7%, which is UK performs significantly better than the world average on international collaboration, and higher than both Germany (65.7%) and Canada (66.3%). The UK is the only country aside from France whose publications have become increasingly international, increasing from 66.6% between 2016-2019 to 68.7% between 2020-2023. France also saw an increase of 2.6 p.p. in the same time-frame.

Figure 35 Bibliometrics – International Comparators - International Collaboration (2020-2023)

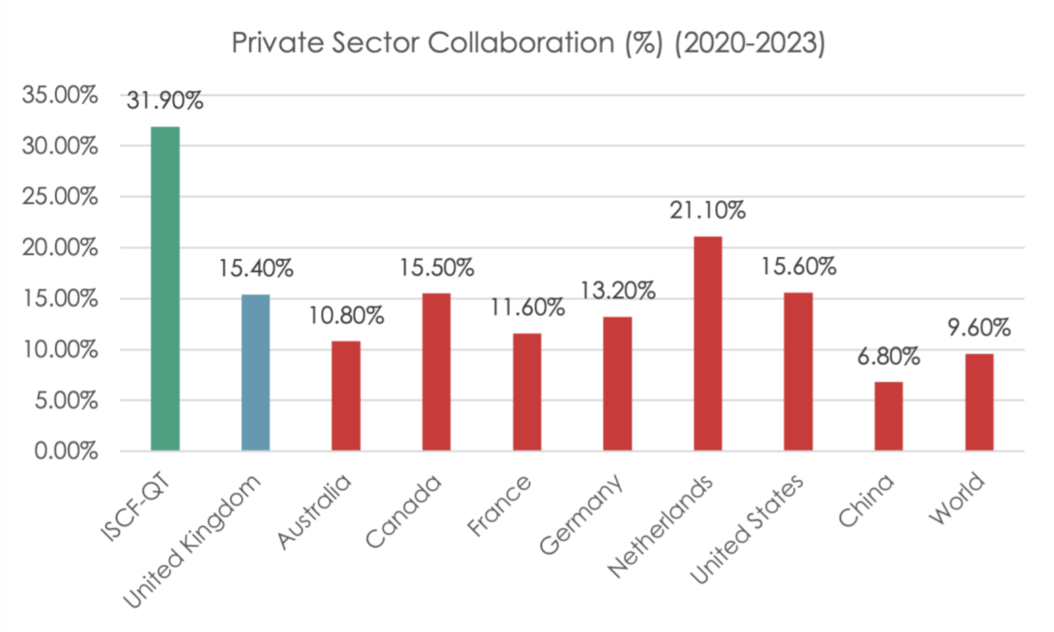


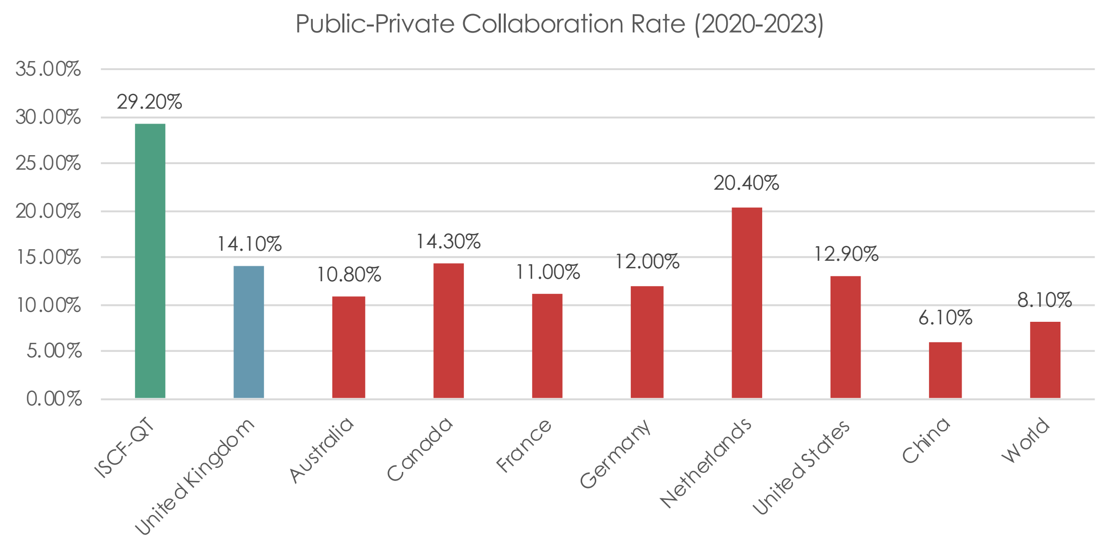
Source: Science-Metrix. ISCF-QT publications refer to publications that have emerged specifically from ISCF funding, rather than broader UK quantum publications.

Private-sector collaboration

The UK ranks 5th in terms of publications that involve the private sector, behind Switzerland, the Netherlands, the United States and Canda, with 15.4% of publications including at least one private sector co-author (see Figure 36). Less than a fifth of UK publications (14.1%) also involved public-private collaboration (determined in terms of publications with co-authors from both the public and the private sector).

Figure 36 Bibliometrics – Private Sector Collaboration (2020-2023)

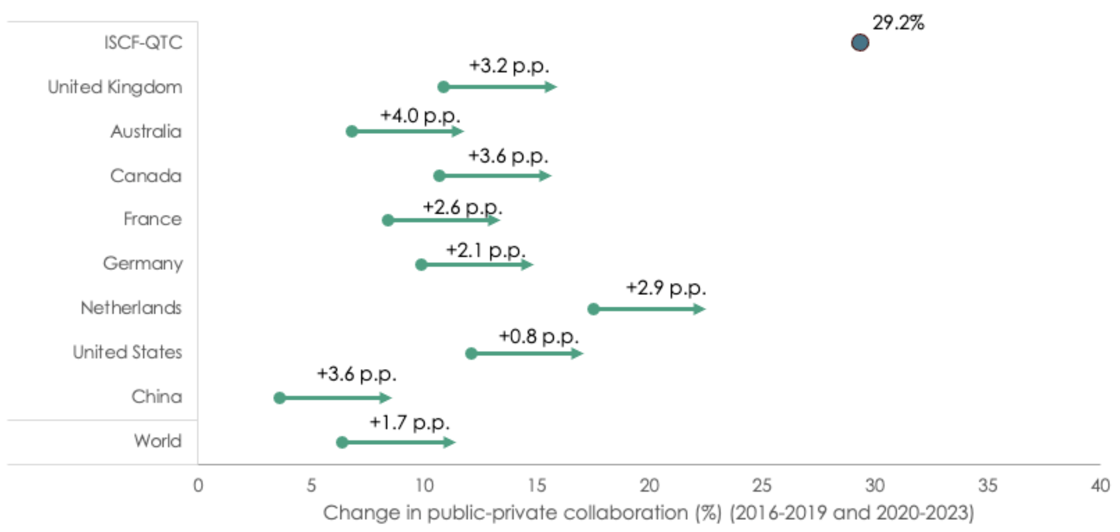




Source: Science-Metrix.

This trend has increased for the UK by 3.2 percentage points. (p.p.) since the baseline period. All international comparators have also increased the share of publications emerging from public-private collaborations, with Australia (+4 p.p.) and Canada (+3.6 p.p.) seeing the greatest uplift and the Netherlands ranks first. The United States only increased the share of publications between the public and the private sector by 0.8 p.p..

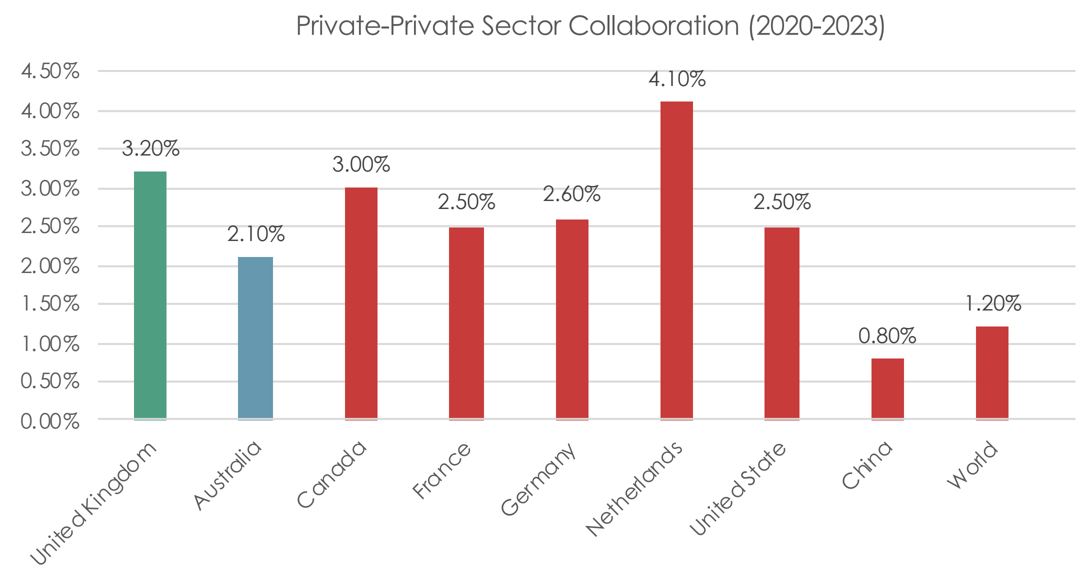
Figure 37 Bibliometrics – International Comparators – Change in public-private collaboration rate (2016-2019 and 2020-2023)

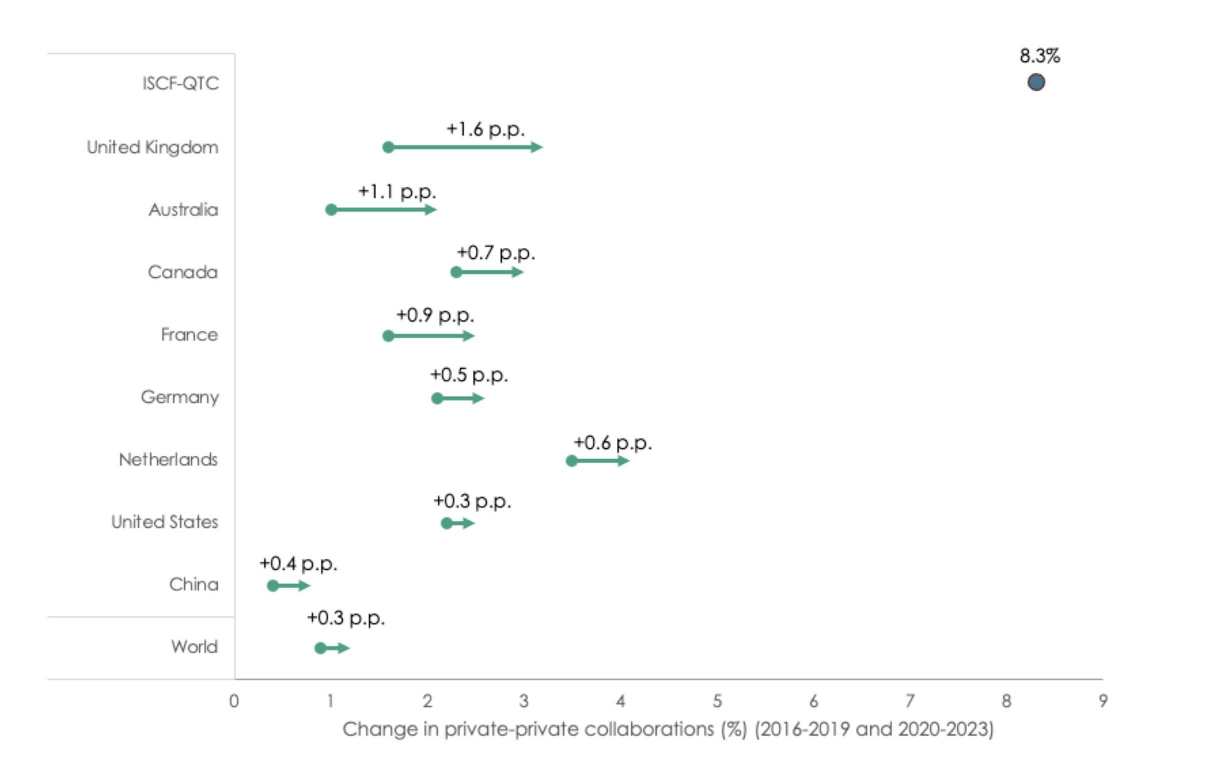


Source: Science-Metrix.

Collaboration can also be considered in terms of the share of ISCF QT-funded publications that involve private-private collaboration. ISCF QT-funded publications have the highest share of such publications (8.3%) compared to the UK nationally (3.2%) and internationally. The UK has seen the largest increase in private-private collaboration amongst international comparators (3 p.p.) and is now ranked 2nd behind the Netherlands.

Figure 38 Bibliometrics – International Comparators – Change in private-private collaboration rate (2016-2019 and 2020-2023)





Source: Science-Metrix

4 Value for Money Assessment

Value for Money assessment is challenging to apply to research and innovation programmes as most of the potential impacts of the programme have not yet been realised. Though the social cost-benefit analysis set out in the Magenta Book can capture short- and long-term impacts, it relies heavily on available data and the ability to monetise the impacts.

In this section, we explore the routes to monetising the benefits emerging from the programme. This is naturally a partial approach, not a reflection of the full value delivered by the programme.[23]

4.1 Approach

This section outlines our approach to assessing the impact and Value for Money (VfM) achieved from the ISCF Quantum programme. The impact assessment focuses on quantitative effects of the programme in terms of net employment growth and net turnover (converted to Gross Value Added, GVA) benefits for businesses. The Value for Money assessment includes a comprehensive set of indicators to evaluate the extent to which the programme's objectives were met.

Our analysis compares the outcomes between successful applicants and the counterfactual, which approximates what would have happened even in the absence of the programme. To estimate this counterfactual, our analysis is based on survey data from a sample of unsuccessful applicants. Data was collected at the organisational level and aggregated to assess the overall value at the programme level. The assessment is based on scaling-up survey results to the population of businesses who have completed or are on track to complete project(s) with the ISCF programme.

4.2 Impact assessment

4.2.1 Employment impacts

The estimated employment impacts achieved from the ISCF QT programme are presented in Table 26.

The analysis indicates that the average growth in employment accumulated since the baseline is 67 FTE per successful business applicant. When we look at the number of employees working in Quantum research, the number is much lower, at just 3 FTEs. After accounting for additionality by netting off the growth in QT employment observed for unsuccessful business applicants, we find that the net cumulative QT employment benefit attributed to the programme is 3 FTE per business, or 129 FTEs across all surveyed businesses in the sample (n=43). If we assume that all successful businesses applicants associated with the ISCF Quantum programme, including those who didn't respond to the survey, experience the same average growth in QT employment, then we find that the total net cumulative employment increase is 474 FTEs (n=158) (or 316 FTEs based on the median figures).

[23] Although we have monetised certain benefits this does not capture the full breadth of outcomes and impacts attributable to the programme, which have been documented in the sub-sections above. For example, the benefits of the programme in supporting the development of the UK's emerging QT sector are difficult (if not impossible) to monetise. Additionally, the potential economic effects of those outcomes would materialise in the future.

In terms of costs, the HMT Green Book indicates that VfM assessments should include in its cost calculations all the costs incurred by the system (i.e., all actors involved) in delivering the projects / programmes. With this in mind, the total programme cost across all strands is £242m, comprised of the £172m in grant funding committed by the ISCF programme and the £70m of matched funding leveraged from programme participants.

As such, the analysis suggests that the cost per net job created is £540k, on average (£811k median).

Table 26 Estimated employment impacts

Description	Overall employment		Employment in QT research	
	Average	**Median**	**Average**	**Median**
A. Gross cumulative employment increase per successful business applicants since baseline	67	12	3	2
B. Gross cumulative employment increase per unsuccessful business applicants since baseline	-3	2	0	0
C. Net cumulative employment increase per successful business applicants	70	10	3	2
D. Survey sample of successful business applicants with employment data	43	43	43	43
E. Total business population part of the ISCF QT programme	158	158	158	158
F. Total net cumulative employment increase for surveyed business applicants	3,010	430	129	86
G. Total net cumulative employment increase for all business applicants, after accounting for survey non-responses	11,060	1,580	474	316

Source: Technopolis, CATI Survey, March-May 2025.

4.2.2 GVA impacts

The estimated GVA impacts achieved from the ISCF QT programme are presented in Table 27. To estimate the cumulative GVA, we multiplied the value of turnover by the ONS conversion factor for the Professional, scientific, and technical activities sector in 2023[24].

The analysis indicates that the value of GVA accumulated since the baseline is £2.3 million per successful business applicant (median of £524). However, the value of GVA derived from the sale of quantum products or services is much lower, at £253k per business, on average. After accounting for additionality by netting off the growth in GVA observed for unsuccessful business applicants, we find that the net cumulative GVA attributed to the sale of QT products is £248k per business, or £8.4 million across all businesses in the survey sample (n=34). If we assume that businesses who did not respond to the survey experience the same average growth per business as those who did respond to the survey, then the total net cumulative GVA

[24] The conversion factor used is 0.551798196.

Non-financial business economy, regional results: Sections A to S, All Regions, 2008 to 2023 https://www.ons.gov.uk/businessindustryandtrade/business/businessservices/datasets/uknonfinancialbusinesseconomyannualbusinesssurveyregionalresultssectionsas benefits increase to £39 million (median of £2.2m). If we assume that these economic benefits are sustained for 5 years and discounted at a rate of 3.5%[25], then the net present value of GVA benefits attributed to QT products or services is estimated at £177 million (or £9.8m total benefit based on the median values).

With a total programme cost of £245m, the analysis suggests that every £1 invested is associated with £0.70 in economic GVA benefits from QT products/services sales supported by the programme funding.

Table 27 Estimated GVA impacts

Description	Overall GVA		GVA from QT products	
	Average	**Median**	**Average**	**Median**
A. Gross cumulative GVA increase per successful business applicants since baseline	£2.3m	£524k	£253k	£14k
B. Gross cumulative GVA increase per unsuccessful business applicants since baseline	£653k	£65k	£5.6k	£0
C. Net cumulative GVA increase per successful business applicants	£1.6m	£460k	£248k	£14k
D. Survey sample of successful business applicants with turnover data	34	34	34	34
E. Total business population part of the ISCF QT programme	158	158	158	158
F. Total net cumulative GVA increase for surveyed business applicants	£55m	£16m	£8.4m	£469k
G. Total net cumulative GVA increase for all business applicants, after accounting for survey non-responses	£256m	£73m	£39m	£2.2m
H. Total net cumulative GVA increase for all business applicants, assuming the benefits are sustained over 5 years	£1.2bn	£228m	£177m	£9.8m

Source: Technopolis, CATI Survey, March-May 2025.

It is important to note that the ISCF investment programme comprises distinctive investment strands, each supporting innovation at different stages of development. Some strands focus on supporting commercialisation, where economic return is an expected outcome at the end of the project. Others, however, support early-stage activities, such as feasibility studies, where the primary objective is to assess the feasibility of research ideas at low TRL and their potential for commercial success. As such, the aggregate GVA estimates per £1 invested should be interpreted with caution, given the different aims and timescales for economic impact across the portfolio.

[25] Discount rate in accordance with Green Book recommendations. See: https://www.gov.uk/government/publications/green-book-supplementary-guidance-discounting

4.3 Value for Money assessment

The Value for Money (VfM) assessment below offers a holistic approach to capturing the variety of impacts, providing a robust way to assess the value of the programme beyond just monetised impacts. It establishes the relationship between the inputs made and the economic returns secured by providing an assessment of the 3Es.

Table 28 Value for Money assessment

Questions	Value for Money assessment
Economy	
Is ISCF Quantum Technologies programme investing in appropriate activities, given its intentions / ambitions?	***The impact and process evaluations find strong evidence to indicate that the programme is investing in appropriate activities to support the development and commercialisation of quantum technologies.*** • **Focus on reduced investment risk.** 34% of successful applicants stated that participation in the programme made the solutions developed more ready for further investment from the private sector. At project close, a large majority (79%, n=283) of participants reported that they are planning further R&D to commercially exploit the technology outputs from ISCF QT project activities. Interviews with wider stakeholders and programme participants noted that the programme had played a valuable role in de-risking the investment into quantum technology R&D. This is because it helped to validate the viability of their potential products and increase the viability with potential partners. • **Focus on supporting collaborations.** According to the business survey, one of the main attractive features of the ISCF QT programme is the opportunity to build new and enhanced collaborations with other organisations. Businesses indicated that they have developed 251 new partnerships, of which 178 (71%) are with industry partners. Most respondents (80%) stated that the programme was a catalyst for the establishment of any new partnerships or collaborations. Feedback from participants indicates that they intended to continue the collaborations beyond the project lifetime.
Is ISCF Quantum Technologies programme mobilising other resources?	***The evaluation has found strong evidence to suggest that the programme mobilised resources from private sector investments to support QT development.*** • **Match funding committed at the application.** Across all strands, the programme committed a total of £172m in grant funding and has further leveraged £70m of matched funding from programme participants (almost all from industry). This means that for every £1 invested by Innovate UK, the programme raised £0.41 in match funding from participants. • **Further funding raised post application.** According to the PCF analysis, around two thirds of project participants (68%, n=306) reported in their PCFs that they had not raised further funding. At the point of project close, 25 companies reported further investment secured as a result of their ISCF projects worth £158m in further investment from private investment sources, i.e. excluding further grant funds. This is heavily skewed by three companies who have achieved great success. • **Internal R&D expenditure.** At project close, the majority (78%) of project leads reported that they planned on investing further R&D to continue their recently closed ISCF QT projects (n=283). On average (median), projects anticipate spending an additional £250k on R&D. According to findings from the business survey, programme participants have seen a marked increase in their levels of R&D expenditure into QT since the baseline, well above those of the unsuccessful applicants (increase of £252k vs £22k).

Efficiency	
To what extend are activities expected to deliver the intended outputs?	***The evaluation found evidence that the programme supported the creation of outputs that likely would not have occurred to the same extent without the funding.*** • **Completion of projects.** Of the 136 projects funded through the ISCF QT programme since 2018, all projects, except one, have been successfully completed (as of March 2025). Performance scores provided by IUK monitoring officers suggest that all projects have performed well, with some variations across cohorts and competitions. In 2022/23, the average score across indicators was 3.9. • **New skills and knowledge.** According to the business survey, 95% (57 out of 60) of programme participants stated that the ISCF QT programme has improved the organisation's internal capability in relation to quantum technologies. Most respondents also indicated that the programme improved their understanding of the end users' requirements and overall awareness of the QT sector more generally. • **Publications.** According to analysis of the PCF, a total of 73 unique publications were identified as a result of ISCF QT-funded research, with nearly a third of publications involving at least one author from the private sector. Overall, the ISCF QT publications account for just 0.95% of the 7,686 UK publications in quantum technologies between 2019 and 2023. • **Patents.** At the end-point of their ISCF-QT projects, 38 companies reported in their project close forms (PCF) that they had either submitted or secured 98 patents in total. According to the business survey, the proportion of respondents who applied for patents increased more significantly among successful applicants (from 18% to 39%) than among unsuccessful applicants, who experienced a smaller rise from the baseline (from 9% to 14%). • **TRL progression.** According to the PCF analysis, following the end of their ISCF QT projects, 80% of project participants reported a TRL of 4 or greater, with a small proportion (5%) reporting a TRL of 8 or 9, indicating that the new product developed is close to market. On average, ISCF QT projects increased the TRL of their products by TRL by 2.3 levels. There is variation by instrument type, ranging from 2.5 levels for Investment Accelerator to 1.5 levels for Germinator (reflecting the shorter time scale of these projects).
Effectiveness	
How well are activities positioned for achieving project outcomes?	***The evaluation found evidence that the programme supported the creation of outcomes that likely would not have occurred to the same extent without the funding.*** • **Jobs created.** Programme participants from industry have experienced stronger growth than unsuccessful applicants, both in overall employment and the number of employees working in quantum R&D. Since the baseline, the average number of employees has increase by 67 FTE for programme business participants (rising from 86 to 153), compared to an average decline of 3 FTE for unsuccessful business applicants (falling from 22 to 19). According to the results from the business survey, the percentage of employees working in quantum research is roughly the same across the two groups, at 4-5%. Since the baseline, the number of employees working in quantum research has increased for programme participants, from 3 to 6 FTE. Over the same period, unsuccessful applicants experienced no change, with only 1 FTE working in quantum research, on average. • **New products.** According to the business survey, both successful and unsuccessful applicants reported an increase in commercial activity since the baseline, though the increase was greater for programme participants. This percentage point (ppt) increase was greater for both launching a product (32 ppt vs 5 ppt) and manufacturing components or QT-based products (16ppt vs 10ppt). • **Turnover.** The business survey results indicate that programme participants have gained a larger absolute increase in the average turnover than unsuccessful applicants (£4m vs £1.2m). In terms of the value of turnover derived from QT

	products/services reported by programme participants, the average turnover has increased from £177k in the baseline to £976k at the end of the 2023/24 financial year. Unsuccessful applicants had a lower average turnover attributed to QT products before applying to the programme and reported a more modest increase over the same period, from £19k to £29k.
How well are activities positioned for achieving programme impacts?	• **Growth in the sector.** The evaluation recorded concrete examples of how the ISCF QT programme has contributed to the establishment of new companies in the UK's QT supply chain. Five academic collaborators and six business participants indicated that the programme contributed to the creation of a new spin-out or start-up. Most survey businesses (73%) also indicated that their organisation's competitive position within the quantum technologies sector has increased following participation in the programme. • **Adoption of QT products.** 48% of survey business participants indicated that the adoption of quantum technologies in their organisations increased since their participation in the programme. The case studies also showcased a wide range of examples of products and services developed as part of funded projects, some of which are available for purchase by end-users. For example, the QT Assemble project enabled the development of several advanced quantum technologies, such as a new PPLN waveguide package, the compact NX Micro laser platform, and a functioning single-photon platform. In the future, the project aims to help new QT businesses enter the market by minimising the size, cost, and complexity of quantum subsystems and making quantum devices practical for real-world applications.

5 Summary and conclusions

The National Quantum Technologies Programme (NQTP), launched in 2013, positioned the UK as a global leader in the emerging quantum landscape by bringing together government, academia, industry, and national laboratories in a long-term, mission-led effort. The Industrial Strategy Challenge Fund Quantum Technologies (ISCF QT) programme, launched in 2018, represents a central pillar of this broader initiative, with a specific focus on accelerating the commercialisation of quantum technologies.

Since the launch of the ISCF QT programme in 2018, the global quantum technology landscape has evolved rapidly, marking a significant shift from foundational research toward real-world application and commercialisation. At the time of the programme's inception, quantum technologies were largely confined to academic and theoretical research environments, with limited industrial engagement and few demonstrable use cases beyond the laboratory. Today, however, the market has evolved considerably. Internationally, major public and private sector investments have accelerated progress across quantum computing, communications, sensing, imaging and metrology. While a commercially available quantum computer is still several years away, applications in communications, sensing, imaging and metrology are much closer to market with initial products already available and early adopters exploring their potential. A growing ecosystem of start-ups, scale-ups, and large corporates are exploring commercial models and integrating quantum capabilities into their R&D pipelines.

This evaluation concludes that the ISCF QT programme has made a substantial contribution to the development of the UK's QT ecosystem, and made significant progress in realising its objectives across all the main areas of expected outcome and impact, as identified in the Theory of Change:

- New knowledge, skills and capabilities
- R&D investment
- New QT technologies, products and services
- Commercially successful QT businesses
- Growing the UK's QT Sector
- Supporting a world-leading QT Sector

ISCF QT has supported the development of new knowledge, skills and capabilities

The development of new knowledge, skills, and capabilities in QT is of critical importance, as it underpins the UK's ability to both generate new insights and to translate cutting-edge research into practical applications and commercial opportunities. Strengthening these capabilities ensures that both academic and industrial stakeholders are equipped to advance QT innovation, build a skilled workforce, and maintain the UK's position as a global leader in this emerging field. The ISCF QT programme has enabled participating organisations to produce codified knowledge assets in the form of 98 patents and 73 academic publications. The programme has also been critical for participants' development of new skills and knowledge in both the technical areas of quantum technologies, as well as the skills and knowledge required to successfully translate and bring their solutions to market.

Project partners also reported new knowledge and insights in the form of **patents.** At the end of the project, a total of 38 companies reported applying for or securing 98 patents, though the majority of projects indicated that they were not yet formally protecting technology developments through IP at that stage.

Academic partners reported, at project close, a total of **73 unique publications** (full counting) as a result of ISCF QT-funded research. This could be considered a relatively small number of publications, though it remains higher than other ISCF challenges and reflects the objectives of the programme to support innovation and commercialisation. These publications account for just 0.95% of the 7,686 UK publications in quantum technologies between 2019 and 2023 (full counting). Notably, nearly a third of all ISCF QT papers involve the private sector (31.9%). This is double the share than at the UK national level (15.4%) and higher than all other international comparators.

Following the end of the projects, programme participants were more likely to apply for patents than unsuccessful applicants, both before and after their participation in the ISCF QT programme. Programme participants surveyed have also experienced more success in applying for QT-related patents after the end of the programme – 39% of participants had applied for a patent and 25% had secured a patent, compared to 14% and 5% of unsuccessful applicants, respectively.

Overall, participation in the programme led to **improved skills and capabilities** for participating organisations. Of the businesses surveyed (n=55):

- 95% agreed that their participation in the programme led to an increase in internal capabilities
- 100% agreed that they had realised increased understanding of the requirements of end-users of QT products, services or components
- 90% agreed that they had realised improved capabilities and skills to incorporate QT in their sector of activity

At project close, project participants most frequently cited the development of technical skills and knowledge as a result of their ISCF-funded project activities (44%, n=371). In addition, all project participants highlighted improvements in their abilities to collaborate and partner (76%), problem solving (74%) and strategic thinking (63%). Interviews with programme participants and the impact case studies highlighted various examples of these new skills, knowledge and capabilities developed, and largely referred to technical knowledge and skills relating to their products or services. This included examples of companies working knowledge their own products and approaches to manufacturing, as well as examples of companies working more closely with end-users to better understand the downstream product-market fit.

Importantly, these skills were developed, in most cases, in collaborations between industry and the research base, with 80% of projects involving industry, most of which were SMEs, and universities or RTOs.

ISCF QT catalysed R&D investment

Increasing R&D investment is one of the four core objectives of the ISCF QT programme and of the wider Industrial Strategy Challenge Fund. One of the driving rationales for the programme is that in de-risking early-stage innovation, it will encourage greater private sector investment in R&D in the QT sector. This includes increasing investment in the short term, through co-investment in projects but also subsequent investments in R&D following the end of ISCF QT projects to accelerate the development and commercialisation of quantum technologies in the UK. Our evaluation finds that in addition to the £70m of matched investment made by project partners, the programme de-risked further investment into R&D, catalysed programme participants' increased expenditure on R&D and enabled them to secure further private and public investment to continue their R&D activities.

Organisations invested in the ISCF QT-funded project either as part of their grant commitments (co-funding) or beyond. The **programme leveraged £70m in matched funding** from participants, almost all (99.8%) from industry.[26] Comparing the matched funding from participants to ISCF QT grant funding, we can see that the internal programme leverage is ~0.41 for the whole programme.

At the end of the ISCF QT projects, the majority of participants (78%) were planning on conducting further R&D on their ISCF QT project (n=81) to commercially exploit project outputs and expected to spend, on average (median), a further £250k on additional R&D activities to continue the development of their ISCF QT supported project.

As of the FY 2023/24, programme participants have seen an increase in their levels of R&D expenditure, well above those of the unsuccessful applicants since the baseline. On average, the increase in QT R&D since the baseline is £252k for programme participants, compared to a slightly smaller increase for unsuccessful applicants of £22k.

Academic participants also increased the number of projects and R&D expenditure overall and in quantum technologies specifically. Academic participants reported a slight increase in the number of R&D grants / projects they secured (3 to 5, median) and an increase in those relating to quantum technologies (3 to 4, median), whilst unsuccessful academic applicants remained the same. All research groups (participants and unsuccessful applicants) increased R&D expenditure between the baseline and 2023/24, with unsuccessful academic groups reporting a larger rise in non-QT R&D (235% vs 162%). However, programme participants saw a significantly greater increase in QT-specific R&D (201% vs 45%), indicating a stronger specialisation in quantum technologies.

Interviews with wider stakeholders and programme participants noted that the programme had played a valuable role in de-risking the investment into quantum technology R&D. This took place on two levels. Firstly, companies noted that the ISCF QT funding helped to validate and provide further assurance as to the viability of their (potential) product and organisation, increasing their credibility with potential partners and investors. Secondly, interviewees also noted that the very existence of the programme and its clear strategy and phasing for investing in the commercialisation of quantum technologies at all provided greater confidence to further increase their R&D activities.

ISCF QT enabled the development of new QT technologies, products & services

The development of new quantum technologies, products, and services is central to the ISCF QT. At the outset of the programme, many quantum technologies were still in the early stages of development, requiring intensive R&D to create reliable, demonstrable hardware or core technology platforms. The evidence shows that the programme has made a clear made a significant and measurable contribution to accelerating the development and launch of quantum technologies – 97% of projects increased the TRL of their product as a result of the project, with an average (mean) uplift of 2.3 TRL levels. In the years following the end of their projects, participants were able to progress their technologies beyond the 'development' phase and into demonstration and commercialisation. Notably, though, a not insignificant proportion (40%) of business's critical QT technologies were still in the early stages of development, reflecting the longer innovation timelines associated with deep tech sectors like quantum. Importantly, programme participants were significantly more likely than unsuccessful applicants to launch new QT products or services (32 pp increase vs to 5 ppt), and to develop

[26] As committed by applicants at the proposal stage

QT-based manufacturing components (16 ppt increase vs 10 ppt), indicating that the programme catalysed both technology progression and broader organisational commercial focus.

ISCF QT projects increased the Technology Readiness Level (TRL) of technologies by 2.3 levels, on average, as a result of their ISCF QT project at project end. Before funding, 97% (n=286) of business and RTO project participants indicated their technology was at a TRL3 or lower. At the point of project close, 80% of project participants reported a TRL of 4 or greater, with a small number reporting a TRL of 8 or 9, indicating that the new product developed is close to market.

In early 2025, businesses surveyed identified 46 products or services that were linked to their ISCF QT projects that they saw as being critical for growing their businesses. Of these products or services, just over half (56%) have moved beyond the 'development' phases and have, at a minimum, started the process of validation and deployment (namely TRLs 7-9) and a fifth (26%) have already reached commercialisation (TRL9). This evidences tangible downstream impact, with a notable number of quantum technologies supported through the ISCF QT entering or nearing market readiness.

There remains, however, a not insignificant proportion (40%) of these critical technologies still in the early stages of development (TRL3-5). This is not necessarily surprising, given that the majority of technologies participants were developing were new to market (78%). This does, however, highlight the fact that whilst some quantum technologies are nearing market readiness, the longer innovation timelines associated with deep tech sectors like quantum are still in progress and the ongoing need for sustained support to bring these technologies to market.

Overall, **programme participants were more likely than unsuccessful applicants to have launched a new QT product or service** since the baseline period. Though both programme participants and unsuccessful applicants report an increase, this was substantially higher for programme participants than for unsuccessful applicants (increase of 32 ppt vs 5 ppt). Similarly, the proportion of both programme participants and unsuccessful applicants that had manufacturing components or QT-based products increased since the baseline period, though this was greater for participants (increase of 16ppt vs 10ppt). This suggests that the programme not only supported progression for individual technologies but also catalysed broader organisational capabilities and strategic focus on commercial outcomes.

Commercially successful QT Businesses

The ISCF QT programme has played a significant role in enhancing the commercial performance and investment-readiness of participating companies. Between 2018 and 2024, programme participants secured a notably higher number and value of private investment rounds (£903m across 67 rounds) compared to unsuccessful applicants (£97m across 13 rounds). The fact that 26% of participating companies had recorded at least one funding round on Crunchbase—compared to 15% of unsuccessful applicants—signals stronger external validation and investor confidence in programme-backed firms.

In addition to investment outcomes, participants experienced more robust business growth. Employment across participating companies grew significantly, particularly in engineering and operations, while unsuccessful applicants saw a net decline. Commercial impact was evident through increases in turnover: participants reported an average rise of £4 million in annual revenue, compared to £1.2 million for the counter-factual group. Turnover specifically attributed to QT activities rose substantially, and participants grew their proportion of QT-related income from 1.8% to 7.5%, suggesting a growing commercial focus within the sector.

Despite these gains, it is important to note that most QT companies remain pre-revenue, as reflected in the median turnover of £0 across both groups. This is consistent with the emerging nature of the technology and the long timelines required for deep tech commercialisation.

The programme also had a positive influence on export potential. While just over half of participants had prior export experience, 81% reported that their ISCF QT project increased the likelihood of future exports. Average export turnover rose by £2 million among participants, further indicating international market opportunities catalysed by the programme.

Overall, the evidence demonstrates that the ISCF QT programme has effectively strengthened the commercial positioning, investment readiness, and growth trajectories of participating businesses. The stronger performance of participants compared to unsuccessful applicants across multiple indicators highlights the programme's additionality and its value in accelerating the development of a competitive UK quantum industry.

A proportion of programme participants had secured further private sector funded by the end of their projects. At the point of project close, 25 companies had secured a total of £158m in further investment from private investment sources (i.e. excluding further grants) as a result of their ISCF projects.

Programme participants have secured a greater proportion of the number and value of private investment than unsuccessful applicants between 2018 and 2024**.** Of the 113 companies participating in the ISCF QT programme, excluding end-users, we have identified 26% as having at least one founding round listed on Crunchbase, compared to only 15% of the unsuccessful applicants. The strong representation of programme participants in the database is itself a positive signal of the strength of the companies. These 29 programme participants have secured a total of 68 rounds of funding between 2018 and 2024, amounting to £903m. More than half (56%) of these funding rounds were secured by programme participants between 2022 and 2024. Unsuccessful applicants secured 13 funding rounds amounting to £97m.

Programme participants have experienced stronger growth than unsuccessful applicants, both in overall employment and the number of employees working in quantum R&D. At the end of their ISCF QT projects, participants reported retaining an average of 1.35 FTE due to their projects. Since the baseline, the average number of employees has increased by 67 FTE for programme participants (rising from 86 to 153), compared to an average decline of 3 FTE for unsuccessful applicants (falling from 22 to 19). Furthermore, interviews with programme participants also noted that the largest areas of growth within their teams (due in part to the support provided by the ISCF QT projects and resulting benefits) has more often been in areas of engineering and general operations, rather than in their core QT R&D teams.

At the point of project close, **the majority of business and RTO participants (89%) reported that their commercial opportunities had either moderately or greatly increased as a result of participation**, though most participants expected the benefits to their market position to be realised at some point in the years following the end of their ISCF QT project. Just under a half (43%, n=264) of business and RTO participants indicated at project close that their ISCF QT project had helped to protect their market position, and a much smaller proportion reported that ISCF QT funding supported an expansion of their market position, either in the UK or abroad (16% and 9% respectively). Instead, **most anticipated that the benefits to their market position would emerge on a longer timeline as both their products and the markets for those products matured.**

Programme participants saw an average increase in annual turnover of £4 million, compared to £1.2 million for unsuccessful applicants. On average (both mean and median), annual turnover increased for all applicant groups, but those who participated in the ISCF QT programme experienced significantly greater growth. Turnover specifically related to QT also increased to a greater extent for participants than for unsuccessful applicants (from £177k in the baseline to £976k at the end of the 2023/24 vs £19k to £29k), indicating that the programme increased opportunities to commercialise their products and services. Programme participants have experienced an increase in the proportion of their QT-turnover, growing from 1.8% to 7.5% of total turnover, compared with a decrease from 6.8% to 1.9% in the unsuccessful group. Notably, though, most applicants (successful and unsuccessful) reported no increase in turnover – the median turnover remained £0 for both groups between the baseline year and 2023/24. This reflects the fact that the majority of QT companies are likely to be pre-revenue, given the emergent nature of the technology.

The ISCF QT programme has enabled an increase in exports for participating firms. A small majority of participating companies (53%, n=286) had exported goods or services prior to their ISCF QT project, though 81% indicated that their project has increased the likelihood they would export goods or services in future due to a combination of the increase in maturity level of the products and services developed through R&D activities and the reported upskilling. On average (mean), both programme participants and the unsuccessful applicants have generated an increase in turnover from general exports (increase of £2m and £818k respectively).

Growing the UK's QT Sector

The ISCF QT programme has also played an important role in convening the sector and supporting the development of the UK's QT ecosystem. ISCF QT projects had an average of 4.2 partners and nearly all (96%) planned to continue collaborations with at least some of their partners beyond their projects. In 2025, participants reported forming an average of 3.9 new partnerships, largely catalysed by the programme.

The programme has provided a pathway for translating knowledge and technologies from world-leading universities into real-world applications, while enabling key RTOs (such as Fraunhofer and NPL) to expand their capabilities, deepen industry connections, and stay at the forefront of emerging developments. Around 48% of participants were involved in multiple projects, often with repeat partners, contributing to ecosystem clustering. Key RTOs like Fraunhofer and NPL acted as central connectors, participating in numerous projects (30 and 23, respectively), enhancing the sector's cohesion and reinforcing their roles as critical nodes in the UK and global QT landscape. Similarly, academic engagement has also been a cornerstone of the programme, with two-thirds of projects including an academic partner and the programme provided a route to translate outputs from the EPSRC Quantum Hubs and supported spin-outs, enhancing industry-academic collaboration. As a result, academic participants reported a marked increase in their connections with industrial partners due to the programme, and as a result, nearly a third of academic publications involved industry (32%, double the national rate). The programme also served as a valuable launch pad for other major public initiatives, including the National Quantum Computing Centre (NQCC).

As of 2025, the UK's core QT sector comprises 195 companies, of which 35% (68) were participants in the ISCF QT programme. The sector has grown substantially even since the baseline evaluation in 2021, with just over a third of companies newly engaged in the sector. Overall, the UK's core QT sector in terms of the number of employees in core QT companies has grown by 32% between 2017 and 2023. Within this, programme participants saw median employment grow from 3 to 27 FTEs, highlighting the programme's role in moving companies from start-up to scale-up.

The emerging QT sector in the UK is small and well-connected relative to other sectors, and the programme supported the strengthening of collaborations and partnerships. Across all partner types, many projects reported that they had previously collaborated on other projects and over half of project participants (56%, n=348) reported that they had collaborated with competitors, either through the ISCF project or in previous R&D work. On average, ISCF QT projects have 4.2 partners per project, ranging from 12.5 for its CR&D Pioneer projects through to 1.7 for Germinator projects. At project close, nearly all project participants indicated that they intended to continue the collaborations beyond the project lifetime (96%, n=354). In 2025, programme participants reported 3.9 new partnerships on average, mostly within the QT sector and end-users, and almost all participants responding to the survey reported the ISCF QT programme as the catalyst for these new partnerships.

Around half (48%) of participants were involved in more than one ISCF project, with some of these being follow-on activities from previous projects in collaboration with some of the same partners. This has created a unique pattern of clustering and ecosystem development even within the portfolio of ISCF QT projects. In mapping the co-participation in projects, we see numerous examples of companies that are functioning as key nodes in the UK's QT ecosystem, as well as clustering of organisations around the ISCF QT's core themes. Wider stakeholders were also united in viewing the programme as instrumental in increasing collaboration and, as a result, helping to generate cohesion across the QT sector.

The role of Fraunhofer and NPL in providing underpinning support to the ISCF QT programme is evident. Placed centrally in the map, they have dense networks and form critical connections between organisations and across themes, in large part due to the number of projects in which they are involved and the amount of funding secured. Within the programme, RTOs and academic research groups are playing a valuable supportive role. Though Fraunhofer participates in 30 ISCF QT projects, it leads only two. Similarly, NPL supports 23 ISCF QT projects but leads only one. Worth noting, however, is that the participation of these organisations is distributed across different departments and research groups, which means that these collaboration patterns are reflective of the role of each organisation as a whole, rather than specific teams. Stakeholders noted that the involvement of these two organisations was a reflection of their expertise and capabilities and that as a result of their participation in the ISCF QT programme, their role as critical nodes in the UK's QT ecosystem has further strengthened. Their centrality also enabled them to promote and catalyse further connections within the sector as well as to their peer organisations overseas.

Two thirds of all ISCF QT projects included at least one academic partner. The only programme strand that was open to academia-led projects, Germinator, and even here only two of the 19 projects were led by research groups (10%). These academic partners are distributed across the UK, though we do see clear alignment between the thematic areas of the programme and the Universities that sit at the centre of the EPSRC Quantum Technology Hubs. All participating research groups surveyed indicated that their involvement in the programme had led to new collaborations and partnerships with UK-based industrial groups, and 86% of research groups reported a significant increase in engagement with industrial developers and providers of QT. As a result, nearly a third of all ISCF QT academic publications involve the private sector (32%) - double the share at the UK national level (15%).

The ISCF QT programme has provided a clear and valuable route for translating outputs from the EPSRC Hubs and supporting spin-outs. Our evaluation also finds that the ISCF QT has played a valuable role in further strengthening the partnerships formed between industry and academic partners in the EPSRC quantum hubs by providing a route to further fund industrial partner engagement. Through this evaluation, we've identified numerous examples of companies that have emerged from the EPSRC Hubs and received valuable, if not vital, support for their start-up. In this sense, it is complementary to the other investments in the wider NQTP programme.

Our evaluation has identified **a total of 195 unique businesses in the UK's core QT sector**, which has been defined as companies who develop quantum technology components and quantum systems. Of these 195 businesses, 46% (89) have applied to the ISCF programme, and 35% (68) are programme participants having been part of at least one successful project application. The programme has engaged with a signification proportion of the UK's emerging sector. Notably, over a third of the companies in the UK's core QT sector have been identified as being part of the sector since the baseline evaluation in 2021 (74 companies). This includes some new companies founded (12), but more often represents companies that are demonstrably moving into or engaging with the QT sector in more recent years.

The **size of the UK's QT sector has also grown in terms of the number of FTE employees – an increase of 10,952 staff between 2017 and 2023**. During this period, the average growth (mean) per company within the core QT sector was 63 employees and the median growth 14 employees (from an analysis of secondary data from FAME). In this pool of companies, we see an increase in the number of employees within both the programme participants and unsuccessful applicants, though the average (mean) size of programme industry participants grew by 63 FTE employees compared to unsuccessful business applicants, which saw a smaller increase of 39 FTEs. Although the median growth was lower than the means, they support the conclusion that successful business applicants have experienced a greater increase in employment than unsuccessful applicants. This growth reflects the fact that, through the programme, many programme participants took their companies from preliminary start-up through to the early phases of scale-up.

As detailed in the Process Evaluation, the ISCF programme team itself has also acted as a focal point for convening and raising awareness of the sector, for example, through the organisation of the National Quantum Technology Showcase and the provision of the Quantum Directory.

The UK's QT sector compared to international comparators

Overall, while the UK demonstrates strong research intensity and strengths in quantum systems development, it hosts fewer QT companies than comparator countries such as Germany, France, and Canada. Germany hosts the largest extended quantum technology (QT) sector in Europe, with 1,128 companies identified across the supply chain. This aligns with its high research output, ranking just behind the US and China in QT-related publications. The UK, by contrast, hosts 513 companies - fewer than France (658) and Canada (689) - despite having higher academic publication volumes than both. This suggests that the UK QT sector may be more research-intensive, with a greater share of activity concentrated in R&D rather than downstream commercial deployment.

There appears to be some differences in the structure of the UK QT sector compared to the comparator countries – though it should be noted that data was not available for all companies in the sector in each country. The UK shows a relatively high proportion of QT systems developers (15% of known-position companies), exceeding the 7–10% seen in most comparator countries. This indicates UK strengths in system-level innovation and quantum computing. However, the UK lags in the number of companies developing quantum technology components (36% vs. 55% in Germany and 48% in France), suggesting weaker supply chain depth. In contrast, the Netherlands, Australia, and Canada have higher proportions of end-user companies (20–25%), suggesting a more advanced adoption of QT in these markets. The UK's lower end-user share (15%) and relatively small component base highlight areas for strategic development to build a more balanced and commercially mature QT ecosystem.

The strength of the collaboration and relationships between the UK's industrial and academic communities seems to be increasing. These trends are visible in the co-authorship patterns in academic publications. The rates of private sector collaboration in the UK have increased by 3.2% between the baseline period (2016-2019) and the evaluation period (2020-2023). The UK has also seen the largest increase in private-private co-authorship in academic publications amongst international comparators (3% increase) since the baseline period. As the ISCF QT publications account for less than 1% of the overall UK QT publications for the same period, the programme is not evidently having a direct impact on these figures. Instead, however, our evidence presented above does allow us to conclude that the ISCF QT contributed to increased engagement and collaboration between industry and academic partners, strengthening the UK QT ecosystem and networks, which in future will continue to support this progression. Notably, though, these trends are not unique to the UK but instead are common across other countries internationally. This therefore could also be a reflection of the increased engagement of industry with quantum technologies research and the spinning out of research.

Appendix A Quantum Supply Chain Categories Definitions

Table 29 Categories within the quantum technologies supply-chain

Position in supply-chain	Description	Examples
Underpinning technologies	Developers and suppliers of underpinning technologies and capabilities that underpin R&D in quantum technologies and underpin manufacturing/ production of quantum technologies	• Single-photon sources • Silicon waveguides • Synthetic diamond • Ion traps • Superconductors • Cryogenic technologies • Optical fibres • Lasers • Ultra-low vacuum technologies • Electron beam lithograph
Quantum-technology components	Developers, manufacturers and suppliers of quantum-technology-based components – that will be incorporated in larger systems that themselves might be classified as 'quantum' (e.g. quantum computers) or not (e.g. instrumentation and control systems using quantum sensors)	• Quantum random number generators • Miniature clocks • Quantum-based sensors • Quantum computing components (qubits, logic gates, read-outs and memory devices, etc)
Systems (using quantum technologies)	Developers and suppliers of systems (systems integrators) that incorporate quantum components. The system as a whole may be classified as 'quantum' or not Systems may be sold/used by customers as products or as services	• Quantum communications systems • Quantum key distribution systems • Quantum simulators and computers • Imaging systems • Measurement and control systems
End-users	Business and public agencies that deploy systems incorporating quantum technologies within their organisations to improve their productivity or enhance their own product offering (e.g. accelerating drug development, ensuring secure communications)	• Telecoms • Pharmaceuticals • Defence • Aerospace / Space • Energy • Finance • Construction • Oil and gas • Health

Source: Technopolis