External Report

Impact Evaluation of the Industrial Strategy Challenge Fund

Final impact evaluation report: annex

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Abbreviations

ATT	Average Treatment Effect on the Treated
CIA	Conditional Independence Assumption
CRL	Commercial readiness level
CRN	Company registration number
DOI	Digital object identifier
FTE	Full time equivalent
GVA	Gross value added
IFS	Innovation Funding Service
ISCF	Industrial Strategy Challenge Fund
MIDRI	Multi- and interdisciplinary research and innovation
MRL	Manufacturing readiness level
PCF	Project closure form
PSM	Propensity Score Matching
RTO	Research and technology organisation
SIC	Standard Industrial Classification
SME	Small and medium enterprises
TRL	Technology readiness level
UKRI	UK Research and Innovation
VfM	Value for money

Annex A. Impact evaluation methods

A.1 Review of Challenge-level impact evaluation reports

Challenge-level impact reports were reviewed and thematically coded against the evaluation framework presented in Annex B in two stages: interim and final. At the interim stage, a total of 16 interim impact reports and four final impact evaluation reports were evaluated, while at the final stage, 13 final impact evaluation reports and seven interim reports were evaluated. The evaluation team developed a codebook with a list of 19 impact subcategories mapped against the six evaluation framework themes. Each impact subcategory consists of multiple 'codes', which are a combination of keywords and lead and lag indicators. Where relevant, comparisons were drawn between 'baselines' established at the Challenge level at the interim stage of evaluation and new or emergent indices at the final stage of impact evaluation reporting. In so doing, progress towards impacts – as codified by impact indicators – could be assessed between the interim and final stages of the evaluations.

We used MaxQDA qualitative data analysis software to code the Challenge-level reports against the codebook. Analysis of the coded material enabled the team to identify a range of evidence across the Fund, with varying levels of progress seen against the impact subcategories. The approach identified areas of common progress as well as areas of variation, where a handful of Challenges had led the way in realising impacts. Evidence in the Challenge-level evaluation reports was supplemented with Fund-level data from the Portfolio Performance Reports (quarterly) and the Delphi dataset. However, an important caveat for this analysis is that it is based only on completed responses from Challenge awardees and some responses are likely missing; therefore, many Fund-level figures are likely underestimated.

A.2 Clustering approach for impact synthesis

The aim of the impact evaluation was to conduct a Fund-level assessment of impact across the ISCF. However, when we were conducting the synthesis and analysis, it was also apparent that certain impact subcategories were more relevant to a specific group of Challenges, for instance health impacts or net-zero/environmental impact. Therefore, the team reviewed the impact subcategories and associated indicators through a cluster lens, grouping similar Challenges together in order to draw out key findings and themes across these groupings. To group the Challenges into clusters, the study team conducted an internal mapping exercise whereby evaluation indicators across all the Challenges, as well as their objectives, were compared to identify where there was significant overlap. The mapping was subsequently presented at an internal RAND and Frontier

Economics workshop, to arrive at intuitive groupings for the Challenges supported by the objectives of the Challenges.

The workshop comprised two interactive activities. In the first, the Challenges were grouped based on the original Grand Challenge rubric, as a potential framework for consideration in the exercise. Referring to the objectives/scope of the Challenges and the preliminary network analysis, participants considered where else a given Challenge could fit within the Grand Challenge clustering and/or whether new clusters could be added. The key aims of this first exercise were:

- To consider possible refinements to the Grand Challenge framework as a clustering of the Challenges from a conceptual perspective.
- To consider potential spillovers where Challenges grouped into one cluster may also have impacts on other clusters.

This discussion identified specific areas of impact of particular importance to a given grouping of Challenges and fed into the second activity.

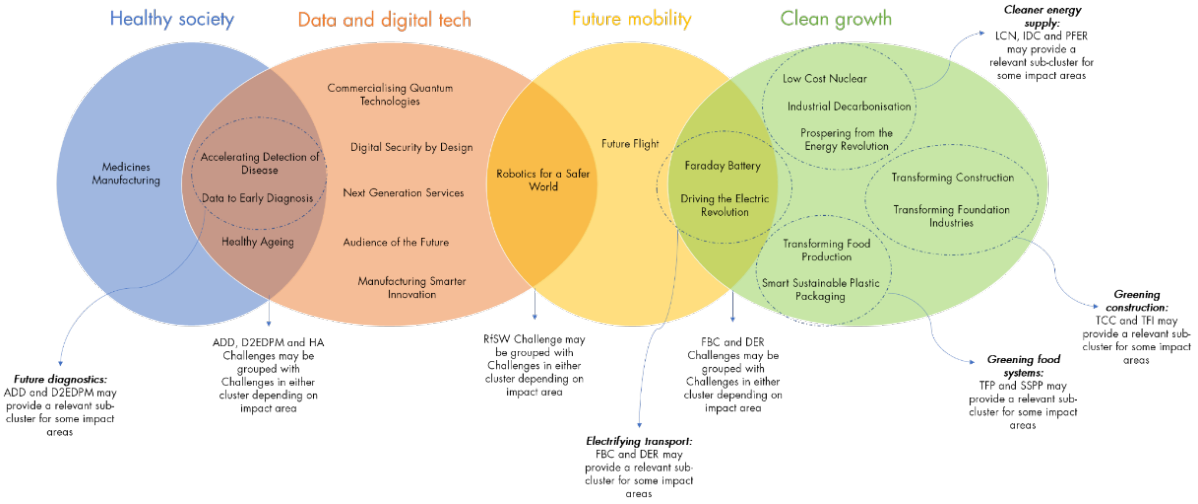
In the second activity, participants were presented with a series of summary heatmaps (from the mapping exercise) to illustrate the consistency of metrics being collected across clusters using the Grand Challenge framework as a 'straw man'. Each summary heatmap presented an assessment of metric consistency for a specific area of the Fund-level impact evaluation framework, e.g. 'networks and collaboration'. For each heatmap, the following key questions were considered during the activity:

- Based on the summary assessment, is it likely that the Grand Challenge clusters will help tell a story of the ISCF's impact in this specific impact area?
- Does the summary assessment suggest that a more aggregate Fund-level analysis would be more appropriate for this impact area, rather than a clustering approach?

The workshop clarified which Challenges naturally aligned more based on objectives and/or metrics being collected across impact subcategories and how Challenges could be appropriately grouped. The outcomes of the exercise revealed clusters that broadly mirrored the Grand Challenges, with some modifications based on the 'ground up' mapping of indicators exercise.

The results of the exercises were shared with UKRI and the ISCF Evaluation Steering Group for sign-off via an internal memo followed by a presentation. The clusters were intended to help aggregate findings, where appropriate, beyond the level of individual Challenges to enable synthesis of generalisable comments on progress (or lack thereof) made by the ISCF across sectors and at the Fund level. They have been used as such throughout the interim impact report.

Figure 1. Alignment of Challenges to various industrial clusters



A.3 Validation workshops with ISCF stakeholders

To validate emerging findings from the Fund-level evaluation, we conducted a workshop with Fund stakeholders, including Challenge directors, Challenge evaluation managers, individuals from Innovate UK, project awardees and industry representatives (n=50). This workshop was conducted as the final analysis step prior to submission of the ISCF interim impact evaluation report. Attendees provided feedback on the findings, and this was used to refine and nuance the analysis presented in the report.

A.4 Survey

A survey was designed to collect the views of representatives from two main stakeholder groups: current or former ISCF stakeholders involved in running the Fund (e.g. Challenge director, PMO or Governance) and industry, government and other external representatives. Different survey protocols were prepared for each stakeholder group to reflect their different experiences, priorities and relationships in relation to the activities of the ISCF. Nine ISCF representatives and nine industry, government and third sector representatives responded to the survey. Among ISCF representative respondents, 56% were Challenge Directors or Deputy Challenge Directors, and 44% had other roles. Of the latter group, 40% were government representatives, 30% were industry representatives, and 30% other stakeholder groups. Survey responses were collected between 14 August 2024 and 30 November 2024.

Survey recipients were asked:

- Whether the Fund has achieved its impacts
- If it has, to what extent

- The mechanisms that have or have not enabled this
- Anticipated long-term impacts.

The survey also inquired about impacts across the five themes of the evaluation framework. The focus of the survey for ISCF stakeholders was on impacts and mechanisms at the Fund and sectoral level, to complement findings from the Challenge-level evaluations.

A.5 Interviews

Interviews were conducted with relevant industry sector representatives, with awareness of ISCF, to contribute to the assessment of the extent to which the ISCF has achieved its impacts and the mechanisms that enabled or hindered these impacts. The interviews focused on the impact of the ISCF on collaboration across sectors and organisations, technological impacts, and impacts on investment and growth. The interviews also aimed to gather evidence on specific outcomes and impacts at the sectoral level, regional differences, and early signs of long-term benefits. Overall, the interview process aimed to address outstanding gaps in evidence for impact within the impact sub-categories. Seven interviews were conducted in total, in February and March 2025.

The Interview protocol is provided in Annex C.

A.6 Overton analysis

Analysis of policy documents associated with ISCF publications was conducted using the Overton Library. Overton uses open scholarly publication metadata provided by Microsoft Academic, OpenAlex and Crossref. Overton defines policy as documents 'written primarily for or by policymakers that are published by a policy focused source'.[1] An article search was conducted for publications (DOIs) linked to ISCF awards in the Overton index. Some 3,609 DOIs were identified, of which 333 (9%) were subsequently cited in policy publications.

A.7 Project closure forms

899 PCFs were submitted to UKRI at the conclusion of the project reporting period (final responses to PCF forms were provided in 2021). PCFs reported on project outputs and outcomes including new products, processes, services, IP, innovation, employment and skills, collaboration and networks, and economic impact. PCF data also covered future plans, project management and finances. Collated PCF data from UKRI was mapped to the impact sub-themes and codes to

[1] Overton. 2024. 'What's your definition of a policy document?'. As of 1 October 2025: https://help.overton.io/article/whats-your-definition-of-a-policy-document/

validate information from Challenge- to Fund-level aggregation. This was done for 16 relevant questions, as described in Annex E.

A.8 Network analysis

We analysed organisations involved in the ISCF to map interactions (or 'connections') between them using data from Delphi and Innovate UK Business Connect (BC). Connections between organisations were traced through their patterns of involvement in ISCF-funded projects as well as attendance at events organised by the Fund or its Challenges. Network analysis helped to generate insights on collaborative ecosystems within the ISCF at two levels: as connections between organisations and between Challenges. An in-depth discussion of the methods used can be found in Annex F.

A.9 Econometric analysis

We employed a Propensity Score Matching (PSM) model to assess the effect of the ISCF on participating organisations' ability to secure external fundraising events and raise capital. The PSM Model was used to compare Fund participants (i.e. those who successfully applied to project funding) with other applicants who were never successful in securing ISCF funding. By matching organisations with similar characteristics such as firm age, number of employees and prior participation in an innovation accelerator, comparable control groups were created to isolate the impact of ISCF participation on business investment outcomes. An 'analytical dataset' for the model was constructed by linking data from Delphi, the Innovation Funding Service and Beauhurst. An in-depth methodological discussion of the PSM model can be found in Annex G.

Annex B. Codebooks

This section contains the codebooks used for the evaluation of the Challenge reports. The evaluation framework comprises six high-level evaluation themes and 20 impact subcategories. Of these, two impact subcategories (i.e., Value for money and Fund-level econometrics) will be assessed in the 2026-27. In this phase, data sources and indicators were mapped to five evaluation themes' impact subcategories, as described below.

Evaluation Theme 1: Creating knowledge

Impact sub-category	Parent code	Sub-code	Indicators and evidence
1.1 Innovation	1.1.1 Advancing the development of products, processes, services	1. IP metrics/examples of IP	Patents and IP (numbers of IP produced, etc); Status of patents/IP submitted/applied for? Expected? Published? Any reference to ISCF as enabler or barrier
		2. TRLs, CRLs, MRLs of projects/project assets	TRLs, CRLs and MRLs; Average TRL reached across projects; Average increase in TRL; Starting TRLs TRL progression of unsuccessful applicants (or other counterfactuals)
		3. Examples of new/ improved products, technologies, services and processes	
	1.1.2 Implementation and adoption of ISCF outputs in society	1. Implementation and adoption of ISCF Technologies	Make a note if they were used in other sectors
		2. Implementation and adoption of ISCF products	

Impact sub-category	Parent code	Sub-code	Indicators and evidence
		3. Implementation and adoption of ISCF processes, services or approaches	Barriers to implementation and adoption
1.2 Knowledge creation	1.2.1. Knowledge contribution	1. Publication outputs	Quantity and quality of outputs
		2. Other knowledge outputs	Include outputs like datasets, etc. Metric not to be confused with innovation outputs (1.1.1)
1.3 Stakeholder and public awareness and understanding	1.3.1 Awareness and understanding of new ISCF technology and outputs	1. Awareness among industry/ business stakeholders	Evidence of awareness and understanding of new ISCF technology and outputs amongst different stakeholders Evidence of knowledge exchange activities and other mechanisms to facilitate increased awareness and understanding ISCF barriers/enablers of engagement
		2. Awareness among academic stakeholders	
		3. Awareness among wider public	
1.4 Engagement with policymakers and informing policy	1.4.1 Policy contributions and perceptions	1. Engagement activities with policymakers and regulators	Events with government stakeholders? Examples of policy reports, grey literature Engagement outside UK Was ISCF an enabler or barrier?
		2. Outcomes or examples of evidence informing policy	Citations and mentions by government policy documents and policymakers

Impact sub-category	Parent code	Sub-code	Indicators and evidence
		3. Perceptions of sector/stakeholders on influence of challenge on policy	
1.5 Learning on mission-oriented R&I	1.5.1 Mission-orientated R&I and goals	1. Enhancing understanding M-O R&I	
1.6 Process to impact	1.6.1 Process to impact	1. Processes to enable impact	
		2. Processes to hamper impact	

Evaluation Theme 2: Capacity

Impact sub-category	Parent code	Sub-code	Indicators and evidence
2.1 Investment	2.1.1 Private investment in R&D		Examples of private investment within Challenge areas, and matched funding Note mentions of investments contributing to the 2.4% GDP R&D target by 2027, including how they measured this contribution
	2.1.2 International investment		Examples of overseas investment Barriers/enablers Links to 1.1.2.3
	2.1.3 Public R&D investment in ISCF Challenges/ Challenge areas		Includes the ISCF investments themselves and any further public investments leveraged (UK or international) Note mentions of investments contributing to the 2.4% GDP R&D target by 2027
	2.1.4 New avenues of investment	1. Examples of new avenues of investment	New funders, new markets, etc.
		2. Mechanisms	Mechanisms (including, e.g., de-risking) for generating new avenues of investment
	2.1.5 Other investment impacts		Evidence relating to investment that is not R&D investment (e.g. plant and machinery)
2.2 Geographic distribution of	2.2.1 Geographic distribution of investments and activities	1. Distribution of investment	Geographic distribution of investments and activities
		2. Distribution of activity	

Impact sub-category	Parent code	Sub-code	Indicators and evidence
investment/ activities			
2.3 Capacity – individual (skills, training) and infrastructural	2.3.1 ISCF impact on individual capabilities and capacity in R&I	1. Impact on individual research capabilities	Training activities, placements, skills development
		2. Mechanisms	
	2.3.2 Non-UK talent and challenge-associated skills attracted		Examples of non-UK talent and challenge-associated skills attracted Mechanisms
	2.3.3 Improvements to infrastructure	1. R&D infrastructure	Examples of R&D infrastructure such as laboratories, facilities, equipment
		2. Mechanisms	
2.4 Diversity	2.4.1 EDI	1. EDI activities and outputs	Examples of specific actions and activities led or supported by Challenges with an EDI focus (could include, e.g., measures of the diversity of participants)
		2. EDI effectiveness	Examples of the outcomes and impacts of these, or broader impacts relating to ED&I that the Challenge would claim some attribution for
2.5 Employment, job creation and spinouts	2.5.1 Business and job creation/ retention	1. Creation or retention of jobs	Quantitative evidence on jobs created or retained
		2. Nature of jobs created or retained	Quantitative or qualitative evidence on the nature of jobs created including skills, education

Impact sub-category	Parent code	Sub-code	Indicators and evidence
			needs, wages, productivity measures, etc.
		3. Creation of new enterprises and spinouts	
		4. Retention of businesses	Focus on business retention in UK or helping viable businesses to survive

Evaluation Theme 3: Connected innovation system

Impact sub-category	Parent code	Sub-code	Indicators and evidence
3.1 Collaboration and partnership	3.1.1 Collaboration and outputs between businesses	1. Collaboration activity/ mechanism	Metrics regarding diversity of businesses among participants not matched to this question
		2. Outputs	Publications, patents, networking events. Overlap with 1.1.1.1
		3. Number of new partnerships	
	3.1.2 Collaboration and outputs between businesses and academia	1. Collaboration activity/ mechanism	Metrics on *joint* publications matched to this question. Overlap with 1.2.1
		2. Outputs	Include publications, patents, networking events Overlaps with 1.1.1.1 and 1.2.1
		3. Number of new partnerships	
	3.1.3 MIDRI research around the Challenge areas		Examples of MIDRI research within Challenge areas
	3.1.4 Collaboration between Challenges		

Impact sub-category	Parent code	Sub-code	Indicators and evidence
3.2 Recognition and prestige	3.2.1 Recognition of ISCF Challenge institutions and clusters in the UK and internationally	1. Recognition in the UK	
		2. International recognition	

Evaluation Theme 4: Economic impact

Impact sub-category	Evaluation question	Parent code	Sub-code	Indicators and evidence
4.1 Economic impacts (turnover, GVA, productivity)	To what extent have the ISCF Challenges supported the growth of UK businesses and created new markets, or enabled increase of UK's share in global market in their respective sector?	4.1.1 Economic impact	1. Turnover	Evidence relating to turnover or sales
			2. Exports and global markets	Evidence relating to exports/sales overseas (could include potential to export as well as realised exports) Evidence of increased UK share of a global market
			3. Sectoral growth	Evidence that ISCF is helping to grow a wider sector/industry as well as benefitting individual firms
			4. New markets	Evidence that ISCF is helping expand into new geographic and/or product markets
			5. Other evidence of economic impacts	Evidence not easily categorised above Overlap with 2.5.1
	What has been the increase in gross value added (including the creation of new products and	4.1.2 GVA and new products/ services	1. GVA increase	Evidence capturing estimated impacts on GVA (including profits if captured separately). Counterfactuals

Impact sub-category	Evaluation question	Parent code	Sub-code	Indicators and evidence
	services in relevant sectors and/or the creation of new markets)?			How GVA was measured
			2. New products and services created	Evidence of new products and services brought to market or fully commercialised
	What has been the productivity change (capital, labour or combined)?	4.1.3 Productivity change		Explicit mention of productivity and/or where GVA is assessed on per capita/per unit basis This can include impacts on supported organisations as well as wider evidence of productivity spillovers (e.g. sectoral, regional or national productivity impacts) The measure of productivity as well as the impact e.g. (TFP, output per worker, output per hour, turnover per worker)
4.2 Geographic distribution of investment impacts	While the ISCF is place-agnostic, to what extent have the economic impacts of the ISCF been widely	4.2.1 Geographic distribution		Geographic distribution of the economic impact of the ISCF across the UK

Impact sub-category	Evaluation question	Parent code	Sub-code	Indicators and evidence
	distributed across the UK?			

Evaluation Theme 5: Wider societal impact

Impact sub-category	Parent code	Sub-code	Indicators and evidence
5.1 Impacts on health	5.1.1 ISCF impacts – health and wellbeing	1. Impact on quality of life	
		2. Impact on life expectancy	
		3. Impact on health inequalities	
		4. Impact on healthcare costs	
5.2 Impacts on the environment	5.2.1 ISCF impacts – environmental and sustainability	1. Impact on emissions/net zero	
		2. Circular economy	
		3. Impact on energy consumption	
		4. Impact on environmental policy	Overlap with 1.4.1
5.3 Impacts on infrastructure and services	5.3.1 ISCF impact – infrastructure and services	1. Improved infrastructure	
		2. Accessibility	
		3. Resilience	
		4. Safety	
5.4 Wider impacts	5.4.1 ISCF's wider societal impacts	1. Wider societal benefits	Evidence of culture change, behaviour change

		2. Unexpected or unintended consequences	Examples of programmes leading to unintended *negative or positive* benefits

Annex C. ISCF interview guide

Background for the interviewee

Thank you so much for agreeing to take part in this interview. The interview is part of an independent impact evaluation of the ISCF, commissioned by UKRI and conducted by RAND Europe and Frontier Economics. As an external industry/academic stakeholder, your views and experiences are essential to help assess the extent to which the ISCF has achieved its impact and the mechanisms that have enabled or hindered it. Today's discussion will cover the ISCF's impact across collaboration, investment and growth.

Consent

1. We will use the feedback you provide, together with any additional information you choose to disclose, for the project only.

2. While the outputs gathered from the interviews will be anonymised in our analysis, given the nature of the interview sampling in the project, complete anonymity may not be possible.

3. We expect to publish the analysis from this work, which will include analysis of information from these interviews alongside other data (from our desk research).

4. We would like to audio record the discussion to help us accurately collect findings for the research. The recordings will be securely stored and be accessible only to study team members. The interview recordings will be destroyed at the end of the study (by 31 May 2025).

Do you consent to be interviewed on this basis? Yes / no (please delete as required)

Questions and prompts:

1. Can you briefly describe your background, highlighting any ISCF Challenges that you may have been involved in or engaged with the outputs of?
2. In your view, did the ISCF encourage participants to collaborate with organisations from different sectors (e.g. from outside the health sector) or Challenges?
    a. Did the ISCF increase engagement between businesses, academics and other types of organisations?

Focusing on the ISCF's **technology, investment and economic impacts** for the next few questions:

3. To what extent has the ISCF facilitated the adoption of technological outputs in various sectors?

4. Based on your experience, did the ISCF create or increase platforms for businesses to engage with international investors?
    a. Prompt for enablers or barriers to international investment, contributing to the extent of the ISCF's impact
5. In your opinion, how has the ISCF contributed to attracting international skills or talent, if at all?

For the next few questions, we wish to learn more about specific **outcomes** generated from the ISCF that you may be aware of.

6. Are you aware of any notable policy influences and outcomes that the ISCF has impacted in your sector?
    a. Prompt to speak about if the Challenge influenced a particular policy/strategy [not just cited in policy documents, as this comes from Overton] and HOW?
7. Can you speak to any geographical balance or imbalances in the distribution of benefits generated from the ISCF, including how any benefits are spread across different regions of the UK?
8. Do you feel that the ISCF or specific Challenges you were involved in received broader recognition?
    a. Prompt to differentiate between international and national-level recognition
9. The Challenge aimed to generate long-term impacts in multiples sectors of health, environmental, societal. While it is too early to see evidence of this, are you aware of any early signs or factors that may hint towards its realisation in the future?
    a. Prompt on early indicators like generation of capacity or infrastructure and HOW they see that turning into longer term impact realisation.
    b. Prompt about other impacts not listed here (e.g. public perception)
10. Is there anything that you would like to add that we have not discussed?

Thank you for your time and participation. Please feel free to reach out to us if you have any further thoughts or questions.

Annex D. Overton analysis

3,609 journal article DOIs, linked to ISCF awards, were extracted from Dimensions and run through the Overton database. Of these, 333 (9%) were identified as articles that have been cited in policy. A list of documents citing the 333 ISCF articles identified was generated, providing a comprehensive list of policy documents from domestic and foreign sources, public, third sector and international organisations. Hits were categorised according to source headquarter country, type (blog post, clinical guidance, scholarly article, working paper, white paper, transcript, legislative document, periodical, and (all other types of) publication), source (government, think tank intergovernmental organisation, aggregators, or other), and where possible, cluster. 1449 unique policy documents citing ISCF DOIs were identified from sources across government, think tanks, NGOs, etc. This is a lower bound of the total number of times ISCF DOIs were cited, as single policy documents may cite multiple ISCF DOIs. Documents were associated with each cluster by matching a list of topics generated through Overton's automated topic identification with keywords and subjects collated from annual reports for each Challenge. The number of hits for each Challenge reflects the number of policy documents associated with the Overton topics matched to the corresponding Challenge. Some policy documents will be associated with Overton topics which are distinct across Challenges and so the total number of hits is larger than the number of policy documents. The search parameters used for each Challenge are recorded in Table 1.[2]

Table 1. Challenge-specific search parameters for Overton index

Challenge	Overton topics	Hits
Future of Mobility Cluster (FBC and DER content overlaps with Clean Growth)		
Faraday Battery Challenge (FBC)	Electric battery, Lithium-ion battery, Battery electric vehicle, Electric vehicle battery, Lithium iron phosphate battery, Rechargeable battery, Battery charger, Battery recycling, Battery Directive, Solid-state battery, Lead–acid battery, Lithium-ion manganese oxide battery, Battery electric bus, Battery pack, Lithium–sulfur battery, Lithium–air battery, Nickel–cadmium battery	149

[2] A large proportion of publications listed were on the topic of COVID, with 152 of 402 hits among UK sources alone directly relating to this topic and related search terms.

Challenge	Overton topics	Hits
Driving the Electric Revolution (DER)	Aerospace, Ancillary services, Battery charger, Battery Electric Vehicle, Battery pack, Battery storage power station, Cogeneration, Distributed Generation, Electric Bicycle, Electric bus, Electric Car, Electric generator, Electric heating, Electric motor, Electric Power, Electric power distribution, Electric power transmission, electric vehicle, electric vehicles, electrical grid, electricity, electricity generation , electrification, floating wind turbine, Fuel cell vehicle, Green vehicles, Grid energy storage, Hybrid electric vehicle, Hybrid vehicle, hydroelectricity, low-carbon electricity, mains-electricity, marine energy, off-the-grid, Offshore wind power, Plug-in electric vehicle, Power electronics, Power station, Precision agriculture, Pumped-storage hydroelectricity, Rail transport, Railway electrification, Railway electrification system, Separator(electricity), Smart charging, Smart grid, Smart meter, Tidal power, Vehicle-to-grid, Wind farm, Wind power, Wind turbine, Zero-emissions vehicle	280
Future Flight	Aerodrome, Aerospace, Aircraft, Airport, Airway management, Fixed-wing aircraft, Flight, Unmanned aerial vehicle	15
Clean Growth		
Smart Sustainable Plastic Packaging	Biodegradable plastic, Bioplastic, Microplastics, Packaging and labelling, Packaging waste, Plastic, Plastic pollution, Plastic recycling, Reusable packaging	47
Transforming Food Production	Food security, Food, Food system, Food industry Food loss and waste, Foodservice, Seafood, Sustainable food system, Food safety, Agrifood systems, Food and Agriculture Organization, Food and drink	62
Transforming Construction	Zero-energy building, Building insulation, Building engineering Building regulations in the United Kingdom, Green building, Building science, Building envelope, Building information modelling, Building material, Construction	77

Challenge	Overton topics	Hits
Industrial Decarbonisation	Alternative fuel, Aviation biofuel, Bioenergy, Bioenergy with Carbon Capture and Storage, Biofuel, Biomass, Carbon Capture and Storage, Carbon Capture and Utilization, Chemical industry, Energy industry, Green hydrogen, Green infrastructure, Hydrogen, Hydrogen economy, Hydrogen fuel, Hydrogen production, Hydrogen storage, Jet fuel, Low-carbon fuel standard, Net Zero emissions, pipeline transport, power station, Synthetic fuel	165
Prospering from the Energy Revolution	Air source heat pump, Charging station, Distributed generation, District heating, Electric energy consumption, Electric power distribution, Electrical grid, Energy demand management, Energy management, Energy system, Feed-in tariff, Grid energy storage, Ground source heat pump, Heat pump, Inductive charging, Microgrid, National Grid, Seasonal thermal energy storage, Smart charging, Smart city, Smart grid, Smart meter, Vehicle-to-grid	187
Low Cost Nuclear	Nuclear power, Nuclear power plant, Nuclear reactor, Small modular reactor	34
Transforming foundation Industries	cement, metals, glass, paper, ceramics, chemicals	72
Data and Digital		
Commercialising Quantum Technologies	"quantum technologies" or "quantum encryption" or "quantum sensor" or "quantum device" or "quantum key" or "atomic clock" or "quantum technology" or "quantum sector" or "quantum chip" or "quantum chips" or "quantum-enabled"	20
Digital Security by Design	Cloud computing security, Computer hardware, Computer security, Computer security exploits, Cyber-security-regulations, Cyberattack, Cybercrime, Cyberwarfare, Digital Security, IT security standards, Information security, Internet security awareness, Secure communication, Security technology	51

Challenge	Overton topics	Hits
Next Generation Services	"digital services"	98
Audience of the Future	virtual reality or "augmented reality" or "extended reality"	67
Made Smarter Innovation	"digital manufacturing"	8
Robotics for Artificial Intelligence and Extreme Environments	Robotics, Robot, Autonomous robot, Lethal autonomous weapon	28
Healthy Society		
Medicines Manufacturing	"medicines manufacturing" or "manufacturing medicine"	6
Data to Early Diagnosis and Precision Medicine	Diagnosis, Precision Medicine	122
Healthy Ageing	ageing, elderly care, end-of-life care life, life expectancy, life satisfaction, old age, quality of life, quality-adjusted life year, social care in England, social exclusion	72
Accelerating Detection of Disease	"early detection" or "early intervention" + "disease"	156

Annex E. PCF data analysis and supplementary findings

E.1 PCF data analysis

Project Closure Forms (PCFs) disclosed by UKRI provided data which was mapped to the impact sub-themes and codes to validate information from Challenge to Fund-level aggregation. This was done for 19 relevant questions identified in the PCFs, with the data presented in bar and column charts. As some questions required respondents to select multiple responses, not all sets of responses sum to 100%.

The following sections detail findings we have referred to but not covered in detail in the main text.

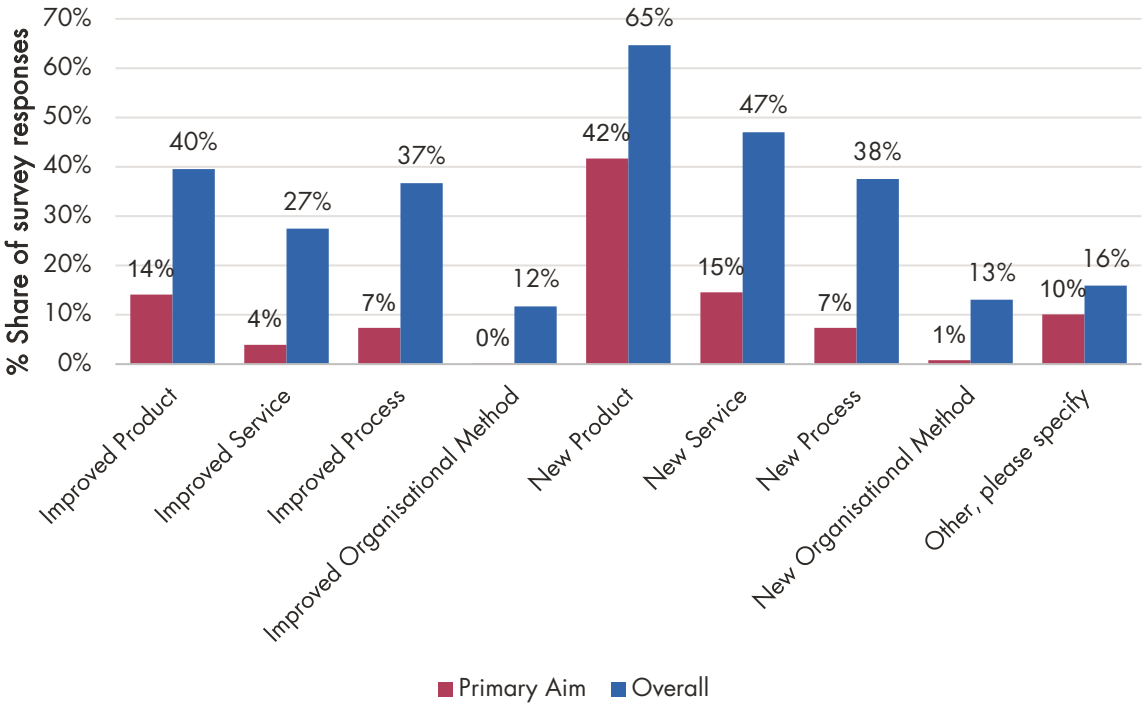
E.1.1. Innovation

Advancing the development of products, processes, services

Relevant Questions:

- Q20* – Please characterise the main type of innovation this project aimed to develop?
- Q22 – Please highlight any other types of innovation this project aimed to develop which are secondary to the main one?

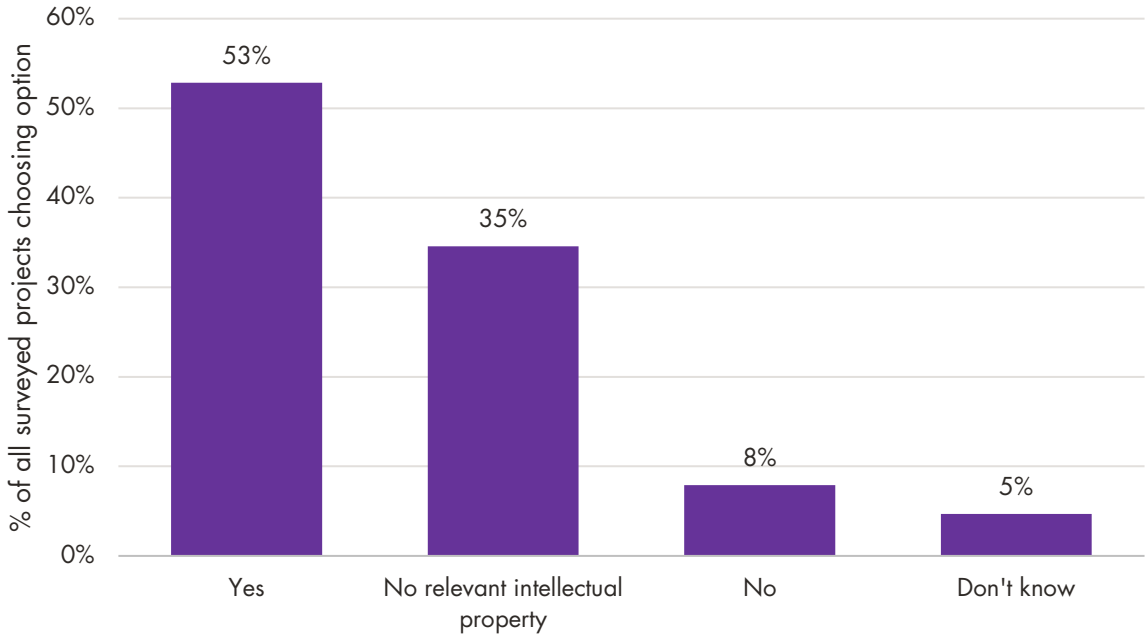
Figure 2. The share of organisations that chose a given type of innovation as either their primary innovation aim or listed as a primary or secondary innovation aim (Overall)



- Key Finding: **Creating a 'New Product' was the most popular type of innovation aim.** 65% of all respondents listed it as an innovation aim, whilst 42% of respondents specifically marked it as their primary innovation objective.
- Respondent characteristics: All 736 Non-Academic (Collaborator and Lead) organisations responded.
- Methodological approach and issues: 'Primary Aim' is a single choice answer and responses therefore sum to 100%. Respondents can choose multiple secondary innovation aims. The 'overall' category includes the innovation type being mentioned either as the primary objective or the secondary objective, so responses may sum to more than 100%.
- Methodological approach and issues: Each organisation was asked their time-bound expectations for introducing new products, new services and new processes. These expectations were single-choice and therefore sum to 100% across each of the three categories.

Relevant Question: Q31* – Did your organisation have the rights to use any required IP for this project?

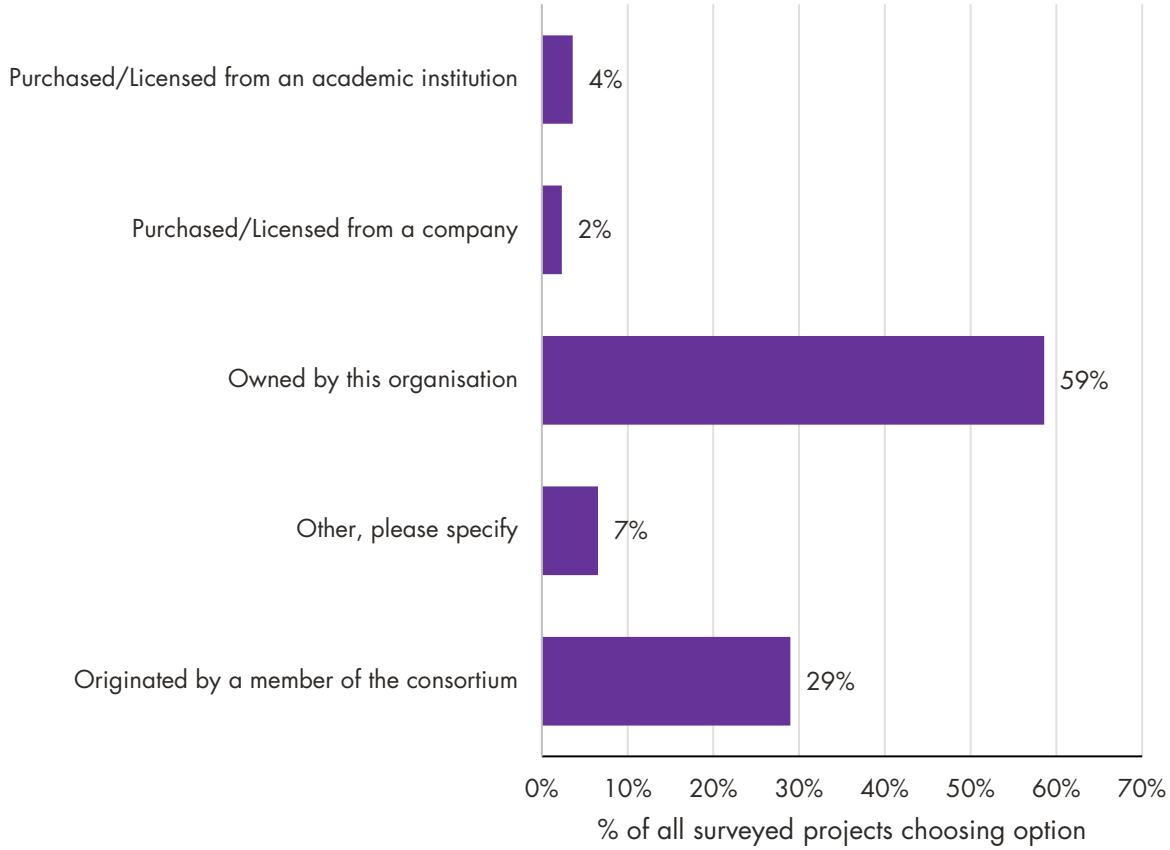
Figure 3. The share of respondents who had rights to use required IP



- Key Finding: The majority of respondents (53%) had the rights to use any required IP. However just over one-third of respondents (35%) said there was no relevant IP. Excluding those for whom there was no relevant IP, 81% of respondents said they had the rights to use required IP, 12% said they did not and 7% did not know.
- Respondent characteristics: All 899 (Academic, Collaborator and Lead) organisations were asked.
- Methodological approach and issues: Organisations had a singular choice for this question and therefore options sum up to 100%.

Relevant Question: Q32 – Where did this IP originate? - Selected Choice

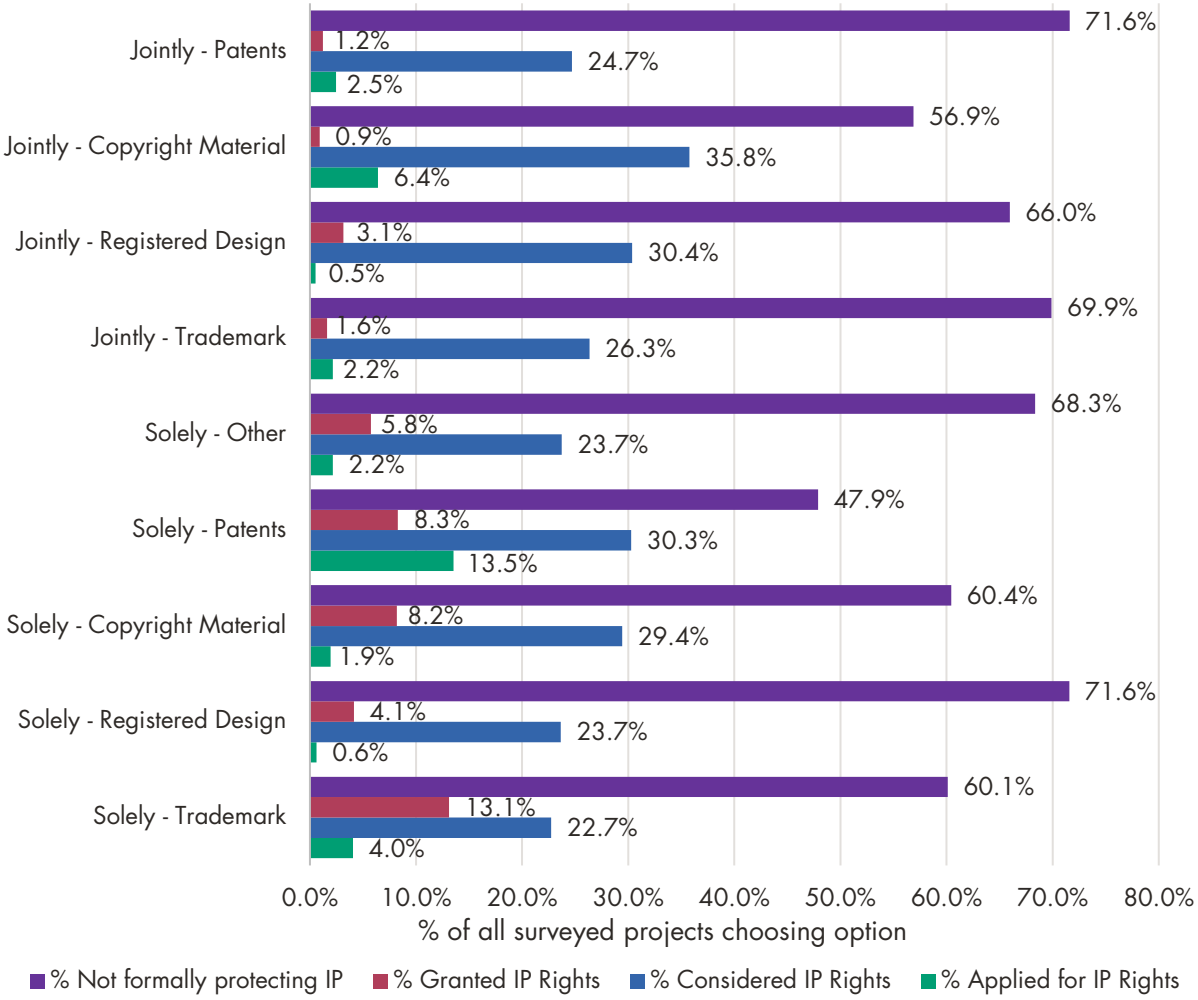
Figure 4. The IP origination point amongst respondents who had rights to use the required IP



- Key Finding: **59% of IP-user respondents cited that their IP origination point was being 'Owned by this organisation'**. 88% of respondents said the origin was within the consortium (own organisation or another member).
- Respondent characteristics: These answers are taken from the 475 respondents who responded 'Yes' to Question 31.
- Methodological approach and issues: Organisations had a singular choice for this question. However, two respondents who did answer 'Yes' in Question 31 left this Question (32) blank. The denominator remains 473, to sum to 100%.

Relevant Question: Q33 – What stage are you at regarding the protection of the IP used on this project and are you conside[ring]…

Figure 5. How organisations report their stage of IP protection, whether granted (red), considering (blue), applied for (green) or not formally protecting IP rights (purple) for each type of IP



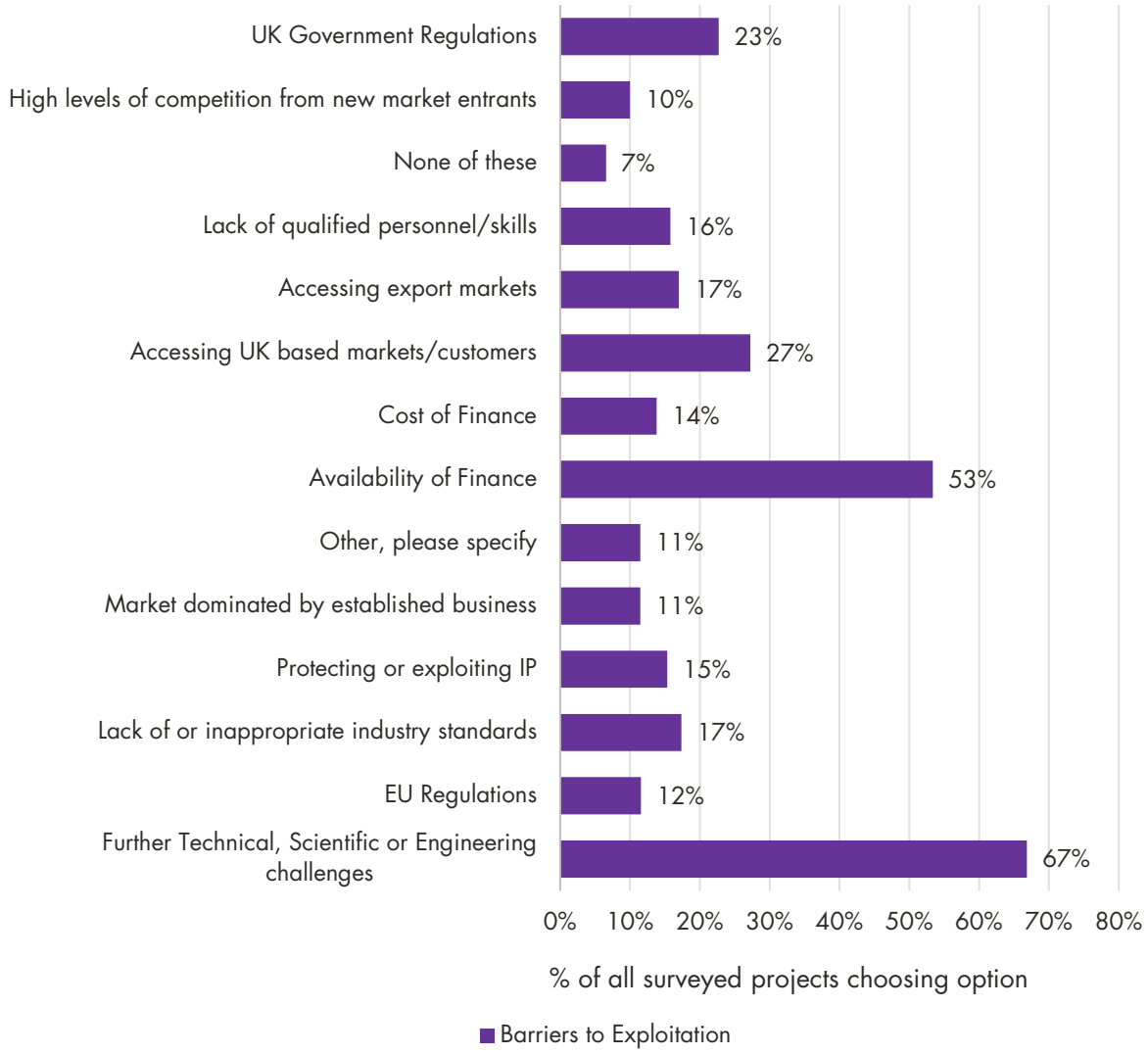
- Key Finding: Across all types of IP categorisations, the most common stage for organisations was 'Not formally protecting IP'. However, for sole patents, fewer than half of respondents (47.9%) chose this option, with more than 13% having applied, the highest for any IP category. Joint copyrights were most often considered, with more than a third of respondents (35.8%) saying they had considered IP rights. In terms of rights being granted, the most common was for a sole trademark (13.1%).
- Respondent characteristics: Each IP right had a singular choice answer, either Applied for IP Rights, Considered IP Rights, Granted IP Rights, and Not formally protecting IP. Answers therefore sum to 100% for each right.

- Methodological approach and issues: Organisations could respond to as many types of IP protection as relevant.

E.1.2. Implementation and adoption of ISCF technologies

Relevant Question: Q48 – What barriers to exploitation remain? Please tick all that apply

Figure 6. The percentage of respondents who found barriers of various types to exploitation



- Key Finding: The two biggest forms of barriers that remain are 'Further Technical, Scientific or Engineering challenges' and 'Availability of Finance', with respectively 67% and 53% of respondents choosing these options.

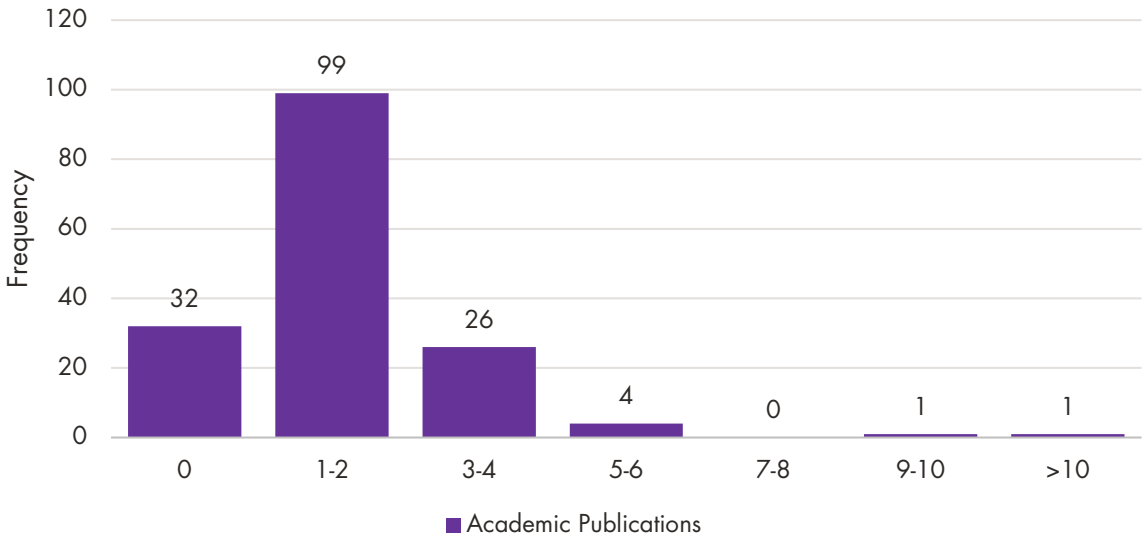
- Respondent characteristics: All 899 (Academic, Collaborator and Lead) organisations were asked.
- Methodological approach and issues: Organisations could tick more than one category, meaning that options sum to more than 100%.

E.1.3. Knowledge creation

Relevant Question:

- Q35 – How many new academic publications have been developed as a result of participation in this project? (Planned)

Figure 7. How many Academics cited a certain number or range of academic publications they planned to produce as a result of participation in their project



- Key Finding: One to two planned academic publications was the most common response by Academics, with 99 citing their intentions to produce a publication as a result of participation in their project.
- Respondent characteristics: All 163 Academic organisations responded.
- Methodological approach and issues: There were some errors in the formatting of the raw data provided in the PCF table. These edits included the following:
    - '01-Feb' we interpreted as 1–2 instead.
    - '2 journal publications' we listed as 2.
    - 'We plan to publish a journal paper reporting the research element of this and the previous Innovate UK funded project, based upon the two conference papers listed below.' We listed as 1.

E.1.4. Employment, job creation and spin-outs (2.5)

Relevant Information:

- Created FTE: FTE Created during the project; FTE expected to be created in 5 years
- Retained FTE: FTE Retained during the project; FTE expected to be retained in 5 years

Figure 8. How frequently organisations cited creating a certain number or range of FTE during the project

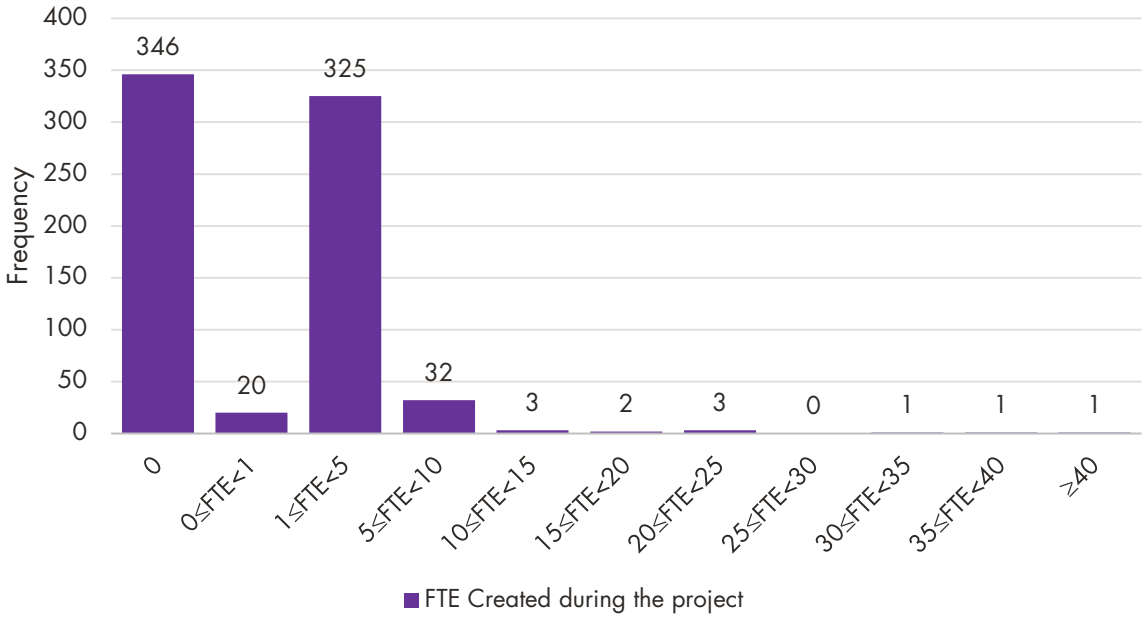


Figure 9. How frequently organisations cited an expected number or range of FTE they will create within 5 years

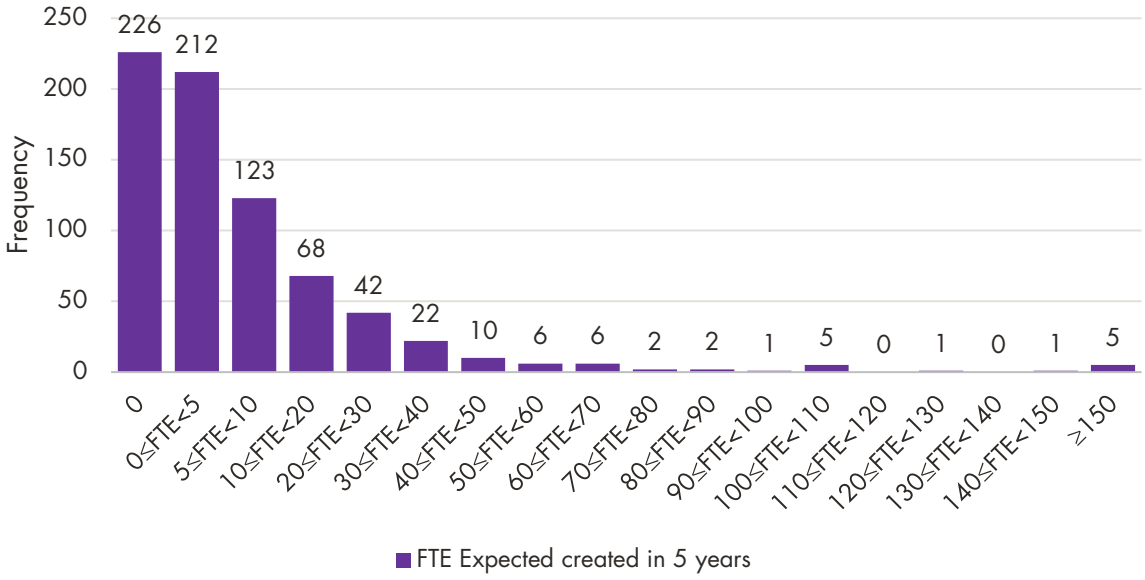


Figure 10. How frequently organisations cited retaining a certain number or range of FTE during the project

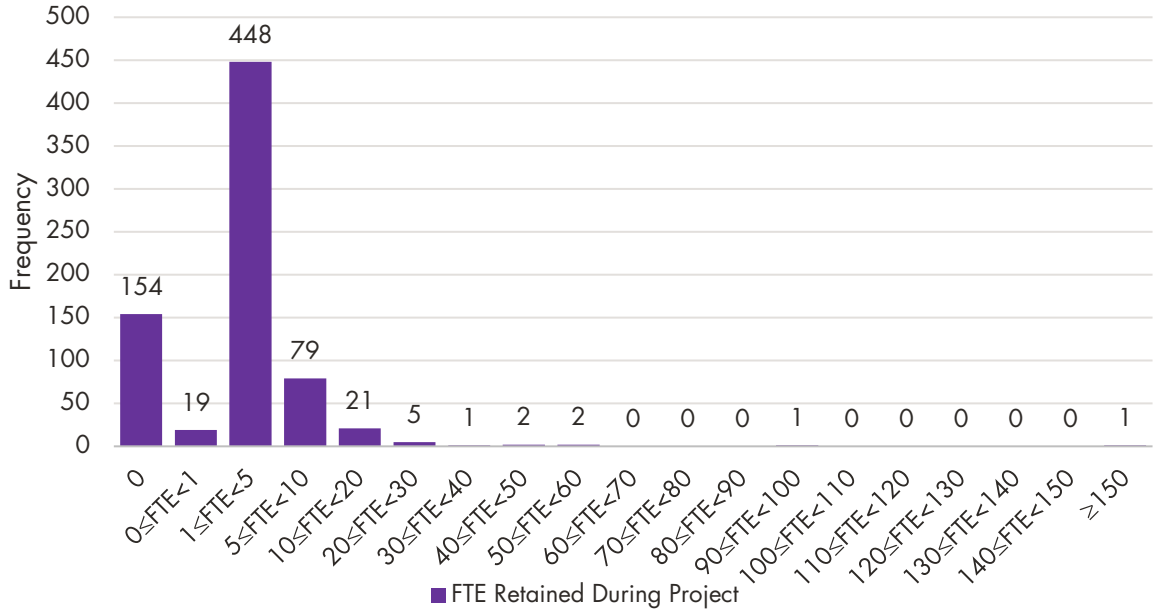
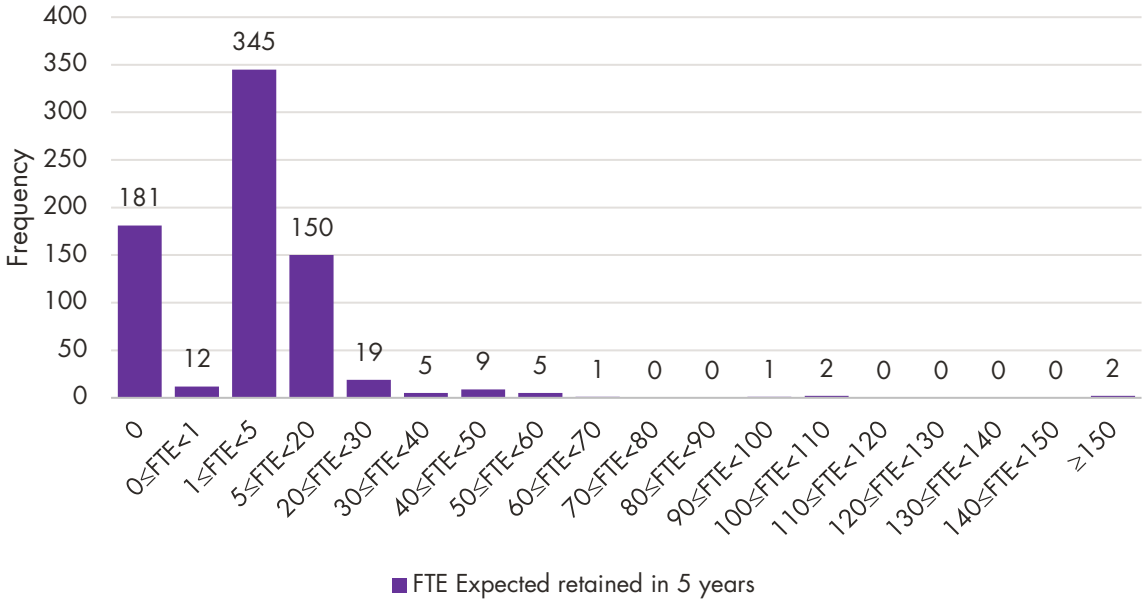


Figure 11. How frequently organisations cited an expected number or range of FTE they will retain within 5 years



- Key Finding: Almost half of respondents (346 of 734 valid responses, 47%) said no jobs had been created during the project. However, only 31% of respondents (226 of 732) expected to create no jobs within five years. It was much more common for respondents to report jobs retained during the project, with only 154 (21%) of respondents saying no jobs were retained during the project, whereas 448 (61%) reported retaining 1–5 FTE jobs.

- Respondent characteristics: All 736 Non-Academic (Collaborator and Lead) organisations were asked.
- Methodological approach and issues:
    - Figure 8: Two respondents left their responses blank, so the sum is 734 responses. The data required cleaning which included:
        - Changing '-' to 0.
        - Changing '2 (as contract labour)' to 2
        - Changing any type of 'n/a' to 0
        - Changing 'none specific to project' to 0.
    - Figure 9: Two respondents left their responses blank, whilst two responses were either '?' or 'not known' giving a sum of 732 responses. The data required cleaning which included:
        - Changing any type of 'n/a' to 0
        - Changing '1 plus' to '>1'
        - Changing '-' to 0.
    - Figure 10: Two respondents left their responses blank, whilst one response was 'not known' giving a sum of 733 responses. The data required cleaning which included:
        - Changing '0,5' to 0.5
        - Changing any type of 'n/a' to 0
        - Changing 'none specific to project' to 0
        - Changing '1.5 (contractor roles)' to 1.5
        - Changing '40 (100%)' to 40
    - Figure 11: Two respondents left their responses blank, whilst two responses were either '?' or 'not known' giving a sum of 732 responses. The data required cleaning which included:
        - Changing any type of 'n/a' to 0
        - Changing 'none specific to project' to 0
        - Changing '0,5' to 0.5
        - Changing '0.5 (contractor roles)' to 0.5
        - Changing '40 (100%)' to 40

- Changing '5 to 20' to 5–20
- Changing '-' to 0.

E.1.5. Collaboration and partnership (3.1)

Relevant Questions:

- Q28 – Have you worked with any of the following on current project (excluding consortium members)? And have you worked with them previously?
- Q29 – For those you worked with on the current project, do you expect to continue working with these organisations in the future?

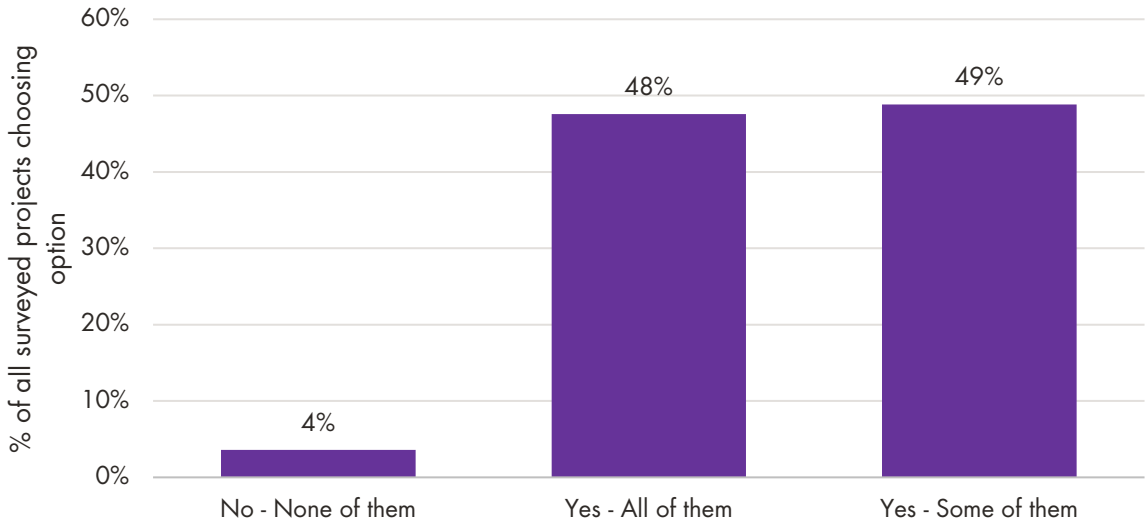
Table 2. The share of respondents which have either currently, previously, or never collaborated with each possible collaborator category included in the question

Collaborator	Current project and previously	Current project but not previously	Total, current project	Ever worked with previously	Never worked with (on current project or previously)
Knowledge Transfer Network (KTN)	6%	10%	16%	50%	40%
Competitors	5%	7%	12%	44%	49%
Investors	5%	11%	16%	42%	48%
Devolved Administrations (Northern Ireland, Scotland, Wales)	0%	0%	0%	21%	79%
Other	5%	8%	14%	6%	86%
Enterprise Europe Network (EEN)	1%	3%	3%	21%	76%

Collaborator	Current project and previously	Current project but not previously	Total, current project	Ever worked with previously	Never worked with (on current project or previously)
Catapults	6%	11%	17%	43%	46%
Innovation and Knowledge Centres (IKCs)	0%	1%	2%	16%	83%
Research and Technical Organisations (RTOs)	6%	9%	15%	42%	49%
UKTI	1%	3%	3%	31%	66%
Design Council	0%	1%	1%	8%	91%
Growth Hubs or LEPs	2%	3%	5%	31%	66%
Universities	21%	23%	43%	67%	11%

Note: The 'total, current project' column may not sum to the total of the preceding two columns because of rounding. In theory, 'current project but not previously', 'ever previously' and 'never' should sum to 100%. However, in a small number of cases respondents reported they had both previously and never worked with a collaborator type, so these totals sometimes exceed 100%.

Figure 12. The scale of expectations of continuing to work with collaborators after the current project



- Key Findings: Across all collaborator types asked about, universities were the most common partner reported on ISCF projects (43% of respondents) followed by Catapults (17%), investors (16%) and the Knowledge Transfer Network (now Innovate UK Business Connect, 16%).
- Of those reporting collaborating with universities on their project, there was a roughly even split between those who had collaborated with universities before and those who had not previously done so.
- More generally, ISCF funding appeared to support new types of collaborations. For all collaborator types, it was more common that respondents working with them on their ISCF project had not worked with that type of collaborator before.
- Collaborations supported by ISCF investments appear to be enduring. Only 4% of respondents said they had no plans to continue working with any of their ISCF collaborative partners in future.
- Respondent characteristics: All 899 (Academic, Collaborator and Lead) organisations were asked.
- Methodological approach and issues:
    - Table 2:
        - Respondents were asked about their engagement with each possible collaborator type. There was also a catch all 'none of them' option.

- For those who selected 'None of them – never', we interpreted this as equivalent to answering 'never' with each collaborator type where the respondent had not indicated any response for a given type.
- For those who selected 'None of them – never' who nevertheless gave a different response for a particular collaborator type (e.g. indicated that they were currently collaborating with Catapults), we took the answer given for the individual type as correct and only filled in 'never' where no response had been given for that type.
- Where the respondent did not provide a valid response to 'None of them – never', we took any missing response for individual collaborators as a non-response to that question.
- Percentages are shown based on the valid number of people providing a response to each collaborator type. As it was possible for respondents to be collaborating currently and previously, responses can sum to more than 100% within each row.

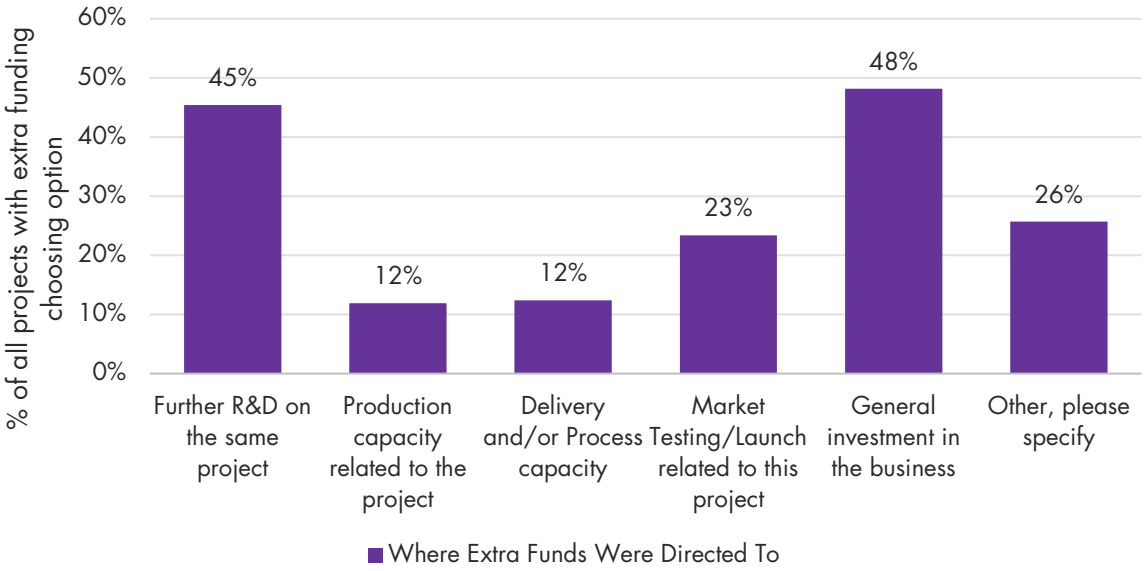
- Figure 12:
  - Organisations had a singular choice for this question. However, 35 respondents did not answer. The denominator therefore is 864, with options summing to 100%.

E.1.6. Investment

Relevant Questions:

- Q66_9* – As a result of your participation in this project, has your organisation been able to raise further funds, in addition to the match funding?
- Q68 – What was this further funding for?

Figure 13. The proportion of respondents who answered 'Yes' to Q66_9 (218 of 736 Non-Academic respondents, or 30%) who then went on to list what the funds were for



- Key Finding: 45% and 48% of respondents respectively identified 'Further R&D on the same project' and 'General investment in the business' as the two most popular uses of extra funding.
- Respondent characteristics: The sample size was 218 Non-Academics who replied 'Yes' to Q66_9. Organisations could identify multiple choices of where extra funds were directed to; therefore, answers do not sum to 100%.

Annex F. Network analysis and supplementary findings

This annex sets out the approach to and findings of the network analysis conducted as part of Phase 4 of the ISCF evaluation. This work extends the preliminary network analysis undertaken as part of Phase 2.

The network analysis forms part of the assessment of how the ISCF has helped to foster a connected innovation ecosystem, one of the key themes of this evaluation.

F.1 What is network analysis?

Network analysis (also known as 'social network analysis') is a quantitative assessment of the connections between things ('nodes') and draws insights from the structure of these links. The technique can be used, for example, to study the structure of friendships in social networks, co-authorship in academic research, or R&D collaboration between firms. Through visualisation of the network and statistics relating to the structure of connections, network analysis can help investigate how entities interact with each other.

Network analysis can provide useful metrics on issues such as:

- Which nodes are most 'well-connected', 'influential' or 'central' in the network?
- How 'clustered' or 'diverse' are the connections in the network?
- Does the network divide into smaller 'communities' or 'silos'?
- Are certain nodes particularly important in bridging communities together?

In the context of the ISCF, we have used network analysis to explore the connections between organisations engaging with the ISCF Challenges in two ways: through funded projects and through event attendance. Insights are thus provided into the patterns of collaboration between organisations involved with the ISCF.

In Phase 2, we conducted a preliminary network analysis. While this was included within the baseline report, the analysis at that time was not a true 'baseline' exercise as it was not possible to obtain data on the connections and collaborations between organisations engaged with the ISCF before the Fund was established.[3] Instead, the Phase 2 analysis represented an assessment of the patterns of collaboration supported by the ISCF based on data available relatively early in the delivery of the Fund. In the present study, the Phase 2 findings are compared with recent data to gain insights into how the ISCF collaboration ecosystem has evolved.

[3] Baseline (pre-ISCF) perspectives on collaboration were captured through the review of Challenge-level baseline reports and the workshops and are referenced elsewhere in the Phase 2 report.

F.2 Data used in the network analysis

The network analysis draws on two sources of data:

1. Delphi, an internal UKRI dataset recording details of funded projects.
2. Innovate UK Business Connect (BC) data on events organised by Challenges and attended by organisations.

We focus primarily on the Delphi data in assessing the ISCF collaborative ecosystem, as it represents formal collaborations between organisations through ISCF-funded projects and so captures realised collaborations enabled by the Fund. By contrast, the Innovate UK BC data captures mutual event attendance, which may reflect common areas of interest and therefore potential collaboration between organisations, but not necessarily realised collaborative activity.

These two data sources are described in more detail below. Neither data set captures informal collaborations between organisations that may have been supported by Challenges, such as smaller meetings or round tables not recorded in the Innovate UK BC data.

F.2.1 Delphi project data

Delphi provides a list of organisations, the projects they were involved with, the grant funding they received for each project, and the Challenge that the project was associated with. Delphi also records some information on the type and size of organisations (for example, academic or business; and small, medium or large).

Table 3 details, for each Challenge, the number of funded projects, total funding, and number of organisations engaged primarily with that Challenge.[4] Due to the different nature, aims and context of each Challenge, some Challenges funded considerably fewer projects, had lower total funding, or had few engagements with organisations. Low Cost Nuclear, for example, funded only two projects recorded in Delphi, with only five organisations primarily engaged with this Challenge, while Next Generation Services awarded only £21m in funding and only eight organisations were primarily involved in the Digital Security by Design Challenge). These differences impact the patterns of connectivity observed in the network analysis and it is therefore important to be mindful of them when interpreting the results of the network analysis.[5]

[4] An organisation is considered to have engaged 'primarily' with the Challenge that they received the most funding from through ISCF-funded projects. 'Accelerating Detection of Disease' did not involve funding of individual projects and so no projects are recorded in Delphi for this Challenge.

[5] Due to the nature of the network analysis, there is no direct way to normalise the analysis by the relative size of each Challenge. However, we do consider normalised statistics where relevant when comparing metrics across Challenges.

Table 3. Projects, funding and organisations by Challenge in the Delphi data

Challenge	No. projects	Total funding (£ million)	No. organisations engaged primarily with this Challenge
Healthy Ageing	229	79	79
Medicines Manufacturing	188	362	206
Robotics for a Safer World	159	126	121
Faraday Battery Challenge	143	609	150
Quantum Technologies	130	170	113
Transforming Food Production	111	70	157
Made Smarter Innovation	102	119	207
Audience of the Future	97	39	78
Driving the Electric Revolution	97	91	85
Digital Security by Design	92	79	8
Future Flight	92	116	167
Prospering From the Energy Revolution	89	91	154
Transforming Foundation Industries	89	110	114
Smart Sustainable Plastic Packaging	88	50	94
Transforming Construction	64	198	153
Data To Early Diagnosis and Precision Medicine	43	210	89
Next Generation Services	43	21	49
Industrial Decarbonisation	29	192	85
Low Cost Nuclear	2	228	5

Challenge	No. projects	Total funding (£ million)	No. organisations engaged primarily with this Challenge
Total	1,887	2,959[6]	2,114

Source: Frontier Economics analysis of Delphi data.

Note: An organisation is considered to have engaged primarily with the Challenge that they received the most funding from through ISCF-funded projects. The count of organisations is based on the final sample included in the network analysis; this excludes universities and organisations with no collaborative links. Accelerating Detection of Disease is not shown because this Challenge did not involve funding of individual projects.

Table 4 and Table 5 below show the split of organisations in the Delphi data by type and size. The majority of organisations in the Delphi data are businesses (1,849), with the next most common organisation types being universities and 'public sector, charity or non Je-S[7] registered research organisations'. The majority of organisations are classed as 'small' (1,080) but there are also many large organisations (622).

Table 4. Organisations in the Delphi data by type

[6] Besides ADD, this total excludes projects from non-Challenge associated programmes (Next Gen Aerospace, National Satellite Test Facility, and Self Driving Vehicles), as well as projects marked as Withdrawn in the Delphi dataset. Additionally, the Delphi Data extraction associated with this analysis dates to 14 October 2024, and so may not account for late grants between then and 1 June.

[7] Joint Electronic Submission (Je-S) is the system used by UKRI funding grants.

Organisation type	Number of organisations	Most connected organisation
Business	1,849	Tata Steel UK
Not for profit	3	Carbon Data Resources
Public sector, charity or non Je-S registered research organisation	198	Offshore Renewable Energy Catapult
Research	13	Rothamsted Research
Research and Technology Organisation (RTO)	42	Centre For Process Innovation
University	162	-

Source: Frontier Economics analysis of Delphi data.

Note: The count of organisations is based on the final sample included in the network analysis, excluding organisations with no collaborative links. The most connected organisation is the organisation with the highest 'Page rank' in the network of organisations. Universities are not included in the main network analysis. Where organisations were recorded with more than one type, we take the modal type recorded.

Table 5. Organisations in the Delphi data by size

Organisation size	Number of organisations	Most connected organisation
Micro	76	Carbon Data Resources Ltd
Small	1,080	Fraunhofer UK Research Limited
Medium	275	Digital Catapult
Large	622	Centre For Process Innovation Limited

Source: Frontier Economics analysis of Delphi data.

Note: The count of organisations is based on the final sample included in the network analysis, excluding organisations with no collaborative links. The most connected organisation is the organisation with the highest 'Page rank' in the network of organisations. Universities are not included. Where organisations were recorded with more than one size, we take the modal size recorded.

F.2.2 Innovate UK Business Connect (BC) event data

Innovate UK BC data provided an anonymised list of attendees for events organised by ISCF Challenges and attended by organisations.[8] This covers a broad range of event types, including briefings, webinars, workshops and networking events. For each attendee, the data contains the name of the organisation they belong to and the organisation 'type' (for example, University or R&D Active Business). The accessed data contained information on 359 events held between August 2017 and December 2023, attended by 6,434 distinct organisations.

We assigned each event to an ISCF Challenge based on its name. In most cases this was straightforward (for example, because the event name included the Challenge name). However, some events could not be easily assigned. In these cases, we undertook additional desk review to attempt to identify the relevant Challenge. This additional review was not always successful due to the very limited information available in some event names (e.g. 'ISCF Project Process Briefing Workshop') or because some events related to multiple Challenges (e.g. 'Mathematical Sciences in the ISCF Workshop'). Where we could not confidently assign an event to a unique Challenge, we did not include it in the analysis.[9]

F.2.3 Approach to the network analysis

We analysed the available Delphi and Innovate UK BC data in two ways:

1. As a network of organisations (i.e. each node is an organisation with connections to other organisations).
2. As a network of Challenges (i.e. each node is a Challenge with connections to other Challenges).

This approach is consistent with the preliminary analysis conducted in Phase 2 and is described further in Table 6 below.

Table 6. Summary of network analysis approach

	Delphi data	Innovate UK BC data

[8] Innovate UK BC data was previously known as Knowledge Transfer Network (KTN) data and was referred to as such in the Phase 2 report.

[9] Of the 359 events, we were unable to assign a Challenge in 52 cases (14%).

Network of organisations	Two organisations are connected if they are collaborators on at least one mutual project. The weight assigned to this connection reflects the total grant that these organisations were awarded across all mutual projects.[10] This is a proxy for the intensity of the engagement, and avoids simply looking at a binary 'connected' or 'not connected' measure.	Two organisations are connected if their members attended the same event. The 'weight' of the connection is the number of event attendances the two organisations have in common.
Network of Challenges	Two Challenges are connected if at least one organisation is involved with projects associated with both Challenges. The weight assigned to this connection reflects the total grant received for these projects by the organisations that were involved in projects associated with both Challenges.[11]	Two Challenges are connected if a single organisation attended events for both Challenges. The 'weight' of the connection between these Challenges is the number of attendees sent by organisations that attended events for both Challenges.

Source: Frontier Economics.

The role of universities in the collaboration ecosystem and their treatment in the network analysis

[10] Specifically, for any two organisations that are both involved in a mutual project and receive grants of £A and £B respectively for this project, we take the minimum of A and B as the weight of the connection between these organisations. If these organisations are involved in multiple mutual projects, we take the sum of the minimum grants received by the two organisations across all mutual projects.

[11] Specifically, if an organisation receives grants worth £A for projects associated with one Challenge and grants worth £B for projects associated with another Challenge, we take the minimum of A and B as the weight of the connection between these Challenges. If multiple organisations are involved in projects associated with both Challenges, we take the sum of the minimum grant amounts between the two Challenges for all organisations.

Universities play a significant role in the collaboration ecosystem. Approximately one in four attendees at ISCF events were from a university. Of the 1,887 funded projects recorded in the Delphi data, 46% involved a university and 34% involved both a university and a business.

If universities are included in the network analysis, this generates the finding that these institutions are very well connected in the innovation ecosystem and suggests a densely connected collaboration network with universities acting as hubs. While this is an interesting, if not unexpected, result given wider evidence on the role of universities in collaborative ecosystems, it may also reflect an issue in the data relating to universities: given that university departments are often distinct organisational units, inclusion of universities as single organisations may generate links between Challenges that are not representative of actual collaboration or engagement activity. Unfortunately, it is not possible to separate out university departments in the available data.

Therefore, consistent with the Phase 2 analysis, the results presented below exclude universities. This approach allows us to focus on the role of businesses, Catapults and research organisations in the innovation ecosystem, while also allowing a direct comparison with the Phase 2 analysis.

In principle, there may be similar concerns for large conglomerate firms or some research organisations, though this would depend on whether they have a clear departmental structure. For consistency with our approach in Phase 2, we have nevertheless included all businesses and research organisations in the analysis.

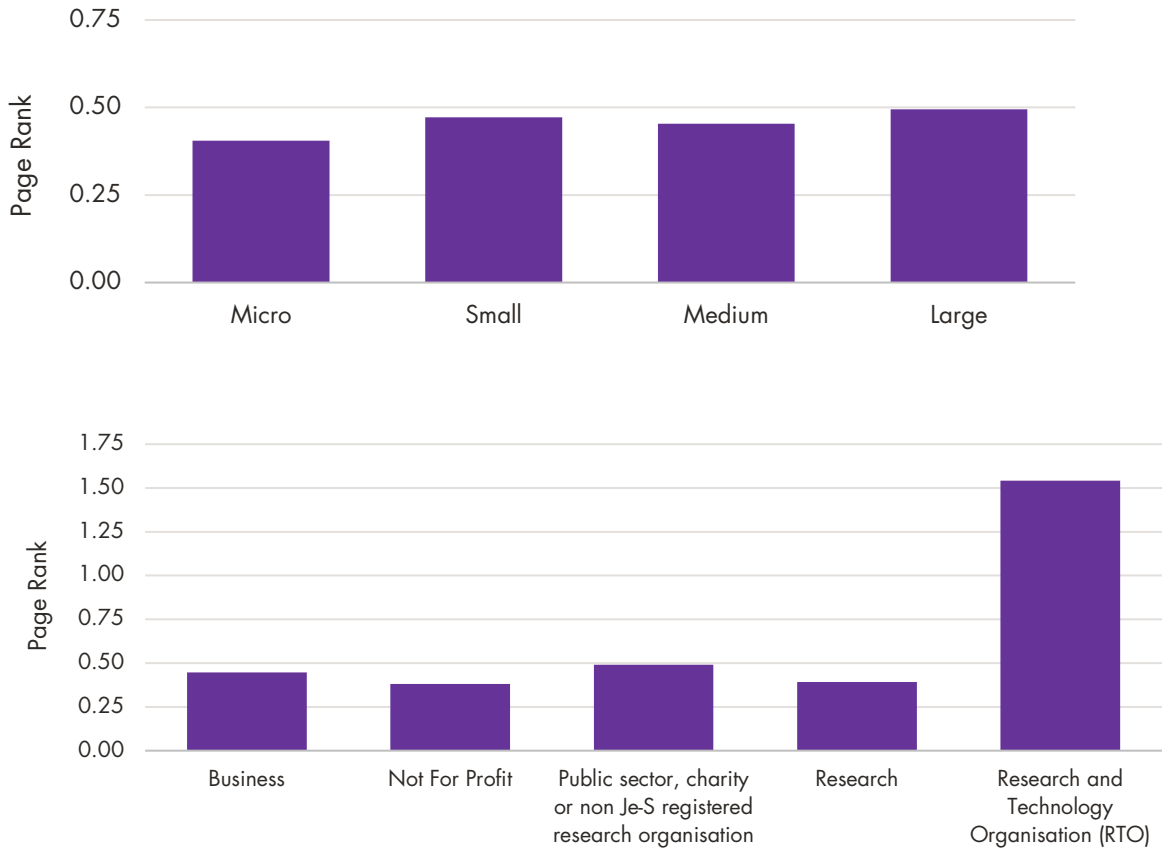
F.3 Supplementary findings from network analysis

Larger organisations and research and technology organisations (RTOs) play a key role in connecting the collaboration ecosystem

Based on Page Rank,[12] a measure of network centrality that accounts for the number and strength of a node's connections but also the number and strength of the nodes it is connected to in turn, large organisations are slightly more well connected and central in the network than small organisations. RTOs are substantially more well connected than other types of organisations – with an average Page Rank over three times larger than that of businesses (see Figure 14).

Figure 14. Average Page Rank by organisation size and type

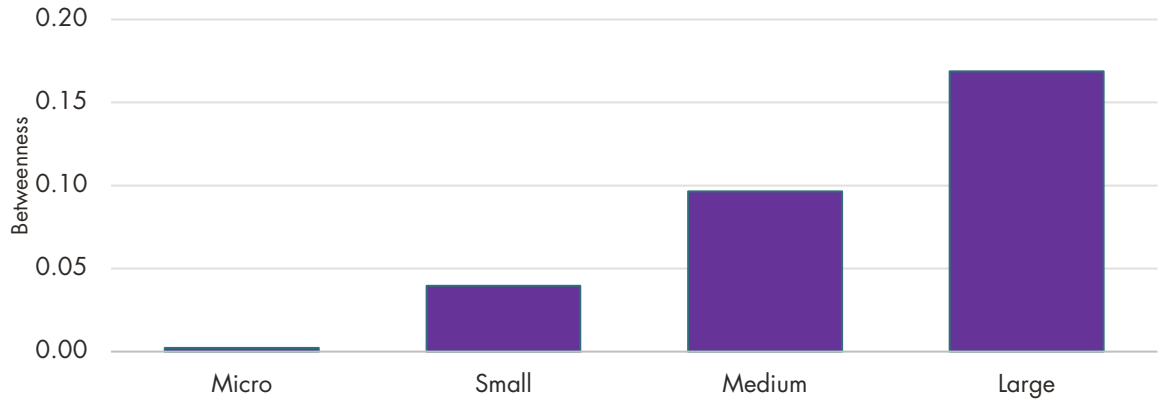
[12] Brin, Sergey, & Lawrence Page,. 1998. 'The Anatomy of a Large-Scale Hypertextual Web Search Engine.' *Proceedings of the Seventh International World Wide Web Conference* 30(1). As of 24 September 2025: https://doi.org/10.1016/S0169-7552(98)00110-X

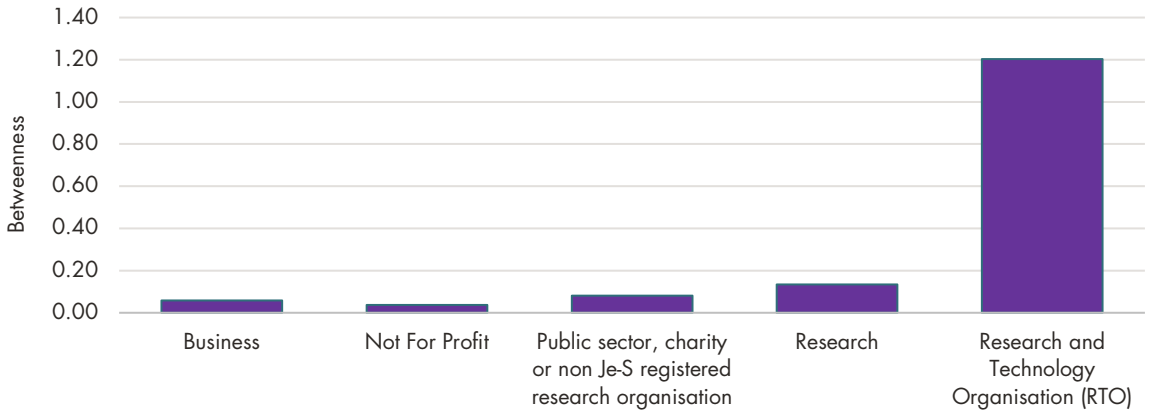


Source: Frontier Economics analysis of Delphi data.

Large organisations and RTOs also have a very high 'betweenness' relative to other organisations. Betweenness is a network measure that captures how often a node lies on the shortest path between two other nodes in the network. This measure therefore indicates the role an organisation plays in bridging otherwise less well-connected parts of the network together. Figure 15 below shows that large organisations have an average betweenness four times higher than small organisations and RTOs have an average betweenness 24 times higher than businesses. This suggests that RTOs played a key role in connecting the broader ISCF collaboration ecosystem together.

Figure 15. Average betweenness by organisation size and type





Source: Frontier Economics analysis of Delphi data.

Note: Betweenness is a network measure that captures how often a node lies on the shortest path between two other nodes in the network.

Natural communities of innovation arose around Challenges with overlapping sectors or subject areas

The overwhelming majority (90%) of organisations engaged with collaborative projects related to only one Challenge. However, a minority of organisations, especially larger entities and RTOs, engaged with a wide variety of Challenges. For example, the Manufacturing Technology Centre engaged with projects led by seven different Challenges and Rolls-Royce engaged with six different Challenges. Table 7 below shows the proportion of organisations engaging with multiple Challenges broken down by organisation size and type.

Table 7. Proportion of organisations engaging with multiple Challenges

Size / type of organisation	1 Challenge	2 Challenges	3 or more Challenges
Micro/Small	93.5%	5.8%	0.7%
Medium	94.6%	4.6%	0.8%
Large	84.3%	12.5%	3.2%
Business	91.1%	7.5%	1.4%
Research and Technology Organisation (RTO)	59.5%	9.5%	31.0%

Size / type of organisation	1 Challenge	2 Challenges	3 or more Challenges
Public sector, charity or non Je-S registered research organisation	88.4%	9.6%	2.0%
Total	90.2%	7.8%	2.1%

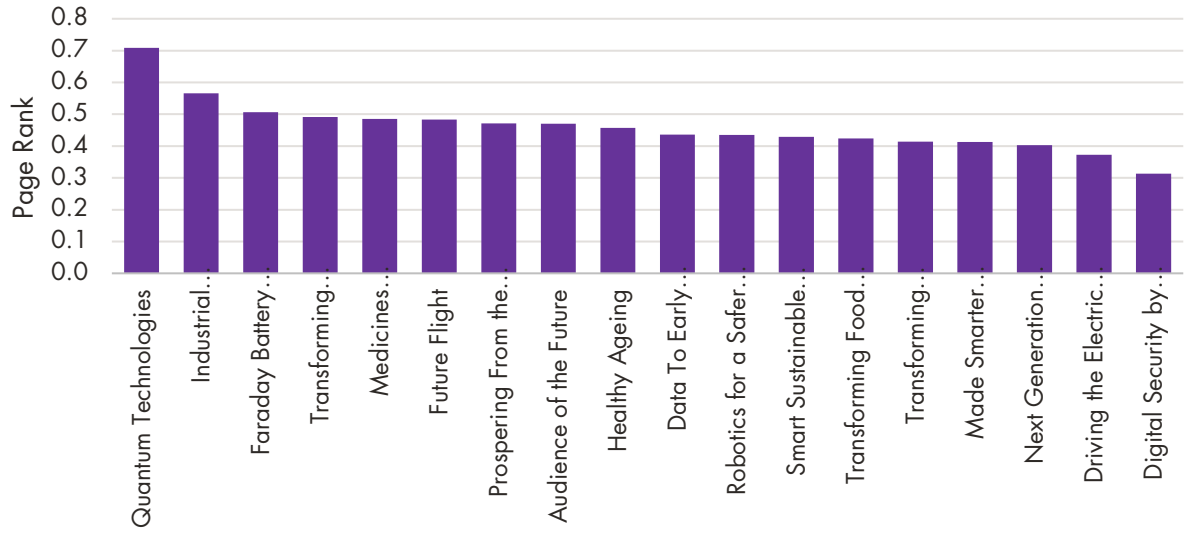
Source: Frontier Economics analysis of Delphi data.

There were considerable differences between Challenges in terms of overall collaboration observed in the Delphi data

Certain Challenges saw considerably more collaboration on funded projects recorded in Delphi. One measure involved is the average centrality score (measured by Page Rank) of organisations that engaged primarily with each Challenge.[13] This is depicted in Figure 16 below, which shows that the connectedness of organisations engaged primarily by the Quantum Technologies Challenge was the highest amongst all Challenges and over twice that of organisations engaged primarily with Digital Security by Design. The second most well connected were organisations primarily involved in Industrial Decarbonisation.

Figure 16. Average centrality score ('Page Rank') by primary Challenge

[13] Page Rank is a measure of connectedness that accounts for both the number and strength of a node's connections and the number and strength of the nodes it is connected to. An organisation is considered to have engaged primarily with the Challenge that they received the most funding from through ISCF-funded projects. Page Rank is a normalised measure, so while it can be used to assess relative differences (e.g. a Page Rank of 0.5 implies twice as much connectedness as a Page Rank of 0.25), there is no 'absolute' interpretation of the metric.



Source: Frontier Economics analysis of Delphi data.

Note: Low Cost Nuclear is not shown due to the very small number of organisations engaged primarily with this Challenge.

However, the average centrality score of organisations primarily engaged with each Challenge will depend partly on the number of projects and total funding awarded by each Challenge. This can be controlled for to some extent by looking at the number of connections created per project funded. This is shown in Chapter 4 of the final impact evaluation report, which also splits connections between within-Challenge and cross-Challenge connections (i.e. connections between organisations engaged primarily with the same Challenge and connections between organisations engaged primarily with different Challenges). Under this alternative measure, Industrial Decarbonisation generated the most collaboration, although we still observe considerable differences between Challenges.

ISCF events supported potential connections between many organisations with overlapping sectors and interests, including both businesses and universities

The Innovate UK BC data records 359 ISCF events held between August 2017 and December 2023, attended by 6,434 distinct organisations and 24,358 unique participants. This includes a broad range of event types, including briefings, webinars, workshops and networking events.

Table 8 shows the number of events organised by each Challenge, along with the median number of participants and organisations attending each event. The table also shows the median proportion of organisations attending that were universities or academic organisations (overall, 27% – more than one in four).

Table 8. ISCF events organised by Challenges and median attendance

Challenge	No. events held	Median no. participants per event	Median no. organisations per event	Median proportion of organisations that were academic
Healthy Ageing	30	58	43	0.27
Audience of the Future	29	41	34	0.31
Faraday Battery Challenge	26	57	47	0.22
Transforming Foundation Industries	25	49	34	0.29
Future Flight	23	85	55	0.15
Made Smarter Innovation	21	72	49	0.33
Smart Sustainable Plastic Packaging	18	61	49	0.22
Prospering From the Energy Revolution	16	84	71	0.23
Transforming Construction	15	66	46	0.33
Transforming Food Production	15	55	48	0.25
Medicines Manufacturing	13	56	25	0.24
Driving the Electric Revolution	13	80	55	0.28
Digital Security by Design	12	74	56	0.35
Next Generation Services	12	35	27	0.45

Challenge	No. events held	Median no. participants per event	Median no. organisations per event	Median proportion of organisations that were academic
Data To Early Diagnosis and Precision Medicine	10	51	37	0.23
Quantum Technologies	10	52	46	0.21
Industrial Decarbonisation	8	59	50	0.28
Low Cost Nuclear	6	93	43	0.17
Robotics for a Safer World	5	110	85	0.27

Source: Frontier Economics analysis of Business Connect data.

Annex G. Econometric analysis

This annex outlines the methodology and results of the econometric analysis conducted to assess the effect of ISCF participation on organisations' ability to secure external fundraising events and raise capital. It focuses on how the Challenge Fund programme has generated economic benefits for businesses supported by one or more Challenges. Rather than explore impacts at the Challenge level, the econometric analysis explores the impact of the ISCF as a whole and across clusters, as discussed in the main body of this report.

In this study, econometric analysis has been used to scrutinise the impact of the Fund on business performance. The approach used data linking to compare how businesses engaged by the Fund (the 'treatment group') perform compared with an objective counterfactual ('control group') of observationally similar businesses. Outcomes include key business performance indicators such as headcount employment, business turnover, business survival, and a proxy for productivity (turnover per worker). This has provided an indication of whether businesses grew more quickly than they would have without the support or were less likely to fail.

The analysis forms a key input into the economic evaluation, feeding into the 'growth of UK businesses' and 'increased productivity' parts of the logic model and into the VfM assessment. As well as corresponding to the ISCF's mission-oriented structure, a key motivation for conducting the analysis at the wider ISCF level was that organisations may interact with multiple Challenges, which means attribution of impact is difficult when done with respect to Challenges in isolation. Pooling the data across multiple Challenges also gives larger sample sizes and more reliable estimates of an average treatment effect.

The scoping of the econometric analysis that was delivered as part of the original ISCF framework report and baseline report (both published in November 2022) has been updated.[14] Since the baseline report, there has been further engagement with Challenges in relation to any Challenge-level data that may be relevant, and we have explored an additional central dataset from the Innovation Funding Service (IFS) which includes both successful and unsuccessful applicants for grant funding, as well as data on application scoring. The IFS also gives a more up-to-date view on grant funding to date and of the potential structure of the dataset to be used. We have assessed

[14] See in particular Sections 5 and 6 of the evaluation framework and Annex A of the baseline report.

UK Research and Innovation. 2022. *Evaluation of the Industrial Strategy Challenge Fund (ISCF)*. As of 24 September 2025: https://www.ukri.org/publications/evaluation-of-the-industrial-stategy-challenge-fund-iscf/; UK Research and Innovation. 2022. *ISCF Fund-Level Evaluation: Baseline Report*. As of 24 September 2025: https://www.ukri.org/publications/iscf-fund-level-evaluation-baseline-report/

whether unsuccessful applicants can provide a counterfactual, exploring the coverage of this data, conceptual soundness of the comparison, and practical considerations for integrating and using the data in the analysis.

We employed a Propensity Score Matching ('PSM') model to compare ISCF participants (those who successfully applied to project funding) with 'never successful' applicants (those who never received an ISCF funding grant but applied to at least one) that exhibit similar observable characteristics, thereby isolating the impact of ISCF participation on business investment outcomes. Our analysis reveals that the ISCF had a clear and sustained impact on organisations' ability to secure external fundraising events.

G.1 Data sources

The analysis draws on several data sources to construct an '**analytical dataset**':

1. 'Delphi', an internal UKRI dataset recording details of funded projects.[15]
2. The 'IFS', an internal UKRI dataset recording applications for projects.
3. 'Beauhurst', a commercial dataset containing information on company characteristics and performance.

Each dataset is described below, along with the cleaning steps and assumptions taken in reaching the final analytical dataset.

G.1.1 Delphi

The Delphi dataset contains data on all funded ISCF projects, with unique identifiers for each project and organisation involved. Organisation-level data includes participant type, size and location. Project-level data includes the Challenge, associated competition, application number and awarding date, the project name and identifier, the start and end date, grant amounts, costs and grant claimed to date.

Delphi covers ISCF projects with project start dates between June 2017 and July 2024. It contains information about a total of 2,555 unique organisations and 1,960 projects.[16]

G.1.2 The Innovation Funding Service (IFS)

The IFS is a central UKRI database that contains information on both successful and unsuccessful applications to funding competitions. Each observation reflects a pairwise combination of an

[15] This is the same dataset described in the network analysis.

[16] Note that this is based on the raw Delphi data, and therefore differs from the set of organisations and projects which are quoted in the network analysis.

organisation within in a project application, and each application is associated to a competition. Organisations can make multiple applications, and applications can feature multiple organisations.

The IFS dataset used in this analysis contains a total of 17,112 unique project applications and 19,799 unique organisations. However, this includes applications for competitions which are outside the scope of the ISCF evaluation.[17] By comparing the information in IFS with funded projects that also appear in Delphi, we identified a total of 6,936 unfunded applications (combining a project and organisation) and 4,512 unique organisations that unsuccessfully applied to ISCF-related competitions.

G.1.3 Beauhurst

Beauhurst is a commercial dataset that provides detailed information on UK companies, including financial information sourced from Companies House, various innovation metrics, and a detailed industry categorisation using information from the company's website description.[18] It includes the Company Registration Number (CRN), allowing the data to be linked to Delphi and the IFS at the organisation level. Beauhurst also contains data on various types of investment fundraising: equity investment in companies is sourced from regulatory filings indicating change of ownership, whereas debt investment is sourced from web-crawling of a diverse set of sources.

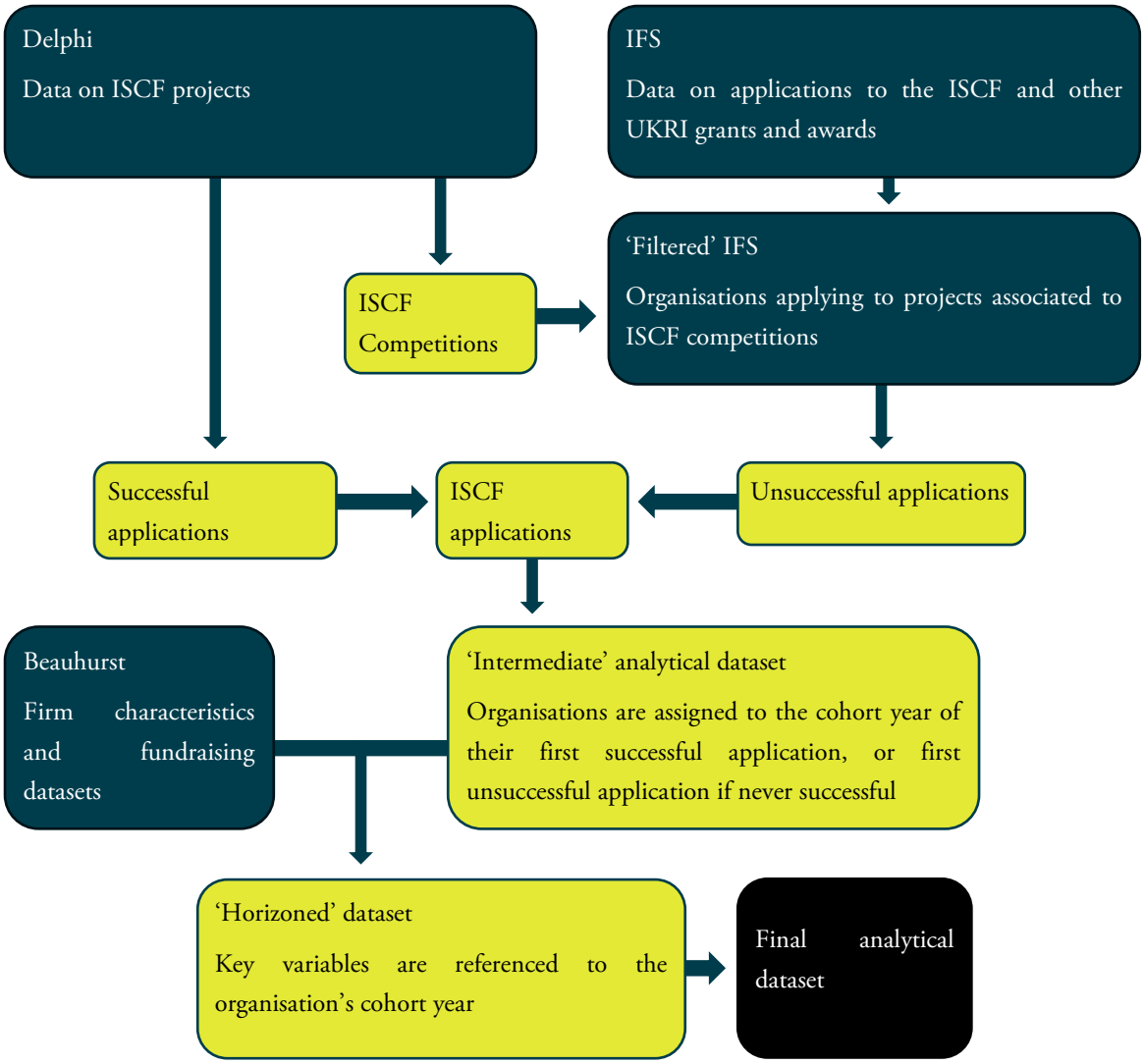
G.1.4 The data-linking process

To construct the analytical dataset for the evaluation, we integrated the key data sources described above using CRNs as the primary linking key. This process is described below and illustrated in Figure 17.

Figure 17. Overview of data-linking process

[17] For example, the project applications to UKRI's Farming Innovation Programme are included in IFS, a programme that sits outside the Industrial Strategy Challenge Fund.

[18] https://www.beauhurst.com/



Source: Frontier Economics.

The first step involved identifying organisations that were unsuccessful in their application for ISCF project funding. Since the IFS contains information on competitions beyond the scope of the ISCF evaluation, we first filtered the dataset to isolate only the ISCF-funded competitions present in both Delphi and the IFS. This ensured that both successful and unsuccessful applicants were correctly classified and fell within the remit of the evaluation.

The next step involved creating a consolidated dataset that included both successful and unsuccessful applicants. Organisations were then assigned to either a treatment or control group using the following criteria:

- **Treatment group**: Organisations that successfully received ISCF funding (identified in the Delphi dataset).

- **Control group**: Organisations that applied for ISCF funding but were ultimately unsuccessful (identified in the IFS dataset). These organisations serve as the counterfactual to compare the outcomes of the treated organisations.

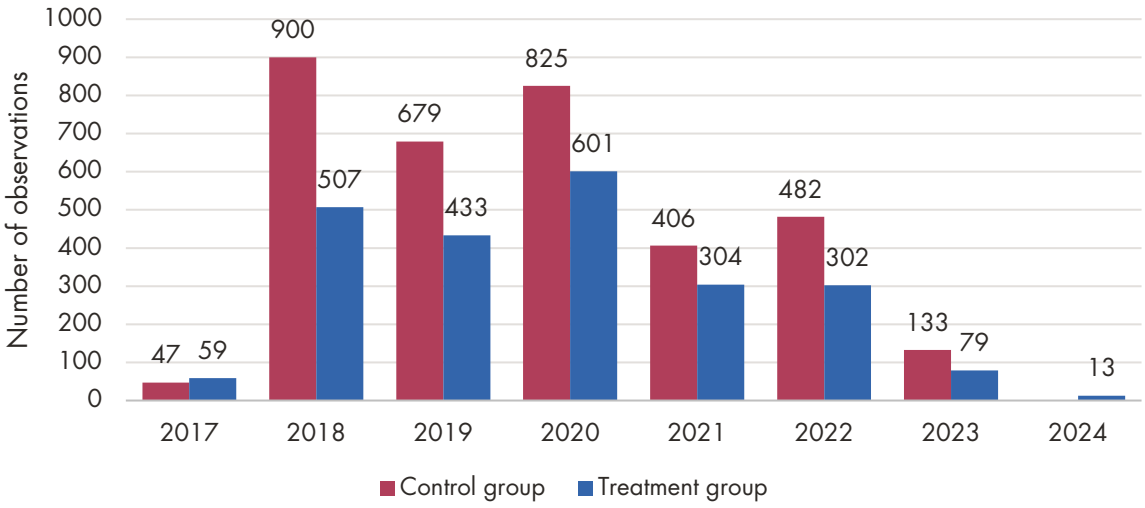
Organisations were ultimately assigned to a cohort which is based on the year of their first successful ISCF application.[19] For organisations that never received ISCF funding, their first unsuccessful application year was used to determine their cohort. Our methodology is outlined below.

Organisations with valid CRNs were then matched to Beauhurst data. This allowed us to extract key firm-level characteristics and fundraising activity. Finally, the dataset was aligned to define organisations' outcomes relative to the baseline time period for the respective cohort year. For example, first applicants in 2018 have a baseline year of 2018, so 2021 is used as the 'T+3' period.

G.1.5 The analytical dataset

The final analytical dataset includes a total of 5,770 organisations, of which 40% are in the treatment group, and 60% in the control group. Figure 18 below shows the distribution of organisations by treatment cohort, with the majority of ISCF activity taking place between 2018 and 2022.

Figure 18. Number of organisations in the analytical dataset by cohort year



Source: Frontier Economics analysis.

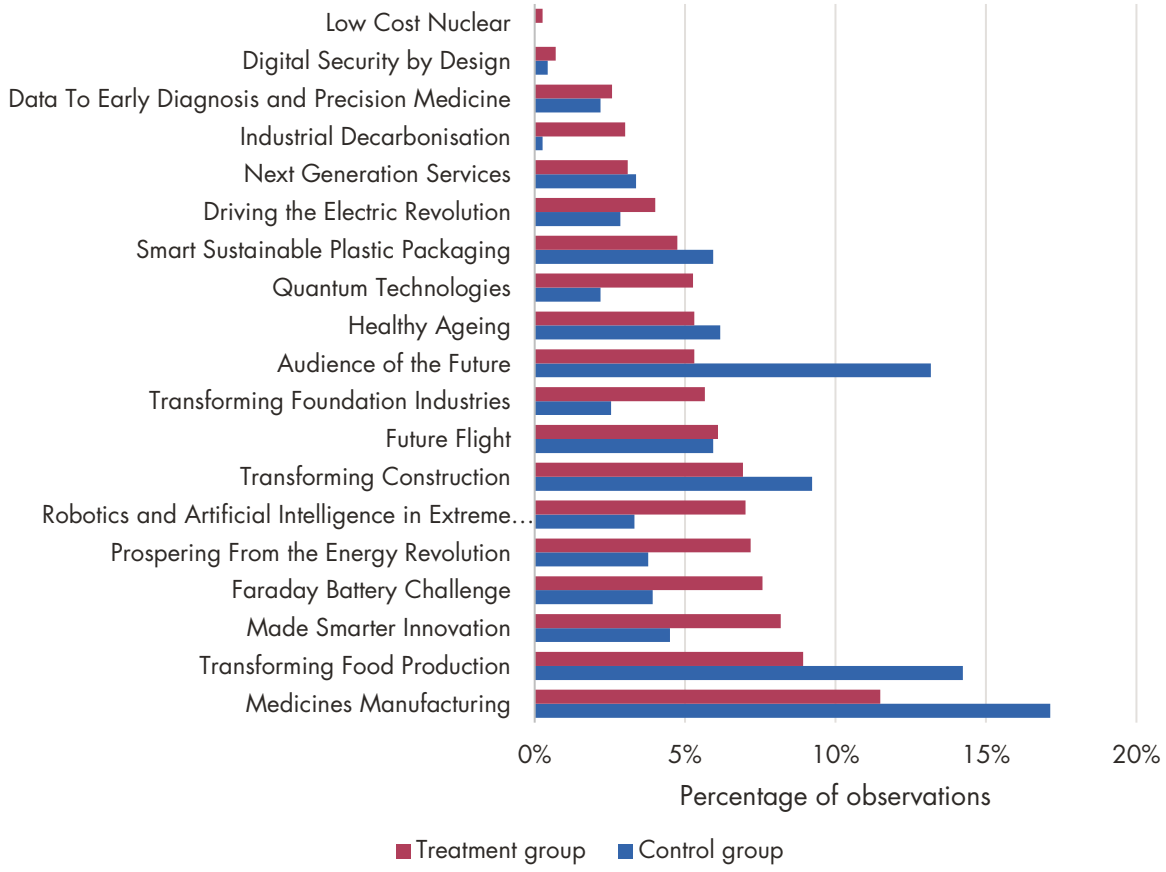
Note: Cohort year is the defined as the year of first successful application for the treatment group, or first unsuccessful application for the control group. The control group only includes firms who are never successful.

[19] Given the variables available in the raw data, the project start date (Delphi) and expected project start date (IFS) were used to assign organisations to their respective cohorts.

The analytical dataset used in this analysis comprises organisations that applied to projects within one of the 19 ISCF Challenges. The only exception is the 'Low Cost Nuclear' Challenge, for which no organisation is observed in the control group. This is because the challenge funded only two projects, as noted in the network analysis.

Figure 19 presents the percentage of organisations associated with each Challenge. We observe a noticeable compositional effect, where certain challenges are significantly more common in the treatment group than in the control group, and vice versa. As discussed in the methodology section, we account for these compositional effects by including Challenge dummies in our PSM model.

Figure 19. Percentage of organisations in the analytical dataset by Challenge



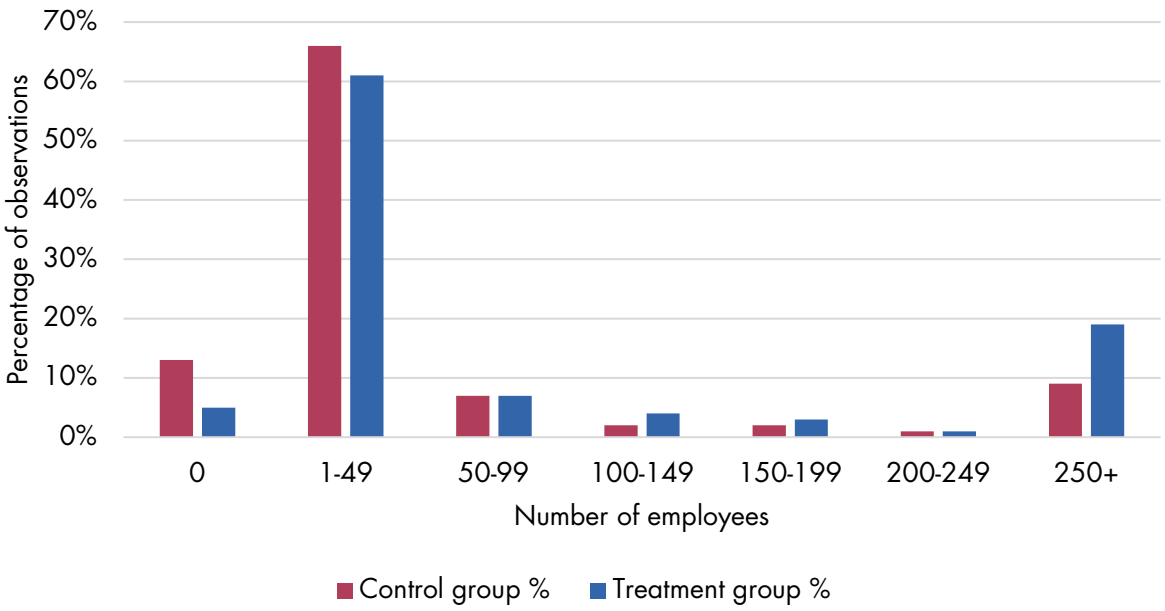
Source: Frontier Economics analysis.

Note: Percentages with groups sum to more than 100% because some participants engage with multiple challenges. Instead of assigning each participant to just one challenge, we represent each challenge as a separate category (a 'dummy' variable), allowing for multiple associations.

Figure 20 illustrates the distribution of organisations based on their number of employees. The sample is predominantly composed of Small and Medium Enterprises (SMEs), with over 80% of

organisations having fewer than 250 employees. Notably, the majority of firms, across both the treatment and control groups, had fewer than 50 employees. Larger firms (250+ employees) are, however, somewhat more represented in the treatment group.

Figure 20. Percentage of organisations in the analytical dataset by number of employees



Source: Frontier Economics analysis.

Note: Excludes observations with missing number of employees.

G.2 Methodology

This section outlines our methodology for assessing the impact of the ISCF on firm-level outcomes. The central challenge in any impact evaluation is establishing a robust counterfactual – put simply, a comparator scenario which represents what would have happened to supported businesses in the absence of the intervention. Since the counterfactual investment outcomes are not observed, these need to be estimated.

A key issue in this evaluation is **selection bias**, as ISCF funding is not randomly allocated. Firms that receive support may differ systematically from those that do not: for example, they may already have high levels of prior engagement with other UKRI programmes. To mitigate this, we restricted our comparator group to firms that applied for ISCF but were *always* unsuccessful. This ensured that all firms in our analysis had demonstrated an interest in innovation funding and went through the same application process, improving their comparability.

Another challenge is that firms may engage in multiple ISCF projects over time, making it important to define treatment and control groups consistently. To address this, we assigned firms

to a cohort based on the year of their first ISCF application. For the treatment group, this was the year of their first successful application, while for the control group, it was the year of their first unsuccessful application. This approach ensured that firms were compared at similar points in their funding journey, helping to isolate the impact of early ISCF support from subsequent funding rounds.[20] However, we note that this means that we were not able to isolate the impact of participating in a single project – and that the estimated effects in the outcomes of interest may have in part been driven by firms that participate across multiple projects following their first successful application.

G.2.1 Propensity score matching

To ensure a robust counterfactual, we applied PSM, a quasi-experimental method that allowed us to control for observable differences between treated and control firms which might influence the probability of an application being successful.[21] The PSM process can be summarised in three steps:

1. We first modelled the likelihood of a business receiving ISCF support (a successful application) based on observable pre-treatment characteristics (the '**propensity score**').
2. For each supported business, we then identified non-supported businesses with similar propensity scores to serve as controls.
3. We then computed the average difference in outcomes between the treatment and matched controls, thus calculating an Average Treatment Effect on the Treated (ATT).

For our econometric approach to provide valid causal inferences, there are two key assumptions that must hold. These assumptions underpin the validity of the PSM methodology and ensure that the results are reliable drawing any conclusions about the impact of ISCF funding on investment.

Conditional Independence Assumption

The first critical assumption in PSM is the Conditional Independence Assumption ('**CIA**'). This asserts that, after conditioning on observable characteristics, the treatment assignment (i.e. receiving ISCF funding) is independent of potential outcomes. In other words, once the variables used to estimate the propensity score are controlled for, no unobserved factors should influence either the likelihood of receiving ISCF funding or the firm-level outcomes. The CIA is based on the premise that all relevant confounders are observable and included in the model. If there are

[20] Although there are a number of firms who engage in multiple projects, the majority (70%) of organisations identified in the Treatment group have only one successful application.

[21] Rosenbaum, Paul R., & Donald B. Rubin. 1983. 'The Central Role of the Propensity Score in Observational Studies for Causal Effects.' *Biometrika* 70(1). As of 1 October 2025: https://doi.org/10.1093/biomet/70.1.41

unobserved factors that influence both treatment assignment and potential outcomes, the assumption would be violated, leading to biased estimates.

While the CIA is fundamentally untestable, since unobservable confounders are by definition unavailable, it can be partly assessed indirectly. After matching, a balancing test can be conducted to check if the treated and control groups are comparable in terms of observed covariates. If the covariates are balanced, we can be more confident that the treatment assignment is conditionally independent of potential outcomes, at least with respect to the observable variables. The lack of selection on unobservables remains a maintained assumption.

Common support

The second key assumption in PSM is the common support assumption. This asserts that for every firm in the treatment group (those that received ISCF funding), there exists at least one firm in the control group (those that did not receive ISCF funding) with a *similar* propensity score. In other words, there should be sufficient overlap in the propensity scores of treated and control firms to allow for meaningful matching.

The importance of this assumption lies in the fact that, without common support, it would not be possible to identify appropriate control firms for all treated firms. If a treated firm has no comparable counterpart in the control group (because its propensity score lies outside the range of the control group), the results of the analysis could be biased, as it would not be possible to construct a valid counterfactual for that firm. To address this, we conducted a support region analysis to ensure that all firms in the treatment group had matching firms in the control group within a reasonable range of propensity scores.

Choice of controls for the central specification

Our central first-stage specification used to model propensity scores included a range of firm-level characteristics that were likely to influence both the likelihood of receiving funding and subsequent investment outcomes. These included a firm's age (in years), the number of employees (in log terms), and prior participation in an innovation accelerator (captured by Beauhurst), all of which captured key aspects of firm size, experience and engagement with the wider UK innovation ecosystem.

Additionally, we accounted for the specific ISCF Challenges associated with each firm's first application project(s), recognising that different Challenge areas may attract different types of firms and funding dynamics, in addition to some Challenges having a higher application success rate compared to others. We also included cohort year fixed effects to account for potential time-related differences in the probability of ISCF participation. While firms were primarily matched based on similar propensity scores rather than strictly within the same year, the inclusion of cohort year fixed effects helped to control for broader economic and policy conditions that may vary across time.

Finally, to address sectoral differences in ISCF participation and investment outcomes, we also incorporated a set of 'industry identifiers'. These consisted of a set of sectoral participation indicators from Beauhurst's 'Industries' and 'Buzzwords' variables. Given the high granularity of these classifications, we applied a stepwise regression process to retain only the most relevant sectoral dummies, those with both substantial observations and strong explanatory power for ISCF participation.[22]

Outcomes

To evaluate the impact of ISCF participation on firms' ability to attract external investment, we examined three key fundraising-related outcomes:

- The probability of securing a fundraising event, which indicates whether a firm successfully raises external funding in a given year. By comparing ISCF-supported firms with their matched counterparts, we were able to assess whether participation in the programme increases a firm's probability of attracting investment.
- The number of fundraising events a firm secures. This measure goes beyond whether a firm raises capital and captures the frequency of its fundraising activity. A higher number of events would suggest that ISCF-supported firms are more engaged with investors, potentially securing multiple rounds of funding or attracting capital from diverse sources.
- The total amount raised, measured in logarithmic terms. This approach offers insight into the overall scale of investment secured by firms. In addition, results in log terms allow estimated effects to be interpreted as percentage changes in the amount raised, providing a clearer picture of the ISCF's impact on fundraising outcomes.

Success of the matching algorithm

Having discussed the methodological approach, in this section we discuss the extent to which the matching algorithm was successful. The first-stage model used to model the propensity score is shown in Table 9 below. In this context, a positive coefficient can be interpreted as firms being more likely to successfully apply for ISCF project funding, while holding other things equal.

Table 9. Results of the first-stage probit model

[22] The matched Beauhurst dataset contains 279 distinct industries and 82 buzzwords. While some sector features are widely represented, others are more specific and may lack sufficient common support for a matching analysis. The stepwise regression model identifies key dummy variables – such as industry identifier 'Artificial Intelligence' – that significantly predict ISCF participation.

Variable	Coefficient	(T-Statistic)
Accelerator participation (T=0 to T=-3)	-0.196**	(-2.313)
Firm age (in years)	0.00116	(0.923)
Log (number of employees)	0.102***	(9.390)
Number of employees (missing)	-0.0686	(-1.293)
Challenge fixed effects (base case = Accelerating Detection of Diseases)		
• Healthy Ageing	0.403**	(2.492)
• Smart Sustainable Plastic Packaging	0.316**	(1.961)
• Transforming Foundation Industries	0.889***	(5.409)
• Made Smarter Innovation	0.717***	(4.608)
• Driving the Electric Revolution	0.525***	(3.100)
• Robotics and Artificial Intelligence in Extreme Environments	0.691***	(4.251)
• Prospering From the Energy Revolution	0.664***	(4.192)
• Digital Security by Design	0.785***	(2.914)
• Faraday Battery Challenge	0.590***	(3.716)
• Transforming Food Production	-0.153	(-1.024)
• Audience of the Future	-0.272*	(-1.773)
• Future Flight	0.371**	(2.304)
• Medicines Manufacturing	-0.128	(-0.856)
• Transforming Construction	0.0168	(0.110)
• Data To Early Diagnosis and Precision Medicine	0.210	(1.191)
• Next Generation Services	0.0423	(0.248)
• Industrial Decarbonisation	1.746***	(7.507)

Variable	Coefficient	(T-Statistic)
• Quantum Technologies	0.737***	(4.397)
Cohort year fixed effects		
• 2018	-0.360**	(-2.543)
• 2019	-0.215	(-1.495)
• 2020	-0.424***	(-2.877)
• 2021	-0.751***	(-5.020)
• 2022	-0.674***	(-4.380)
• 2023	-0.790***	(-4.582)
Region fixed effects (base case = East Midlands)		
• East of England	0.177*	(1.822)
• London	0.200**	(2.330)
• Missing	0.367***	(3.143)
• North East	0.196	(1.543)
• North West	0.258***	(2.623)
• Northern Ireland	0.206	(1.374)
• Scotland	0.302**	(2.293)
• South East	0.140	(1.550)
• South West	0.0813	(0.818)
• Wales	0.191	(1.511)
• West Midlands	0.223**	(2.180)
• Yorkshire and The Humber	0.208*	(1.952)
Buzzword / Industry fixed effects		
• Software-as-a-Service (SaaS)	0.231***	(2.983)

Variable	Coefficient	(T-Statistic)
• Drones	0.476***	(3.156)
• Physical product design, testing and quality assurance	0.401***	(3.168)
• Pharmaceuticals	0.469***	(3.863)
• Waste management and recycling	0.348***	(3.240)
• Research tools and reagents	0.400***	(2.955)
• Technology consultancy and IT and telecommunications support	0.209**	(2.038)
• Electronics hardware	0.189**	(2.335)
• Parts and components	0.335***	(2.999)
Constant	-0.613***	(-2.873)
N	5,704	
Pseudo R^2	0.118	

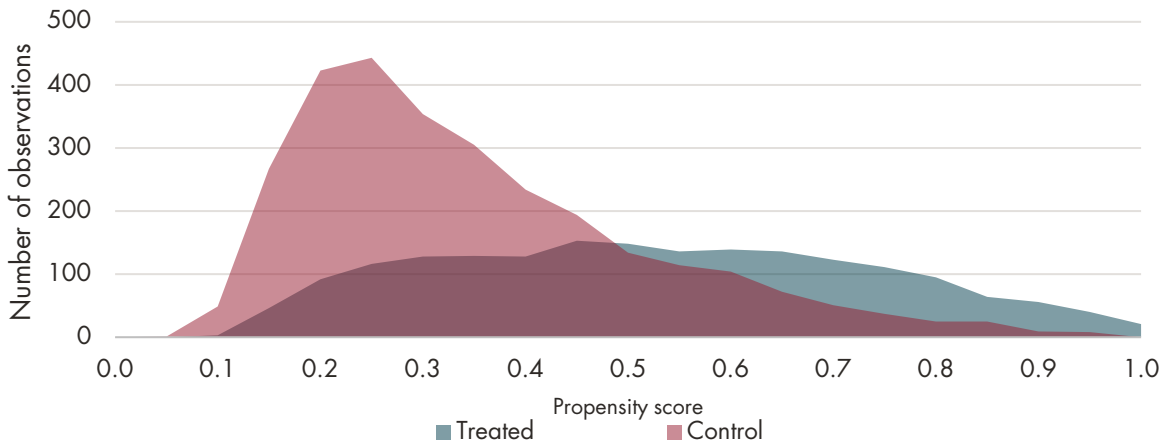
Source: Frontier Economics analysis.

Note: T-statistics in parentheses. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

Common support

Figure 21 shows the distribution of propensity scores for the treated and control groups in the central specification. Unsurprisingly, the control group (red) tends to have a lower propensity score, compared to the more evenly distributed range for the treatment group (blue). However, there is a reasonable degree of overlap between the two distributions, particularly in the 0.2–0.6 range, indicating a comfortable level of common support.

Figure 21. Distribution of propensity scores in the central specification



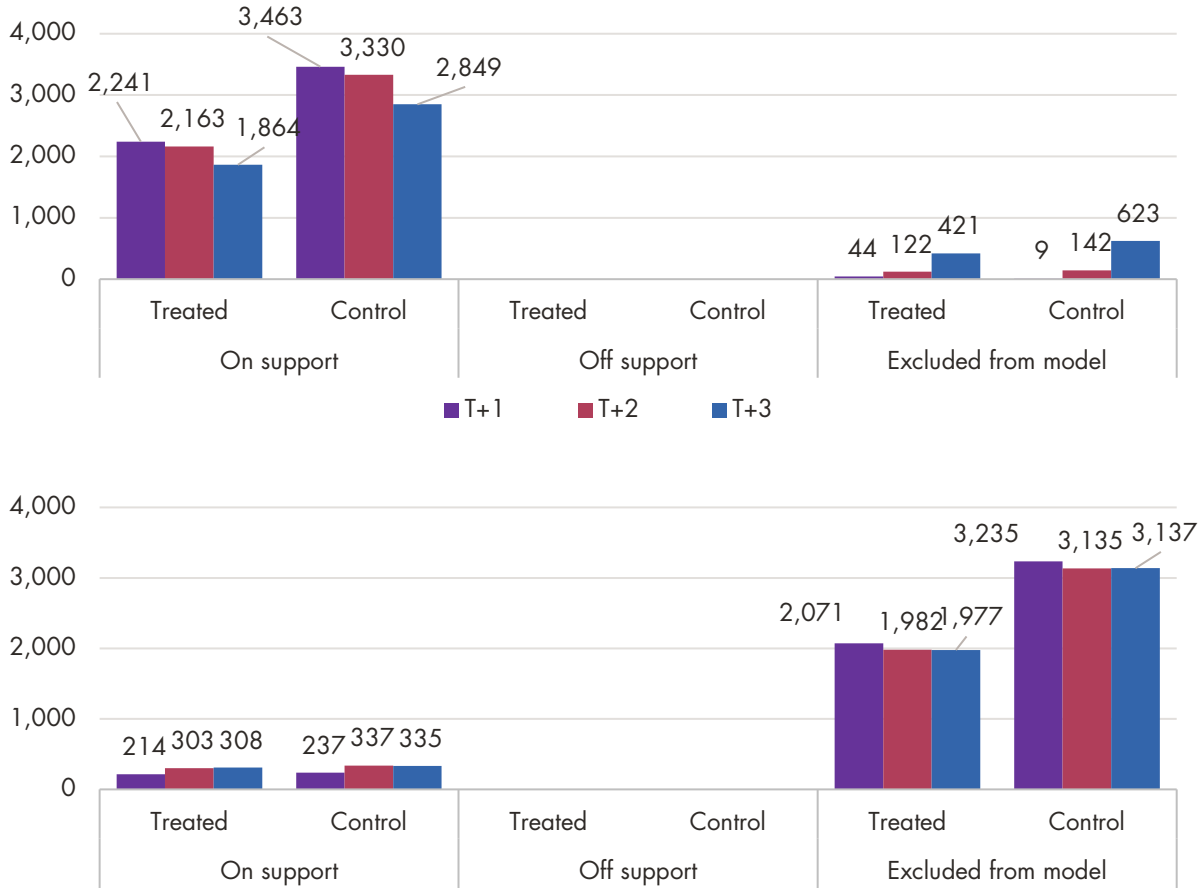
Source: Frontier Economics.

In addition to exhibiting a sufficiently overlapping propensity score distribution, the matching algorithm used in the central specification retains all observations that are within the common support range. As shown in Figure 22, there are no data points 'off support', meaning every treated observation has a comparable control observation. However, some observations may be excluded from the analysis due to issues such as missing values for a covariate included in the matching algorithm.

While the algorithm successfully aligns treated and control units within the support range, it is important to note that the number of retained observations decreases from T+1 to T+3, where T+X denotes outcomes observed X years after a firm's cohort year. This reduction occurs because later cohorts are dropped as the analysis approaches the end of the data period (i.e. 2024). Firms treated at later points in time have not been observed for a long enough period to capture the outcome of interest at T+2 or T+3, leading to their exclusion from the analysis.

Additionally, the number of observations on support drops significantly when the model is adjusted to focus only on log investment. This is because the model requires firms to have non-zero investment for inclusion, resulting in a smaller subsample. As a result, while the matching algorithm ensures all retained observations are within the common support range, the overall sample size is reduced in this specific specification due to the more restrictive criteria. This limits the interpretability and inference we were able to draw from the results obtained for the log investment outcome.

Figure 22. Number of treatment and control observations post-matching



Source: Frontier Economics.

Balancing

While PSM finds matched control units that have similar propensity scores to the treatment group, it is still possible that the groups may differ in terms of characteristics that drive the likelihood of treatment. For example, the treatment group might be more heavily weighted towards larger firms, whereas the matched controls are weighted more heavily towards particular buzzword that predict treatment. In this case the two groups would be different in key respects, calling into question the validity of the comparison.

To alleviate these concerns a 'balancing test' was applied, which ran through each covariate in turn and compared the mean of the treatment group and matched controls. Table 10 below shows the averages for the two groups, with the p-value showing whether the difference is statistically significant. In a large majority of cases the difference is insignificant, indicating that the groups are similar. Table 11 does the same for the outcomes of interest, during the three years preceding an observations' cohort year. This pre-trend test assesses whether the treatment and control groups followed similar trends, ensuring that any post-treatment differences are not driven by pre-existing trends. In particular we note that there isn't a statistically significant difference between both groups other than the number of events at T=-2.

Taken together, the balancing tests provide reassurance that the PSM algorithm yields treatment and matched control groups which are comparable in terms of their observable characteristics. The small number of imbalances fall within the range of what would be expected due to random variation.

Table 10. Balancing test for the central specification

Variable	Mean		%bias	T-statistic	p-value
	Treated	Control			
Accelerator participation (T=0 to T=-3)	0.05	0.05	-1.20	-0.41	0.69
Firm age (in years)	16.24	16.97	-4.00	-1.14	0.25
Log (number of employees)	2.85	2.85	0.00	0.01	0.99
Challenge fixed effects (base case = Accelerating Detection of Diseases)					
• Healthy Ageing	0.05	0.06	-2.10	-0.72	0.47
• Smart Sustainable Plastic Packaging	0.05	0.05	1.20	0.43	0.67
• Transforming Foundation Industries	0.06	0.06	-0.40	-0.12	0.91
• Made Smarter Innovation	0.08	0.10	-6.50	-1.84	0.07
• Driving the Electric Revolution	0.04	0.04	0.20	0.05	0.96
• Robotics and Artificial Intelligence in Extreme Environments	0.07	0.06	4.80	1.44	0.15
• Prospering From the Energy Revolution	0.07	0.07	-0.60	-0.18	0.86
• Digital Security by Design	0.01	0.01	0.70	0.22	0.83
• Faraday Battery Challenge	0.07	0.06	2.70	0.81	0.42
• Transforming Food Production	0.09	0.09	-0.20	-0.08	0.93
• Audience of the Future	0.05	0.06	-1.00	-0.44	0.66
• Future Flight	0.06	0.06	0.30	0.09	0.93

Variable	Mean		%bias	T-statistic	p-value
	Treated	Control			
• Medicines Manufacturing	0.11	0.11	0.30	0.11	0.91
• Transforming Construction	0.07	0.07	-1.00	-0.37	0.71
• Data To Early Diagnosis and Precision Medicine	0.03	0.03	-3.90	-1.18	0.24
• Next Generation Services	0.03	0.03	0.10	0.04	0.97
• Industrial Decarbonisation	0.03	0.02	10.10	2.80	0.01
• Quantum Technologies	0.05	0.05	-0.50	-0.13	0.90
Cohort year fixed effects					
• 2018	0.22	0.20	4.40	1.56	0.12
• 2019	0.19	0.21	-4.20	-1.40	0.16
• 2020	0.27	0.26	1.50	0.51	0.61
• 2021	0.13	0.13	1.30	0.42	0.67
• 2022	0.13	0.14	-0.80	-0.26	0.79
• 2023	0.03	0.04	-3.80	-1.25	0.21
Region fixed effects (base case = East Midlands)					
• East of England	0.09	0.09	0.80	0.27	0.79
• London	0.25	0.26	-2.30	-0.78	0.44
• Missing	0.05	0.05	-2.10	-0.65	0.52
• North East	0.03	0.04	-0.80	-0.24	0.81
• North West	0.09	0.09	0.60	0.20	0.84
• Northern Ireland	0.02	0.02	0.60	0.20	0.85

Variable	Mean		%bias	T-statistic	p-value
	Treated	Control			
• Scotland	0.03	0.03	-1.10	-0.33	0.74
• South East	0.15	0.13	3.10	1.07	0.28
• South West	0.07	0.08	-1.30	-0.44	0.66
• Wales	0.03	0.03	3.30	1.16	0.25
• West Midlands	0.08	0.07	2.30	0.74	0.46
• Yorkshire and The Humber	0.07	0.07	-2.0	-0.63	0.53
Buzzword / Industry fixed effects					
• Software-as-a-Service (SaaS)	0.02	0.03	-1.8	-0.49	0.62
• Drones	0.03	0.04	-4.8	-1.30	0.19
• Physical product design, testing and quality assurance	0.03	0.04	-5.8	-1.59	0.11
• Pharmaceuticals	0.04	0.04	1.5	0.46	0.65
• Waste management and recycling	0.03	0.03	-1.8	-0.51	0.61
• Research tools and reagents	0.04	0.04	-2.6	-0.78	0.44
• Technology consultancy and IT and telecommunications support	0.07	0.07	1.6	0.48	0.63
• Electronics hardware	0.05	0.05	-1.6	-0.44	0.66
• Parts and components	0.02	0.03	-1.8	-0.49	0.62

Table 11. Balancing test for outcome variables

Outcome	Period	Mean		%bias	T-statistic	p-value
		Treated	Control			
Probability of fundraising	T=-3	0.23	0.22	2.10	0.72	0.48
	T=-2	0.15	0.16	-2.50	-0.86	0.39
	T=-1	0.11	0.11	-2.00	-0.60	0.55
	T=0	0.11	0.09	8.10	2.64	0.01
	T=1	0.10	0.08	6.10	1.98	0.05
	T=2	0.12	0.11	1.90	0.60	0.55
	T=3	0.24	0.23	3.50	1.16	0.25
Fundraising amount	T=-3	230,000	160,000	2.40	0.81	0.42
	T=-2	530,000	160,000	3.70	1.24	0.22
	T=-1	330,000	480,000	-4.00	-1.16	0.25
	T=0	410,000	350,000	1.30	0.39	0.69
	T=1	420,000	330,000	1.30	0.42	0.67
	T=2	450,000	430,000	0.70	0.21	0.84
	T=3	660,000	230,000	8.20	2.77	0.01
Number of fundraising events	T=-3	0.42	0.49	-4.20	-1.15	0.25
	T=-2	0.43	0.56	-7.80	-2.26	0.02
	T=-1	0.59	0.65	-3.40	-1.01	0.31
	T=0	0.57	0.49	4.60	1.43	0.15

Outcome	Period	Mean		%bias	T-statistic	p-value
		Treated	Control			
	T=1	0.53	0.47	3.90	1.22	0.22
	T=2	0.48	0.43	3.00	0.89	0.37
	T=3	0.50	0.36	8.60	2.46	0.01

Source: Frontier Economics analysis.

G.3 Central specification results

This section sets out the results of our 'central' PSM specification. We used a matching algorithm in which the treated observations were matched to the ten 'nearest neighbours' by propensity score. Compared to only using the nearest observation by propensity score, this reduced the bias caused in particular by observations with extreme (either very large, or very low) propensity scores. In the sensitivity analysis we explored alternative matching algorithms.

Our analysis found that ISCF participation is associated with a statistically significant increase in the probability of a fundraising event.

- In the first year following participation (T+1), organisations were 1.7 percentage points more likely to secure funding, a result that is statistically significant at the 10% level.
- In the second year after participation (T+2), the probability of securing a fundraising event remains positive, with an estimated increase of 2.3 percentage points, an effect statistically significant at the 5% level.
- Indeed, by the third year (T+3), the estimated effect reaches 3.8 percentage points, statistically significant at the 1% level.

This suggests that the impact of the ISCF on organisations' ability to attract investment extends beyond the immediate post-participation period.

Table 12. Results from the central specification

	T+1	T+2	T+3
	ATT	ATT	ATT
Probability of fundraising event	0.017* (1.82)	0.023** (2.05)	0.038*** (2.86)

	T+1		T+2		T+3	
	ATT		ATT		ATT	
Number of fundraising events	0.066	(1.17)	0.095	(0.93)	0.316*	(1.93)
Fundraising amount (log)	0.22	(0.92)	0.16	(0.83)	0.454**	(2.16)

Source: Frontier Economics analysis.

Note: T-statistics in parentheses. * p ≤ 0.10, ** p ≤ 0.05, *** p ≤ 0.01

When considering the **number of fundraising events,** a similarly positive and sustained effect is observed:

- For the first two years (T+1 and T+2), the effect on the number of events is positive, but not statistically significant.
- However, by the third year (T+3), the effect becomes more pronounced, with a statistically significant increase of 0.32 fundraising events, significant at the 10% level.

Finally, when considering the estimated **impact of ISCF participation on the total fundraising amount**, measured in log terms:

- The effect is positive, although not statistically significant for the first two years (T+1 and T+2).
- By the third year (T+3), there is a positive effect which is statistically significant beyond the conventional threshold of 5%. We estimate that the amount fundraised is 57% higher compared to those who did receive fundraising but were unsuccessful in their ISCF application.[23]

Despite the positive effect on fundraising amount, we note that this analysis considers a limited time horizon. The window from T+1 to T+3 may be too short to observe the full long-term effects of ISCF participation on fundraising outcomes. It is plausible that the impact on the total capital raised becomes more pronounced beyond the three-year period, as firms solidify their position in the market or scale up their operations.

G.3.1 Additionality of investment

[23] $(e^{0.454}-1) \times 100 \approx 57\%$.

Additional investment comes via two sources: firms that would otherwise not have been funded without ISCF support, and firms receiving more funding than they otherwise would as a result of ISCF support.

Step 1 – additionally funded firms

ISCF participation has a positive effect on the likelihood of a firm receiving funding of 1.7 percentage points after one year, 2.3 percentage points after two years, and 3.8 percentage points after three years. Applying these uplifts to numbers of firms in cohorts suggests 80 additional firms received investment and would not have done so without ISCF participation.[24] This can then be multiplied by an assumed amount invested per firm. For ISCF firms receiving funding within three years, the mean average amount received was around £8.5m per firm, however this distribution is heavily skewed by a small number of very large investment amounts. A more conservative approach would be to use the lower quartile or median investment amounts. This assumes that the cases of fundraising induced by the programme will be moderate and not include any very large cases. Using a lower quartile funding amount of £450k per firm suggests additional funding of £40m. A median value of £1.5m per firm suggests additional funding of £133m.

Step 2 – higher funding value for funded firms

The investment size analysis suggests that for firms that receive investment within three years, the amount is 57% larger for ISCF-treated firms (or conversely, without treatment their funding amounts would be 36% smaller). ISCF-treated firms received £3.6bn in investment in the three years after treatment.[25] Applying this impact suggests additional funding of £1.2bn due to ISCF participation.[26]

This approach assumes a constant uplift irrespective of the 'underlying' investment size. Potentially, we might expect smaller firms to get larger proportional uplifts (an additional £5m might double the investment for a smaller firm but only represent a small increment in investment for a large firm), which would cause the estimates to be overstated. However, we actually observed a positive correlation between the firm-level treatment effect and firm size (that is, it appears that

[24] Of these, 72 are in cohorts up to 2021 and have the full t+3 impact used, whereas for the other 8 the t+2 or t+1 impact parameters and funding amounts are used

[25] This also includes totals for the 2022 and 2023 cohorts, which have not yet been observed for the full three years, and have the smaller t+1 or t+2 impacts applied.

[26] For cohorts up to 2021, t+3 effect = 36.5% x £3.27bn; for 2022, t+2 effect = 16% x £303m; for 2023, t+1 effect = 22% x £28m. These sum to £1.24bn. However, there is some double counting as we also capture value uplifts in firms that are additionally funded. This double counting represents between £13m and £43m depending on the approach used, so that the 'net' effect is £1.20bn to £1.23bn.

larger firms in employment terms get larger proportional uplifts in investment amounts), which points against an overstatement interpretation.

Results and context

The probability of funding impacts in step 1 compares with funding rates of 18%. Broadly speaking, the additional impact represents a fifth of firms receiving funding (3.7% vs 18%) that would not otherwise have done so. Overall ISCF-supported firms have received £3.6bn in the three years since first participation, so the uplift of around £1.2bn associated with ISCF participation is substantial.

It should be noted that the 'larger investment' results from step 2 are driven to a fair extent by several companies that have received very large investments. Six firms have received more than £100m each, totalling £325m or around a quarter of the overall impact. More generally, there is a need for caution in that there may be selection on unobservables, including the possibility that the firms are getting other public funding support which might also be contributing to the investment outcome.

G.4 Sensitivities

A sensitivity analysis was conducted to assess the robustness of the results obtained with the central specification. Specifically, we examined the impact of different controls, matching algorithms, as well as the influence of firm size. The analysis helped to ensure that our findings were not overly dependent on specific model choices.

Choice of controls

A key aspect of the analysis is the choice of control variables in the first stage of the PSM, and in particular, how we account for the fact that industry and sectoral effects might influence both the probability of a firm being in the treatment group, and the outcomes of interest. Our central specification includes a set of industry identifiers (derived from Beauhurst's 'Industries' and 'Buzzwords' classifications) to capture sectoral heterogeneity. We tested the use of an alternative set of Standard Industrial Classification (SIC) code groupings, which were aggregated to improve statistical power and interpretability.[27] We present these results in Table 13 and Table 14 below.

Table 13. Choice of controls tested

[27] There are over 600 individual SIC codes, which can in turn be aggregated into broader 'sections' using the ONS's SIC(2007) classification, with each letter representing a broad sector. We have further aggregated these divisions into broader settings designed in a way to balance sectoral specificity with statistical robustness. For example, the ONS classifications 'D' (Electricity, Gas, Steam and Air Conditioning Supply) and 'E' (Water Supply, Sewerage, Waste Management and Remediation Activities) are merged into a broader 'Utilities' group.

	SIC Codes	Buzzwords and industries
Central specification		✓
Controls 2	✓	✓
Controls 3	✓	
Controls 4		

Source: Frontier Economics analysis.

Table 14. Sensitivity checks on choice of controls

Outcome	Time period	Controls 2		Controls 3		Controls 4	
		ATT		ATT		ATT	
Probability of fundraising event	T+1	0.019**	(2.01)	0.025***	(2.75)	0.027***	(2.94)
	T+2	0.016	(1.37)	0.035***	(3.14)	0.034***	(3.1)
	T+3	0.036***	(2.77)	0.055***	(4.23)	0.053***	(4.12)
Number of fundraising events	T+1	0.093*	(1.65)	0.097*	(1.75)	0.115**	(2.07)
	T+2	0.083	(0.81)	0.201**	(1.98)	0.183*	(1.82)
	T+3	0.301*	(1.83)	0.457***	(2.8)	0.404**	(2.48)
Fundraising amount (log)	T+1	0.108	(0.43)	0.088	(0.38)	0.156	(0.7)
	T+1	0.243	(1.22)	0.271	(1.38)	0.235	(1.27)
	T+2	0.348*	(1.67)	0.475**	(2.27)	0.482**	(2.39)

Source: Frontier Economics analysis.

Note: T-statistics in parentheses. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

The results from the sensitivity analysis provide further validation of the central model's findings, particularly regarding the effects by T+3, which remain consistently positive and statistically significant.

For the probability of fundraising, the estimated effect ranges from 3.6% to 5.5% across all sensitivities. This suggests a robust and sustained increase in the likelihood of securing a fundraising event for ISCF participants, in line with the 3.8% central result.

Similarly, the number of fundraising events shows positive effects consistent with the central specification, with estimated increases ranging from 0.3 to 0.46, in line with the central estimate of 0.32 additional events following ISCF participation.

Finally, we find across the range of sensitivities that firms receive between 42% and 62% additional fundraising, an effect that is comparable to the central estimate of 57%.

Choice of matching algorithm

A second robustness check was conducted to consider whether our results were driven by the choice of parameters underpinning the matching algorithm. In a PSM analysis, there are two key parameters which can influence how treated and control units are matched based on their propensity scores:

- **Neighbour** specifies the number of nearest neighbours to match each treated unit with.[28]
- **Caliper** specifies a restriction on how close the propensity score of matched treatment units and control units must be, measured in standard deviation units.[29]

To understand whether our results were driven by a particular set of choice of neighbour and caliper parameters, we tested a set of PSM models in which we employed a series of more restrictive matching algorithms, as shown in Table 15 below.

The results – shown in Table 16 – support the validity of our initial findings. By the third year after the first successful application, firms that participated in the ISCF are estimated to be 3.7% to 4% more likely to secure a fundraising event – a statistically significant result closely aligned with the central estimate of 3.8%. Similarly, the estimated increase in the number of fundraising events ranges from 0.28 to 0.34, which is both statistically significant and consistent with the

[28] For example, a neighbour of 1 will match each treated unit with the closest control unit based on the propensity score – also known as nearest-neighbour matching. On the other hand, a neighbour parameter set to 10 will match each treated unit with the ten closest controls.

[29] For example, a caliper of 0.1 restricts matches to control units whose propensity score is within 0.1 standard deviations of the treated unit's score. A smaller caliper of 0.01 restricts the matching to ensure a closer match, but may result in fewer observations retained by the algorithm.

central estimate of 0.32. In terms of the additional amount invested, the estimated effect is also comparable to the central estimate of 57%.

Table 15. Choice of parameters tested

	Neighbours	Caliper
Central specification	10	0.1
Parameters 2	10	0.01
Parameters 3	10	0.001
Parameters 4	1	0.1

Source: Frontier Economics analysis.

Table 16. Sensitivity checks on choice of parameters

Outcome	Time period	Parameters 2		Parameters 3		Parameters 4	
		ATT		ATT		ATT	
Probability of fundraising event	T+1	0.016*	(1.73)	0.013	(1.35)	0.013	(1.07)
	T+2	0.022**	(1.98)	0.017	(1.51)	0.018	(1.28)
	T+3	0.037***	(2.84)	0.04***	(3.04)	0.04**	(2.44)
Number of fundraising events	T+1	0.063	(1.12)	0.017	(0.31)	0.056	(0.76)
	T+2	0.09	(0.88)	-0.023	(-0.22)	0.033	(0.26)
	T+3	0.304*	(1.85)	0.276*	(1.68)	0.334	(1.56)
Fundraising amount (log)	T+1	0.286	(1.39)	0.173	(0.69)	0.151	(0.44)
	T+2	0.005	(0.03)	-0.002	(-0.01)	-0.05	(-0.19)

	T+3	0.5*** (2.45)	0.55** (2.2)	0.428 (1.56)

Source: Frontier Economics analysis.

Note: T-statistics in parentheses. * p ≤ 0.10, ** p ≤ 0.05, *** p ≤ 0.01

However, when using only the nearest neighbour to match treated units (Parameters 4), the probability of securing a fundraising event remains significant, but the other two outcomes – number of fundraising events and fundraising amount – become insignificant. This suggests that while our core findings hold, the choice of matching algorithm can impact the precision of some outcomes. We note, however, that the key disadvantage of using only the nearest neighbour is that it increases the risk of poor matches at the extreme of the propensity score distribution.

Results by firm size

As highlighted in our description of the analytical dataset, the sample used in our PSM analysis was predominantly composed of small and medium enterprises (SMEs). However, a significant proportion of firms in both the treatment and control groups have more than 250 employees – specifically, 19% of treated firms and 9% of control firms fall into this category, with some of the largest firms exceeding 100,000 employees.

There is a risk that larger firms could have greater access to fundraising opportunities independent of ISCF participation. We therefore explored how restricting the sample to a subset of observations based on firm size might influence our results. Specifically, we re-estimated our central specification while stratifying the sample by firm size categories.[30]

The results are shown below in Table 17. For firms who do engage in external fundraising, **we observe that the impact of the ISCF is more pronounced on smaller firms (those with less than 50 employees)**. Specifically, smaller firms secure 79% more funding relative to their unsuccessful counterparts, compared to 57% uplift in the central estimate (which includes all firms, regardless of size).

Table 17. Sensitivity checks on choice of parameters

[30] We do not include a sensitivity restricted to firms with more than 250 employees due to small sample size.

Outcome	Time period	≤ 250 employees		≤ 150 employees		≤ 50 employees	
		ATT		ATT		ATT	
Probability of fundraising event	T+1	0.018 *	(1.81)	0.015	(1.44)	0.018	(1.62)
	T+2	0.028 **	(2.25)	0.023 *	(1.85)	0.029 **	(2.13)
	T+3	0.049 ***	(3.4)	0.045 ***	(3.04)	0.048 ***	(3)
Number of fundraising events	T+1	0.085	(1.38)	0.068	(1.07)	0.065	(0.96)
	T+2	0.158	(1.41)	0.117	(1.01)	0.123	(0.99)
	T+3	0.374 **	(2.07)	0.262	(1.4)	0.299	(1.47)
Fundraising amount (log)	T+1	0.347	(1.48)	0.331	(1.42)	0.361	(1.49)
	T+2	0.084	(0.44)	0.123	(0.65)	0.238	(1.18)
	T+3	0.514 **	(2.48)	0.452 **	(2.17)	0.58* **	(2.74)

Source: Frontier Economics analysis.

Note: T-statistics in parentheses. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.