



Department for
Business & Trade

ATI Programme Impact Evaluation 2023/24

Final Report

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Executive Summary

Frazer Nash Consultancy and M·E·L Research were commissioned by the Department of Business and Trade's (DBT) Advanced Manufacturing Directorate (AMD) to undertake an independent impact evaluation of the Aerospace Technology Institute (ATI) Programme. This evaluation provides the first quantitative assessment of the ATI Programme.

The Aerospace Technology Institute (ATI) Programme

The ATI programme, a joint government and industry investment, was launched in 2013 and co-funds the development of innovative technologies in the civil aerospace sector. The programme was designed to accelerate innovation and maintain the UK's global competitiveness whilst reducing global aviation emissions. It received £3.5bn of joint funding from government and industry between 2013 and 2024¹. The three main objectives of the ATI Programme are to:²

- Position the UK to lead the global aerospace sector on the path to Net Zero.
- Accelerate the adoption of technologies aligned with a Net Zero ambition through capabilities for design, manufacture, and through-life support.
- Secure UK industrial competitiveness.

The programme includes a Strategic Programme, an SME Programme, Non-CO2 Program, and National Aerospace Technology Exploitation Programme funding streams.³ The Strategic Programme is the focus of this evaluation, and offers funding for research and technology development in the UK to maintain and grow the UK's competitive position in civil aerospace. The Programme is delivered in partnership, coordinated and managed between:

- Department for Business and Trade (DBT), the government department accountable for the programme budget. DBT decides which projects will be funded with government resources and performs value for money (VfM) assessments on project proposals.
- Innovate UK (part of UK Research and Innovation), the funding award and contracting authority for the programme. It delivers the competition processes, including an independent assessment of full stage applications, and provides funding recommendations to the DBT. Following the funding award, Innovate UK manages the programme via contracting projects, and oversees project change requests to completion.
- Aerospace Technology Institute, the strategic advisory to DBT. Its mission is to help the UK realise growth by creating a coherent and ambitious portfolio of research and technology (R&T) projects. It is responsible for developing the UK Aerospace Technology Strategy and encourages projects that fit with this strategy and maximise the potential to the UK economy.

¹ 2024 financial year end, March 31st.

² [ATI-Tech-Strategy-2022-Destination-Zero.pdf](#)

³ [Funding - Aerospace Technology Institute \(ati.org.uk\)](#)

Aims and objectives of the evaluation

The scope of this evaluation focusses on the Strategic Programme funding. The evidence in this impact evaluation provides an understanding of how the ATI programme has contributed to the competitiveness of the UK aerospace sector, how the programme compares to other similar international schemes, the spillover benefits from industry-academia collaboration, and the market opportunities for UK aerospace firms. This evaluation focuses on the impacts of research and development (R&D) funding granted within the ATI programme and it aims to provide evidence on the effectiveness of the programme in achieving its core aims. The key evaluation questions were:

- 1) How far has ATI Programme funding leveraged additional (direct) expenditure on new aerospace technologies (technology readiness level (TRL) 6+), both amongst beneficiaries of ATI Programme funded research and development (R&D) projects and their suppliers?
- 2) How far has ATI Programme funding led to an improvement in the infrastructure which is used to undertake R&D?
- 3) How far has ATI Programme funding created or safeguarded high value jobs in R&D, including the longer-term manufacturing during production in the UK which otherwise might have been lost or moved overseas?
- 4) How far has ATI Programme funding been successful in the development of new civil aerospace technology funded through the projects (i.e., progress through TRLs)?
- 5) How far has ATI Programme influenced the development of partnerships and patterns of collaboration across UK firms, universities public sector organisations, and research organisations, or introduced new ones?
- 6) What additional benefits are realised by beneficiaries who have formed consortiums funded by the programme?
- 7) How far is the ATI Programme expected to deliver spill over benefits in the UK based on evidence on nature and extent of collaborations/supply chain outputs?
- 8) How far has ATI Programme funding increased the UK's share of the global aerospace market?

Methodological approach

This evaluation adopted a mixed-methods approach, which included quasi-experimental econometric analysis and an HM Treasury Magenta book compliant theory-based evaluation. An accompanying technical paper details the econometric approach, which implemented two-way fixed effects and staggered difference-in-difference models to provide robust evidence of the ATI Programme funded companies' performance compared to those not funded and not yet funded in the aerospace and manufacturing sectors. Office for National Statistics longitudinal data from 2010 to 2020 or 2021 (the latest available) was used to observe changes in the following performance measures:

- **Private research and development (R&D) expenditure:** Changes in R&D expenditure indicated the leveraging effectiveness of ATI Programme grants (from the Business Expenditure on Research and Development Survey, data available to 2020).
- **Capital expenditure:** Changes in expenditure on capital investments demonstrated the extent to which ATI Programme grants have stimulated growth in R&D, facilities, and production (from the Annual Business Survey, data available to 2021).
- **Turnover and gross value added (GVA):** Changes in company growth revealed the economic impact of ATI Programme funding (from the Business Structure Database and the Annual Business Survey, data available to 2021).

- **Employment and wages:** Changes in the employment and wages paid to employees showed the impact on workers (from the Business Structure Database and the Annual Survey of Hours and Earnings, data available to 2021).

A counterfactual scenario was developed to understand the additional effect of the ATI Programme, describing what would have happened to companies benefitting from the programme had they not received funding. This analysis used three control groups, representing companies with similar characteristics to those awarded grants in as many ways as possible, aside from funding status. Two control groups were based on the type of business undertaken by the companies, sorted by industry sector. As there may be unobservable differences between companies in both the control and treatment groups that are sorted by industry, the third control group compared companies awarded grants early in the ATI Programme with the companies awarded grants later in the programme period:

- 9) **Manufacturing sector:** The group of companies identified by all two-digit SIC codes between 30 and 33.
- 10) **Aerospace sector:** The group of companies that sit within SIC codes that relate to aerospace; mostly a subset of the manufacturing sector. These companies sit within the seven, five-digit SIC codes that are most common among ATI Programme beneficiaries.
- 11) **Pipeline:** This approach used companies funded later in the programme as a counterfactual to companies funded in the early years to eliminate possible bias in estimates caused by unobserved differences between funded and non-funded companies. This relies on the assumption that the effects of ATI Programme grants were visible amongst the earlier funded companies first.

The three control groups were defined to match the treatment group as closely as possible, and differences in characteristics across groups were controlled for. Therefore, the analytical approach scores a three on the Maryland scientific methods scale.

The primary results presented in this report are the estimates from the staggered difference-in-difference model using the pipeline approach. This model was preferred as it best eliminated possible bias in estimates caused by unobserved differences between funded and non-funded companies. When results from other models are referred to, they are explicitly indicated.

The theory-based analysis included a detailed theory of change (ToC) as a framework for analysis of beneficiary sentiment. Interviews, focus groups, and a survey with recipients of ATI grants were used within a contribution analysis design to analyse causal impact.

Key findings

The findings from this evaluation represent qualitative analysis from interviews, focus groups and survey conducted in 2024 and quantitative analysis up to 2020/2021 (the latest available data). As such, the quantitative results represent a limited time span, seven years post the programme start.

Evidence from econometric analysis showed that the programme has led to substantial benefits that include additional leveraged R&D activity, jobs created or safeguarded, progression through TRLs, and establishment of new partnerships and relationships.

The theory-based evaluation affirms that the programme has made significant contributions to improving the economic outlook, technological progress, collaborative opportunities, and cross-sectoral contribution through its funded projects. One of the most prominent impacts highlighted by beneficiaries has been the formation of new collaborations and the strengthening of existing partnerships. The nature of the programme promotes knowledge sharing between consortium partners, enhancing the overall quality and impact of the research and development efforts. This has accelerated collaborative benefits in the sector by facilitating and integrating diverse perspectives and expertise. Qualitative evidence suggested that large organisations, universities, research

organisations, and SMEs were able to operate in an environment that leveraged expertise and capabilities, drove innovation and strengthened ties between industry and academia.

Quantitative results showed weaker evidence of benefits for collaborating partners in additional company turnover, employment and employee earnings compared to non-funded companies. Results showed no evidence of benefits for collaborating partners in additional R&D expenditure, R&D employment, capital expenditure, or GVA. Thus, the majority of these quantifiable impacts created by the programme were concentrated within a subset of companies, namely those companies leading ATI Programme funded projects.

However, the commercialisation timelines in the aerospace sector are typically ten or more years. As all completed projects took place within the last 9 years, the full commercial benefits are likely to be long-term. Therefore, this evaluation may not capture the expected ultimate effects of the ATI Programme, such as productivity increases, strengthening of the UK aerospace supply chain, and commercialisation of new technologies. The long-term value of the programme will likely be seen by a persistent increase in productivity of funded companies, an area that should be of key interest to examine within the next quantitative evaluation.

Programme progress

The ATI Programme provides grant funding for R&D projects with matched contributions from industry. By the end of the public sector financial year 2024, £1.9bn of government grants (matched by £1.7bn of private industry investment) had been allocated to 417 projects across 438 organisations, 290 of which are SMEs.⁴ To date, 225 projects have been completed.⁵

Research and development activity

The econometric analysis provided evidence that the programme led to a 24% increase in average annual private R&D spending of ATI funded companies, compared to companies that had not yet received funding. The findings imply that over the lifetime of the programme, the programme led to an increase in R&D expenditure of £2.7bn by 2023, showing that 76% of the total £3.5bn spending would not have occurred without the support of ATI Programme grants. However, the impact is seen exclusively within companies who have led funded projects.

The estimated £2.7bn in additional private R&D expenditure was leveraged through £1.9bn of public spending, indicating that the programme leveraged £0.39 of additional private R&D spend per £1 of public sector spending by 2023. The estimated leverage is smaller than comparable programmes focused on other sectors, such as automotive manufacturing. Nonetheless, considering that the commercialisation timelines in the aerospace sector are typically longer than other sectors, it is expected that this analysis underestimates the true effect and that the full impact of the programme will likely be greater in the long-term.

Beneficiary companies echoed this sentiment, noting that the scope of their R&D activity would have been narrower without ATI Programme funding.

“The financial strain post-pandemic has been immense. Without the backing of ATI [Programme] our hands would have been tied, limiting our capacity to innovate.”

Furthermore, SMEs reported that ATI Programme funded, collaborative R&D led to a range of additional intangible benefits. Notably, the programme was reported to have increased the volume of collaborative opportunities, enabling SMEs to better anticipate market needs.

⁴ [Aerospace Technology Institute](https://www.ati.org.uk/) <https://www.ati.org.uk/>

⁵ [Innovate UK funded projects since 2004](https://www.ukri.org/publications/innovate-uk-funded-projects-since-2004/) <https://www.ukri.org/publications/innovate-uk-funded-projects-since-2004/>

"There's a lot of hidden intangible benefits of actually working with companies as partners or even vendors. If you get to know or get a feeling as to their competence and how well and how easy they are to deal with, that is a major influence in being able to give them production contracts in future."

Strengthening the UK supply chain

From interviews, focus groups, and the survey, there is supporting evidence that the ATI Programme helped to develop a strong UK base to advance aerospace work within the region and reduce reliance on imported goods. ATI Programme funded companies claimed that closer work with existing suppliers has enabled them to benefit from economies of scale, co-optimize processes, and transfer expertise. This was reported to be a function of the greater resource and capacity afforded by grants, allowing companies to dedicate additional resource to engaging with the supply chain. Additionally, beneficiaries highlighted the effect of the ATI Programme in generating a greater degree of diversification within supplier networks, providing a better understanding of local capability and expertise.

"The local focus encouraged by ATI [Programme] funding has been crucial in building a strong innovation ecosystem within the UK"

Survey responses supplemented beneficiary sentiment, indicating that approximately 64% of surveyed ATI Programme beneficiaries reported that funding enabled them to focus their efforts on utilising and supporting UK based suppliers.⁶ ATI Programme funding has also allowed 77% of surveyed companies to base their R&D activities in the UK, increasing the number of UK-based companies contributing to the technologies and the number of products developed under the ATI Programme. This has resulted in a higher proportion of aerospace activities being produced in the UK and subsequently led to greater employment opportunities and improved UK competitiveness in the sector.

"For [the type of] test we did, if we had gone to France or gone to the United States it would cost around three-quarters of a million dollars but it's 10% of that if you do it at [UK SME company]"

Economic growth

The econometric results suggested the total growth in turnover was 14% higher for ATI Programme funded companies. Results showed that funded companies leading ATI Programme projects also benefited from a 5% additional increase in GVA, there was no evidence to support such increases in project collaborators. Most beneficiaries reported that the impact of grant funding was more significant than the econometric results suggest. Beneficiaries noted the increase in capability enabled by the programme, and their ability to transform this capability into revenue-generating products.

⁶ Survey response rate was 8%, representing 38% of programme funding. Therefore, survey results are reported as supplementary to interview and focus group evidence, rather than statistically significant in their own right.

"When we started [...] we were probably a less than 10 million turnover organisation. This year we're looking at [sic: between] 100 and 115 million in turnover. So we've grown significantly, each project helps you grow because it attracts more customers and it demonstrates more capability. So you win more projects but also bigger projects."

The programme led to a 3% increase in the wages of workers employed by beneficiaries compared to non-funded companies. However, this does not necessarily reflect a change in productivity; the econometric results showed no evidence to support additional productivity growth, measured by GVA per worker, compared to non-funded companies.

Econometric analysis examined the effect of the programme on R&D infrastructure through two metrics: net capital investment and R&D employment. Results from the preferred model (5) showed no statistically significant increase in capital expenditure in funded companies compared to companies funded later in the programme. Results from other model specifications (1-4) suggested the programme increased capital expenditure by between 5% and 7% per year in companies leading on ATI Programme funded projects.

Results suggested the programme increased R&D employment by 6% in companies leading ATI Programme projects; however, there was no evidence to support such increases in project collaborators. This is equivalent to an increase in R&D employment of between 1,870 and 2,490 R&D job years across the duration of the programme. In interviews and focus groups, beneficiaries reported that the ATI Programme enabled the development of new R&D infrastructure and that the impact was significant.

"Investment in new laboratories and testing facilities through ATI [Programme] funding has significantly enhanced our research capabilities."

Notably, the results presented reflect the short-term impacts, the full economic benefits associated with the programme will likely be determined by how these gains persist over the longer term.

Jobs created or safeguarded

Econometric results suggest that the programme led to a 12% increase in the number of jobs created or safeguarded by UK companies. This estimate indicates that the programme created or safeguarded 59,400 additional job years (jobs multiplied by years) up to 2023.⁷ This finding was independent of company size, as this was controlled for in the econometric specification.

From interviews and focus groups, larger companies noted that some growth in employment over time should be expected, meaning that evidence of sustained impacts attributable to the programme was not easily identifiable. However, SMEs noted that it was rare to attain the long-term contracts necessary to justify long-term employment and emphasised that employment growth was a direct consequence of the income security offered by the ATI Programme.

"We've increased our workforce because of this ATI Programme. We're taking on people and we're training people and they're gaining experience and learning"

⁷ The econometric process did not differentiate between jobs created and jobs safeguarded.

about liquid hydrogen. So, there is definitely both an increase in the number of people we're employing and an upskilling of the workforce."

There was mixed evidence for whether the ATI Programme had substantial influence on beneficiaries' decisions to retain jobs in the UK. The beneficiaries with the capacity to redistribute production across the world, who tend to be large multinational aerospace organisations, noted that ATI Programme funding enabled production to be successfully shifted to UK-based plants. Other beneficiaries noted that ATI Programme funding was only a small factor in production location. These organisations stated that UK-wide factors, such as the relatively high cost of labour and land, the difficulty involved with building new manufacturing facilities, as well as global factors such as Covid-19, were much more influential over the period in question.

"The ATI [Programme] funding has allowed us to bring more work back into our plants, particularly in the UK, which has significantly enhanced productivity and cost-effectiveness."

Development of new civil aerospace technology

As several projects are now complete, there are numerous examples of new and refined aerospace technologies with ATI Programme funding, evidenced by progression through TRLs. Beneficiary organisations noted three types of products and services:

- Aerospace products, such as high-speed electric motors, wings, and fan blades.
- Enabling software, including computer-aided design capabilities, and digitalisation.
- Testing capabilities.

Some new concepts were developed throughout ATI projects, although the programme focused on developing technologies that were TRL 3 or above. These technologies were developed to as high as TRL 6 throughout the programme. Through the process of developing these capabilities, ATI Programme funded organisations achieved several benefits, including upskilling, IP generation, and application of technologies to new contexts. Beneficiaries indicated that components progressed over two TRLs on average across the projects. In almost 30% of cases, components progressed by three levels or more, and in rare cases, components progressed four or more levels.

Beneficiaries also reported that patents were created due to their direct involvement in ATI Programme funded projects. These organisations claimed that new IP enabled them to differentiate their products and services, and, in some cases, led to increased market share.

Whilst this evidence suggested that the programme has had a substantial influence on the development of technologies, there is little evidence from beneficiaries regarding the commercialisation of technologies (TRL7 – 9). This is likely due to the long time horizon to commercialise technologies seen in this sector and is of key importance to analyse in the next evaluation.

Spillover benefits in the UK

Beneficiary companies identified a set of spillover effects, stemming mostly from civil engine development, with wider defence and business aviation applications. For example, improvements in combustion technologies and computational fluid dynamics methods have been leveraged in the development of defence engines, enhancing their performance and efficiency.

"ATI [Programme] funding has been instrumental in fostering collaborations that drive innovation across multiple sectors."

50% of surveyed beneficiaries indicated that the automotive industry heavily benefitted from ATI programme grants, supporting fleet logistics, technologies for large off-road vehicles, and developments in electrification. The construction industry (28%) and the wind and marine industry (14%) realising spillover benefits in manufacturing materials and wing blade development, respectively. The remaining respondents (8%) alluded to knock-on impacts in space, healthcare, defence, and electrical industries.

This evidence indicated some potential benefits seen due to spillovers in the UK, however, there was a lack of other wider spillover benefits seen from cluster or agglomeration effects.

Development of partnerships and collaborations

ATI Programme beneficiaries reported that ATI Programme supported projects had a positive influence on partnerships between large organisations, universities, research and technology organisations (RTOs), and SMEs. Collaboration played a significant role in stimulating growth and performance of UK aerospace firms and contributed to the development of stronger UK aerospace primes, according to beneficiaries. Without the cross-company interactions facilitated by ATI Programme funding, there would be missed opportunities for mutual learning and technological advancements among companies. Therefore, collaboration became vital for continuous learning and development and provided additional opportunities for future employment and career prospects in the industry.

"The cross-pollination of ideas and expertise from different ATI [Programme] projects has been invaluable in driving our R&D efforts."

The collaborations enabled by ATI Programme funding created opportunities to leverage the knowledge and skills of partners. Forming consortiums rather than bilateral (or similar) agreements enabled the funding for universities, research organisations, and industry partners throughout the supply chain tiers to mutually benefit from the collaborations. Beneficiaries highlighted that open communication, knowledge sharing, and problem solving between the consortium members was of key importance to enable firms to make best use of the research base. Moreover, the academic institutions involved in ATI Programme projects are some of the highest performing universities in the UK, by research output, showing that the projects can attract the interest some of the best researchers available.

Through interviews and focus groups, beneficiaries described that interactions with the supply chain were considered valuable for matching between suppliers and customers and streamlining processes. Companies in lower tiers of the supply chain noted the engagement had developed their abilities to meet customer demand more effectively. The evidence of additional benefits to firms across different tiers of the supply chain is limited to areas that can be broadly described as efficiency gains. There was no evidence to support other additional benefits that might arise from forming a consortium, such as de-risking, creating demonstration technologies, or demand aggregation.

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1. Introduction

Frazer-Nash Consultancy and M·E·L Research were commissioned by the Department of Business and Trade's (DBT) Advanced Manufacturing Directorate (AMD) to undertake an independent impact evaluation of the Aerospace Technology Institute (ATI) Programme. The aim of this evaluation was to collect evidence for, and analyse the impacts of, the ATI Programme since its launch in 2013. With a focus on the short-, medium-, and long-term outcomes of the programme, this evaluation also features a new post-project monitoring (PPM) survey to create an evaluation framework for future evaluations.

The evidence gathered during this evaluation provides an understanding of how the ATI Programme has contributed to the competitiveness of the UK aerospace sector, and how the ATI Programme compares to other similar international schemes, such as Clean Sky 2. The evaluation also investigated the spill over benefits from industry-academia collaboration and the market opportunities for UK aerospace firms.

The ATI Programme

The ATI Programme was launched in 2013 and co-funds the development of innovative technologies in the civil aerospace sector. The programme was designed to [accelerate innovation so as to maintain the UK's global competitiveness](#) and as of 2024 has delivered £1.9 billion in government grant funding, achieving £3.5bn spend (total industry and government funding). This joint investment from those organisations that have received grant funding has supported 417 projects across 438, of which 290 are ^{8,9}

In the 2021 Spending Review, the UK government committed to continue funding aerospace R&D through the ATI Programme up to 2031, allocating a further £685m between 2021/22 and 2024/25. The 2023 Autumn Statement allocated an additional £975m for the programme from 2025/6 to 2029/30.

Decisions on which projects to fund are guided by the ATI-developed UK Aerospace Technology Strategy. Its latest iteration, "Destination Zero", was published in 2022 and prioritises [three technology areas](#):

- Zero-carbon emission aircraft technologies.
- Ultra-efficient aircraft technologies.
- Cross-cutting enabling technologies and infrastructure.

The investment is focused around the [three main objectives of the ATI Programme. These are to](#):

- Position the UK to lead the global aerospace sector on the path to Net Zero.
- Accelerate the adoption of technologies aligned with a Net Zero ambition through capabilities for design, manufacture, and through-life support.
- Secure UK industrial competitiveness.

⁹ [Aerospace Technology Institute](https://www.ati.org.uk/) <https://www.ati.org.uk/>

The programme supports industrial research projects or capital infrastructure projects that address the requirements of the UK Aerospace Technology Strategy, such as testing facilities and software projects that enable technology development and technology benefits to the sector.¹⁰

For this evaluation, the following definition applies to ATI programme projects and partners:

- **Portfolio companies** – The two companies that collectively receive the majority of ATI Programme funding. These companies each hold a portfolio of ATI Programme funded projects and engage with many partners throughout the programme.

Previous Evaluations

Three evaluations have been conducted since the launch of the ATI Programme. These are a scoping study, process evaluation and an early impact evaluation.

Scoping Study, 2016

The [scoping study](#) was produced by SQW and Cambridge Econometrics. It established baselines, monitoring systems, and evaluation methodologies for the ATI Programme.

The study highlighted a series of internal and external drivers that present challenges to evaluating the outcomes of ATI Programme funding. For example:

- The diversity of ATI Programme beneficiaries and technology areas means that there is no 'typical' project: projects realise outcomes at different times and in differing ways, bringing difficulty in measuring and capturing benefits.
- Partners are likely to be involved in multiple ATI Programme projects, leading to difficulties both in the use of industry data to attribute outcomes to an individual project, and in the attribution of spillovers (such as a firm in another sector imitating an ATI Programme technology, or ATI Programme partners engaging in further collaboration with other sectors).
- The UK aerospace sector is dominated by a handful of large firms, such as Rolls-Royce or Airbus, all in receipt of ATI Programme funding. This results in there being no suitable counterfactual or control group against which to compare these large firms.

Process Evaluation, 2016

The [process evaluation](#) was carried out by Ipsos Mori to evaluate the effectiveness of the ATI grant awarding process. It comprised 21 policy stakeholder interviews, 20 case studies, and a review of secondary data. The evaluation found that the ATI Programme was successful in attracting a range of different partners, including large industry, SMEs, and academia.

A key finding was that firms that were not ATI Programme funded but had gained aerospace technology patents were most likely to be non-aerospace SMEs. This suggests that technology from other sectors is spilling into the aerospace sector and vice versa and highlights the importance of cross-sector collaboration.

Early Impact Evaluation, 2020

An [early impact evaluation](#) was produced by SQW. It established the short-term outcomes of ATI Programme funding through use of case studies and contribution analysis. Key findings of this work include:

- Indications that ATI Programme funding has positively influenced the decisions of firms to locate production and projects in the UK, with the suggestion that several projects would have been

¹⁰ [ATI-Tech-Strategy-2022-Destination-Zero.pdf](#)

based abroad in the absence of the ATI Programme. This success is attributed to increased certainty, de-risking innovation and the closing of cost-gaps.

- ATI Programme funding helped to progress new technologies through technology readiness levels (TRLs¹¹). All the case study projects had progressed from TRL3 (proof-of-concept) to between TRL4 and TRL6 ('basic laboratory validation' and 'prototype demonstration in a relevant environment', respectively). ATI Programme funding was also linked to subsequent industry investment and progress of projects to between TRL7 ('technology prototype demonstration in an operational environment') and TRL9.¹
- ATI Programme led to improvements in infrastructure that has been used both in the aerospace sector and more widely. However, while there were indications that existing partnerships had been strengthened through ATI Programme funding, no evidence was found to suggest the programme had substantially influenced patterns of collaborations.

Evaluation questions

This report builds on previous evaluations, extending the focus to longer-term impacts of the ATI Programme. It assesses the short (2-3 years), medium (3-10 years) and, partly, long (10-15 years) term impacts of a sample of ATI projects that were launched over a 10-year period between April 2013 and March 2023. This impact evaluation addresses the following questions (Table 1) which were provided by DBT in the original specification for this evaluation.

Table 1. Key evaluations questions from the original specification.

Economic and Strategic Benefits Evaluation Questions	
Q1	How far has ATI Programme funding leveraged additional (direct) expenditure on new aerospace technologies (TRL 6+), both amongst beneficiaries of ATI funded research and development (R&D) projects and their suppliers?
	a How much of this would have not taken place at all/at a slower rate/at higher risk/outside the UK?
	b How far has the availability of ATI Programme funding led to – or encouraged - the initiation of new R&D projects (TRL 3 - 6) in the new aircraft design and manufacturing technologies (i.e. projects' funding)?
Q2	How far has ATI Programme funding led to an improvement in the infrastructure which is used to undertake R&D?
Q3	How far has ATI Programme funding created or safeguarded high value jobs in R&D and the longer-term manufacturing during production in the UK which otherwise might have been lost or moved overseas.
	a How far has the ATI Programme started to influence the plans of aerospace companies to locate production in the UK resulting in commitments for manufacturing jobs?
Technology Benefits Evaluation Questions	

¹¹ Technology readiness levels are a type of measurement system used to assess the maturity level of a particular technology. They range from TRL1 ('basic principles observed and reported') to TRL9 ('actual technology qualified through successful mission operations')

Q4	How far has ATI Programme funding been successful in the development of new civil aerospace technology funded through the projects (i.e., progress through TRLs)?
Collaborations and Partnership Benefits Evaluation	
Q5	How far has ATI Programme influenced the development of partnerships and patterns of collaboration across UK firms, universities, and research organisations, or introduced new ones?
	<p>a How far has the ATI Programme increased the volume and strength of collaborative relationships both between firms in the aerospace industry. E.g., has ATI funding increased the amount (volume, £) of Aerospace manufacturing developed by multiple companies?</p> <p>b How far has the ATI Programme increased the volume and strength of collaboration beyond the aerospace sector? i.e., automotive, marine, defence, wind, and rail supply chains, and with academic institutions?</p>
Q6	What additional benefits are realised by beneficiaries who have formed ATI Programme consortiums?
	<p>a How far does the involvement of research and academic institutions in ATI Programme consortiums add additional benefits?</p> <p>b How far does the involvement of a firms across different tiers of the supply chain in ATI Programme consortiums bring additional benefits?</p>
Q7	How far is the ATI Programme expected to deliver spillover benefits in the UK based on evidence on nature and extent of collaborations/supply chain outputs?
International Comparisons	
Q8	How far has ATI Programme funding increased the UK's share of the global aerospace market?
Q9	How do any impacts arising from the ATI Programme compare against similar international aerospace business support schemes?

The remainder of the report is structured as follows:

2. Methodology – describes the approach to qualitative and quantitative analysis. Further details of the econometric approach are contained in the Technical Annex.

3. ATI Programme progress – provides an overview of the current state of the programme, including funding awarded, projects completed, and the Theory of Change.

4. Direct outcomes and impact on R&D activity - presents the evidence from qualitative and quantitative analysis on the impact of the programme on R&D activity, expansion of capital investment, creating or safeguarding jobs, and company performance.

5. Development of new civil aerospace technology - outlines the different types of technologies and innovations the programme has helped to develop. Presents evidence on the extent to which the programme has influenced creation and application of new and innovative technological developments, progression through TRLs, and development of intellectual property (IP).

6. Collaborations and partnerships – discusses the extent to which the programme has created a cooperative aerospace ecosystem in the UK through formation of new collaborative ties and strengthening of existing partnerships, and partnerships between industry, academia, and research base.

7. International comparisons – discusses how the programme had developed the UK's share of the global aerospace market and how the impacts compare with similar international aerospace business support schemes.

8. Conclusions – concluding remarks on the extent to which the ATI programme has had an impact to date.

2. Methodology

Summary

This evaluation has adopted a mixed-methods approach. It includes a quasi-experimental econometric analysis, development of a theory of change model, a theory-based evaluation, and a review of international comparisons.

Econometric evaluation

The econometric evaluation employed a quasi-experimental approach to evaluate the impact of the ATI Programme. It used Office for National Statistics (ONS) UK business datasets to compare the outcomes of ATI Programme-funded companies (the treatment group) and non-ATI Programme funded companies (the control groups). The analysis uses three different control groups, two of which are based on the type of business and industry sector activity the company undertakes. As there may be unobservable differences between companies in the treatment and control groups that were selected by industry, the third control group compared companies awarded grants early the ATI Programme with the companies awarded grants later in the programme period.

- **The treatment group:** The group of companies that received ATI Programme funding during a given year.
- **The manufacturing control group:** The group of untreated companies identified by all two-digit SIC codes between 30 through to 33. Typically, this control group contained between 1,000 and 10,000 companies each year, depending on the database analysed.
- **The aerospace control group:** The group of untreated companies within the narrower aerospace sectors, reflecting the five-digit SIC codes that are most common among ATI Programme beneficiaries. These industry sectors included *manufacture of air and spacecraft and related machinery* and *manufacture of engines and turbines, except aircraft, vehicle and cycle engines*. Typically, this control group contained between 500 and 4,500 companies each year, depending on the database analysed.
- **Pipeline control group:** This approach used companies funded later in the programme as a counterfactual to companies funded in the early years to eliminate possible bias in estimates caused by unobserved differences between funded and non-funded companies. This relies on the assumption that the effects of ATI Programme grants were visible amongst the earlier funded companies first. Typically, this group contained 100 companies each year.

The analysis measured the causal impact of ATI Programme funding through the following estimators:

- **Two-way fixed effects (TWFE).** The two-way fixed effects model estimates the impact ATI Programme grants had on performance outcomes, whilst controlling for company characteristics and unobserved differences between companies.
- **Staggered difference in differences.** The staggered difference-in-difference (DiD) estimator involves comparing outcomes across different firms and time, accounting for the varying timing for firms being awarded ATI Programme grants. This estimator is particularly useful for capturing variations in treatment timing, as it can provide more precise estimates of the treatment effect compared to other estimators.

To provide robustness, five models were used to estimate the impact on each of the key outcome variables. Model 5 was the preferred approach and provided the basis for the results discussed in this report, as it eliminates possible bias in estimates caused by unobserved differences between funded and non-funded companies. When results from other models are referred to, they are explicitly indicated.

Model 1: Two-way fixed effects estimation using the manufacturing control group, without out time fixed effects.

Model 2: Implements model 1 with time fixed effects.

Model 3: Two-way fixed effects estimation using the aerospace control group.

Model 4: Two-way fixed effects estimation using the pipeline control group.

Model 5: Staggered difference-in-difference estimation using the pipeline control group.

The analysis considered the period from 2010 to 2021 (the most recent available data). The period from 2010 to 2012 acted as a baseline. In this period, the ATI Programme was not in existence. It is possible that some companies within the control groups were supported by funding from other programmes, whilst observed company characteristics are accounted for there may be unobserved effects that are only accounted for by the pipeline approach. The analysis compared the difference in key outcomes between companies receiving ATI Programme grants and non-funded companies from the baseline throughout the 2013 to 2021 period. In doing so, it provided robust quantitative estimates for the impact of the ATI Programme. The econometric evaluation considered the following outcome metrics of company performance:

- **Private research and development (R&D) expenditure:** Changes in R&D expenditure indicated the leveraging effectiveness of ATI Programme grants (from the Business Expenditure on Research and Development Survey).
- **Capital expenditure:** Changes in expenditure on capital investments demonstrated the extent to which ATI Programme grants have stimulated growth in R&D, facilities, and production (from the Annual Business Survey).
- **Turnover and gross value added (GVA):** Changes in company growth revealed the economic impact of ATI Programme funding (from the Business Structure Database and the Annual Business Survey).
- **Employment and wages:** Changes in the employment and wages paid to employees showed the impact on workers (from the Business Structure Database and the Annual Survey of Hours and Earnings).

A detailed explanation of the approach to the analysis of each metric is presented in the accompanying technical report.

Theory based evaluation

The evaluation employed a HM Treasury Magenta book theory-based approach to determine the extent of the ATI programme's impacts and uncover how they materialised.

The theory-based analysis followed three stages. First, a detailed theory of change (ToC) was constructed to provide a framework for subsequent analysis. A range of stakeholder engagement including interviews, focus groups, and a survey was conducted to collect evidence in line with the theory of change. Collated evidence was analysed through a HM Magenta book contribution analysis design to robustly analyse causal impact.

Theory of change

The theory of change is the conceptual framework that establishes the rationale of how a particular set of activities are expected to lead to the immediate outputs, short-term and medium-term outcomes, and long-term impacts of a programme. It is a tool recommended for evaluation by the HM Treasury Magenta book that explains how an intervention is expected to lead to a specific development change or impact, drawing on a causal analysis based on available evidence. This theoretical framework was used to identify the mechanisms that led to the impact of the programme

by mapping inputs through to outcomes and impacts. This provided an overview of how the ATI Programme was expected to make meaningful contributions to the UK economy, the aerospace sector, and the companies that operate in it.

An initial ToC model was created to reflect the knowledge base during the early stages of the evaluation. The model was developed through review of programme documentation, examination of project case studies, and stakeholder engagement.

Consultation with ATI Programme funded organisations

25 stakeholder interviews, 16 surveys and two focus groups were conducted with representatives from a range of organisations that received ATI Programme funding. This resulted in a total of 43 stakeholder interactions as outlined in Table 2. In total, the stakeholders engaged were awarded 66% of the total ATI Programme funding to date.

Table 2. Breakdown of stakeholder engagement activities.

Engagement type	Attendees	Number of companies represented	Response rate to invitation	% of total funding represented
Interviews	Composed of 13 large organisations, 6 small and medium-sized enterprises (SMEs), 3 universities and 3 research and technology organisations (RTOs).	25	24%	13%
Surveys	Composed of responses from large organisations, SMEs, and universities.	16	8%	38%
Focus Groups	Involved project managers from portfolio organisations.	2	100%	16%

Survey response rate was 8%, representing 38% of programme funding. Therefore, survey results are reported as supplementary to interview and focus group evidence, rather than statistically significant in their own right. The mixture of engagement methods enabled the collection of both detailed and high-level information to understand the overarching benefits of programme funding. The approach examined the judgement and opinions of organisations that received programme funding to build a picture of how the financial support has contributed to improving strategic, economic, technological, collaborative impacts, spillovers, and similar international programmes. The responses were assessed using the HM Treasury Magenta Book method of contribution analysis to deduce the key stakeholder themes and validate the theoretical links outlined in the theory of change model. The set of questions used to prompt discussion during interviews and focus groups are presented in appendix A.

Contribution analysis

This approach was used to assess the performance of the programme towards the expected outcomes. The responses from stakeholder consultation were used to test and validate the theory of change to infer causality and provide evidence-backed narrative for the programme's impact. The outcomes and impacts identified in the ToC model were tested through stakeholder interviews and surveys using a set of questions that covered the key thematic areas, as outlined in appendix A. A systematic examination of responses was undertaken and evaluated through thematic and deductive analysis. This illustrated the common themes which were used to identify support (or otherwise) for the causal impact of the ATI Programme, as per the theory of change, providing a credible consensus on the evidence. This process was cognisant of the potential for individuals to be overly optimistic when assessing impact, which was addressed through consensus-based thematic

analysis. A thematic analysis approach was preferred, enabling depth of analysis of stakeholder engagements that spanned a variety of different organisation types.

Evaluation limitations

- **Response rates:** Qualitative analysis focuses on saturation of themes to provide robustness rather than a focus on sample size, however, the response rates for interviews and surveys were 24% and 8% respectively (Table 2). As a result, survey responses were considered in the context of other evidence before conclusions were drawn. Whilst the organisations involved in stakeholder engagements, were in receipt of approximately two thirds of the programme funding, a greater response rate could illuminate greater nuances not observed within the sample.
- **Self-selection and perception:** Respondents are self-selected participants, and the views of those not selecting to participate remained unobserved. Stakeholder responses represent the opinion, judgement, and understanding of what had occurred. Thus, the role within projects, seniority level, exposure to company performance information, and memory of events will differ across respondents and affect the accuracy and the level of detail of the insights. However, the respondents were judged to be those best suited to discuss the impact of funding for their organisation.
- **Availability of data:** Databases used for econometric analysis are updated annually but with a time lag. Data from 2010 was used to give a pre-programme baseline while avoiding the impacts of the financial crisis. The latest available period for the data used was up to 2021. In addition, the databases are a sample of registered UK businesses, meaning that academic institutions and public research organisation were not included in quantitative analysis. As a result, the evaluation quantitatively captured the business impacts of the ATI Programme but not the academic or government impacts.

3. ATI Programme progress

Funding Inputs

The ATI programme provides grant funding for R&D projects with matched contributions from industry. By the end of financial year 2024, £1.9bn of government grants (£3.5bn funding including industry investment) had been allocated to 417 projects, 225 of which have been completed.¹²

Theory of change

The theory of change has been developed to build on the understanding presented in previous evaluations of the ATI Programme; using project outcomes to verify proposed causal mechanisms, and outlining the long-term benefits of the programme and external factors that influence the programme's ability to generate impact. The inputs, activities, and outputs defined the direct consequences of the programme. They are directly controlled by the ATI and its programme partners and are bounded by the scope of the programme.

- **Inputs** are the fundamental resources fuelling the programme including the knowledge, skills, and time of those that run and participate in the programme, as well as the funding to date.
- **Activities** are the actions taken and work performed through funded projects and enabling activities.
- **Outputs** are the research and technology spend undertaken in the projects, the creation of research and technology infrastructure, the creation and strengthening of collaborations, and the expansion in expertise and capabilities in the UK aerospace sector.

Figure 1 sets out the way in which ATI programme outputs lead to beneficial impacts, and in doing so, identifies the key outcomes that drive the programme's impact. Outcomes have been grouped into five categories:

- **Strategic outcomes** drive programme impact by enhancing the market position of UK aerospace companies through non-economic means. These outcomes increased the diversity of suppliers, enhanced reputation, more accessible routes to market, and positions UK aerospace companies for long-term success. They can be expected to increase the performance of UK aerospace companies, reduce reliance on imports, and increase the UK's competitiveness in the global aerospace market.
- **Economic outcomes** contribute to programme impact by quantifiably improving the economic position of UK aerospace companies and UK aerospace workers. Company-level economic outcomes, such as increased R&D investment, turnover, and GVA, are expected to contribute to the UK aerospace sector's growth, innovation, and competitiveness. Worker-level economic outcomes, such as job creation and upskilling, are expected to lead to the UK aerospace workforce expanding and gains in wages and productivity. This, in turn, is expected to make the UK aerospace sector more internationally competitive.
- **Technology outcomes** relate to the additional capabilities gained by ATI Programme-funded companies and the wider UK aerospace industry, including IP, know-how, and technological innovations. Technology outcomes are expected to drive programme impact by advancing the technological frontier of the UK aerospace industry, accelerating commercialisation; and, in the

¹² [Innovate UK funded projects since 2004](https://www.ukri.org/publications/innovate-uk-funded-projects-since-2004/) https://www.ukri.org/publications/innovate-uk-funded-projects-since-2004/

long term, reducing the cost of aerospace components by streamlining processes and enabling mass production.

- **Collaboration outcomes** describe the strengthening of ties between aerospace organisations in the UK. Closer and more frequent collaboration between aerospace primes, SMEs, universities, and RTOs is expected to contribute to programme impact by improving productivity and efficiency, generating follow-on opportunities, and enabling previously inaccessible routes to market. In the long term, these impacts are expected to facilitate an enhanced R&T ecosystem.
- **Spillover outcomes** are a positive externality of the programme. Intra-firm spillovers occur when ATI Programme-funded R&D is used by the funded company in a context beyond its original purpose. Inter-firm and inter-sectoral spillovers occur when knowledge and capability spreads to companies that were not funded by the ATI Programme, enabling further technological innovation. Spillovers also occur between project partners, where ATI Programme-funded organisations gain expertise and capability from project partners. Spillovers are expected to boost the productivity and efficiency of ATI-Programme funded companies and non-ATI Programme funded companies, growing the aerospace and wider UK economy.

Impacts are the medium- and long-term effects that the ATI programme is expected to produce, flowing from each of the five outcome groups and represent a tangible change to the state of ATI Programme project partners, the UK aerospace industry, or the UK economy. The expected impacts of the programme are defined as follows:

- **Higher proportion of aerospace technologies produced in the UK;** enabled by a reduced reliance on imports and a stronger UK aerospace supply chain.
- **Improved performance of UK aerospace organisations;** driven by increased productivity and market access, and spillover effects.
- **Improved aerospace reputation,** both at a company and nation level, as ATI Programme-funded organisations provide valuable new aerospace innovations.
- **Increased competition in the UK aerospace industry,** as suppliers diversify and the number of SMEs with access to aerospace primes increases.
- **Increased UK aerospace GVA and employment,** propelled by expansion of the UK aerospace market as the performance of ATI Programme funded and wider organisations increases.
- **Exploitation of newly produced patents** from R&D projects facilitated by ATI Programme funding.
- **Increased strength of aerospace primes,** as the specialist knowledge SMEs provide is integrated into the production cycle, and ATI Programme funding opportunities are leveraged to access other R&D initiatives.
- **Development of greener technology in aerospace and beyond,** driven by R&D-based efficiency developments and spillovers into wider industries.

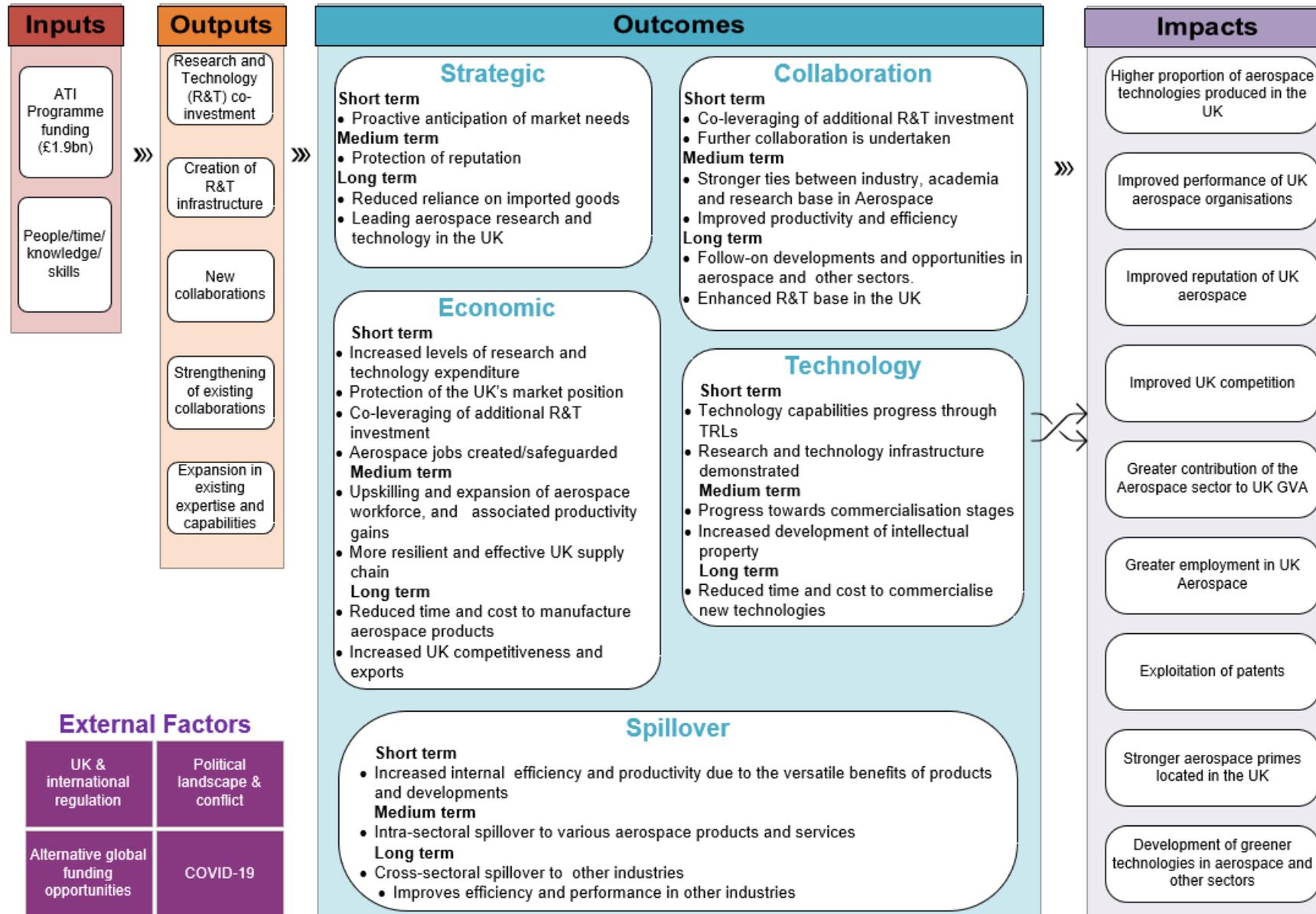
Additionally, the ToC considers a range of external factors that sit outside the sphere of influence of the ATI Programme and are likely to impact the effectiveness of the programme. These factors are as follows:

- Covid-19.
- International and UK-based regulation.

- The political landscape and international conflict.
- Similar international funding programmes.

Each factor represents an exogenous shock to the demand for aerospace organisations' products, the ability of organisations to operate, the global attractiveness of the UK, or the aerospace supply chain. They present the context in which the ATI Programme operates and play a key role in attributing any observed outcomes and impacts to the ATI Programme.

Figure 1. The theory of change model



Completed projects to date

Information on ATI funded projects from inception in 2013 to financial year 2024 was available from Innovate UK¹³. Each listed project is linked to participating organisations and the amount of funding awarded and spend to date. By the end of the 2024 financial year, 225 projects were closed and 92 were ongoing. Table 2 presents the key data for completed ATI projects by lead partner. Information on partners leading on just one project have been summed.

- There were 94 different lead partners across the 225 closed projects. This has changed significantly since the early ATI projects (2013-2016) with 45 projects ongoing and 11 different lead partners.
- Rolls-Royce and Airbus received 45% of the funding of closed projects, £448m (including projects not as lead participant).
- Projects involved between 1 and 17 organisations, although, the majority of project teams were smaller. On average, each project was driven by a group of 4 organisations, 70% of projects had 4 or less organisations.

Table 3. Completed projects breakdown by lead partner

Partner	Number of lead projects	Average number of partners	Award Offered (£)	Actual Spend to Date (£)	Total Costs (£)	Enterprise Size	Region
Rolls-Royce Plc	61	4	307	299	718	Large	East Midlands
Airbus Group	29	5	124	116	261	Large	East of England
Safran Group	8	6	19	18	43	Large	South East
University of Sheffield	7	1	16	16	16	Academic	Yorkshire and The Humber
GKN Aerospace Services	6	5	25	24	50	Large	South East
GE Aviation Systems	5	4	13	13	31	Large	South West
NCC Operations	5	1	28	28	28	Catapult	South West
University of Strathclyde	2	1	7	7	7	Academic	Scotland
Short Brothers	2	3	5	5	10	Large	Northern Ireland
Advanced Manufacturing (Sheffield) Limited	2	3	0	0	1	Micro/Small	Yorkshire and The Humber
Helitune Limited	2	4	1	1	1	Small	South West
University of Nottingham	2	1	6	6	6	Academic	East Midlands
Zeroavia Ltd	2	3	11	10	24	Micro/Small	London
Cabot Design Limited	2	2	0	0	0	Micro/Small	South West
Meggitt Aerospace Limited	2	5	2	2	8	Large	South West
Sensor Coating Systems Limited	2	3	0	0	0	Micro/Small	London
Vertical Aerospace Group Ltd	2	2	12	12	25	Medium	South West
Twil Limited	2	5	4	4	4	RTO	East of England
Phoenix Scientific Industries Limited	2	4	1	1	1	Small	South East
Boeing UK Limited	2	3	2	2	4	Large	London

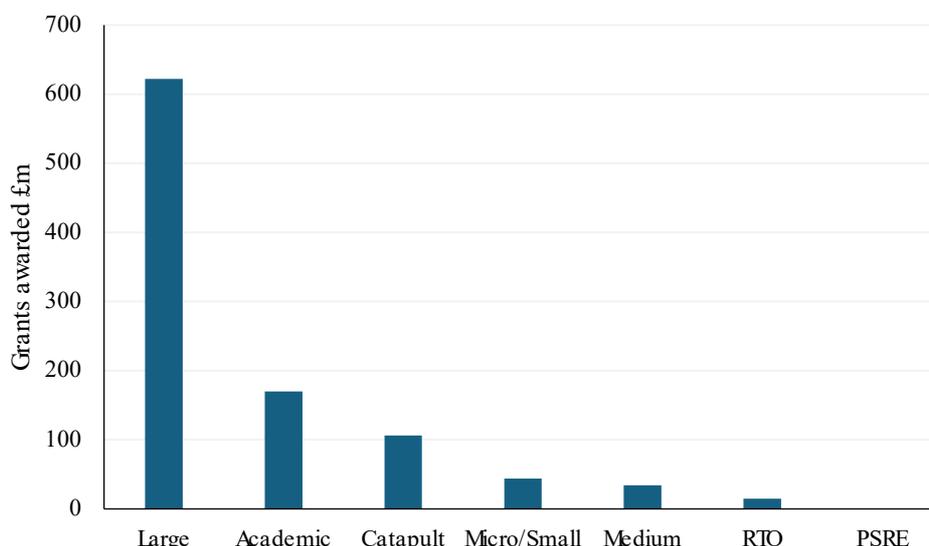
¹³ UKRI (2024). [Innovate UK funded projects since 2004](#).

Qinetiq Limited	2	4	1	1	1	Large	South East
Goodrich Control Systems	2	4	1	1	3	Large	West Midlands
Rinicom Limited	2	2	0	0	0	Micro/Small	North West
Adaptix Limited	2	2	0	0	1	Micro/Small	South East
Others, leading 1 project each	70	3	66	61	99		
Grand Total	225	4	650	628	1344		

Source: Innovate UK, adapted by authors

One of the most significant changes in the make-up of consortia since the previous evaluation is the greater presence of academic and research organisations. There are now 32 academic institutions involved in ATI Programme funded projects, collectively receiving 17% of the grant funding, Figure 2. There is also a greater involvement from small companies. Approximately 9% of grant funding is secured by SMEs, overshadowed by large companies receiving 63% of grant funding. The remaining funding going to Catapult and non-academic research organisations.

Figure 2. Grant funding for completed projects by organisation type



Source: Innovate UK, adapted by authors

Of the completed projects, approximately 34% of grant funding was secured by organisations based in London, 10% in the South East, and 26% in the South West. Figure 3. This concentration reflects the location of the large OEM and Tier 1 companies' headquarters but does not necessarily reflect that location of all R&D activities, which are often spread across multiple locations.

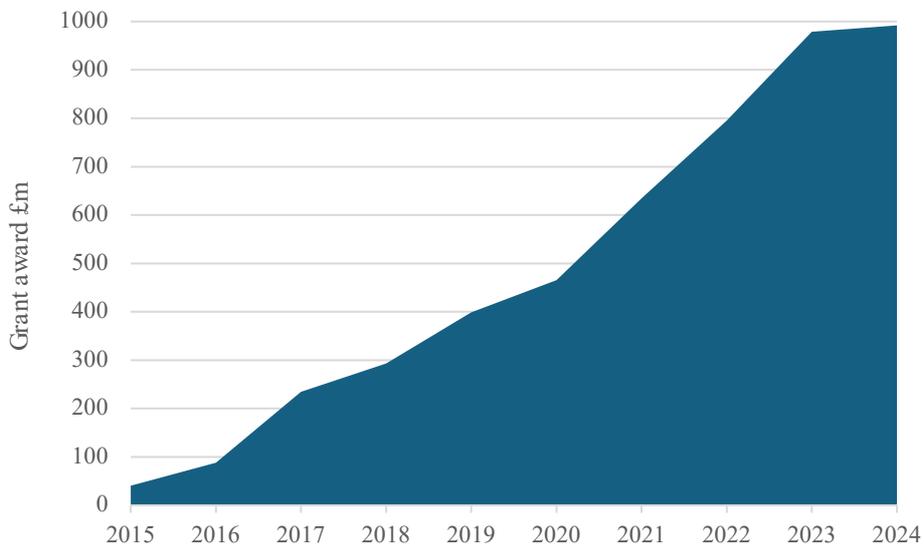
Figure 3 Grants awarded for completed projects by region



Source: Innovate UK, adapted by authors

The first six projects were completed in 2015. Since then, 25 projects have been completed per year on average. Whilst this does highlight the successful completion of projects, it also means that the full impact on the aerospace sector from completed projects may not fully be seen for some time. The time to market in the aerospace sector is typically at least a decade. Therefore, completed projects—all of which fall within the last nine years—are unlikely to have reached commercial maturity yet, limiting their observable impacts.

Figure 4. Cumulative value of completed project grants over time



Source: Innovate UK, adapted by authors

Implications for evaluation

Analysis of the programme progress to date highlights implications for this evaluation:

- **Impact on non-lead partners:** Grant funding was more highly concentrated towards lead partners, and, even more so to Rolls Royce and Airbus. It was important to explore a balance of projects, covering those led by these companies but also the impact on beneficiaries not leading projects.
- **Impact on micro, small, and medium businesses:** Grant funding was highly concentrated within large companies. The beneficiaries range from micro organisations to multinational primes, and include academic institutions, research and technology organisations (RTOs) and catapults. Therefore, the qualitative and quantitative analysis captures the impact of the programme across the variety of organisation types, with a particular interest in the impact on small business.
- **Impact across regions:** Grant funding has been more highly concentrated in the south of England. The variation of the programme's impact across regions in the UK was therefore a key interest and forms part of the econometric analysis.
- **Time to market:** The commercialisation timeline in the aerospace sector are typically ten or more years whereas all completed projects took place within the last nine years. Short-term outcomes such as the additional funding leveraged, changes in employment, progression through TRLs, and the establishment of new partnerships and relationships can be observed. However, the full commercial benefits are likely to be long-term, therefore, this evaluation may not capture the ultimate effects of the ATI Programme.

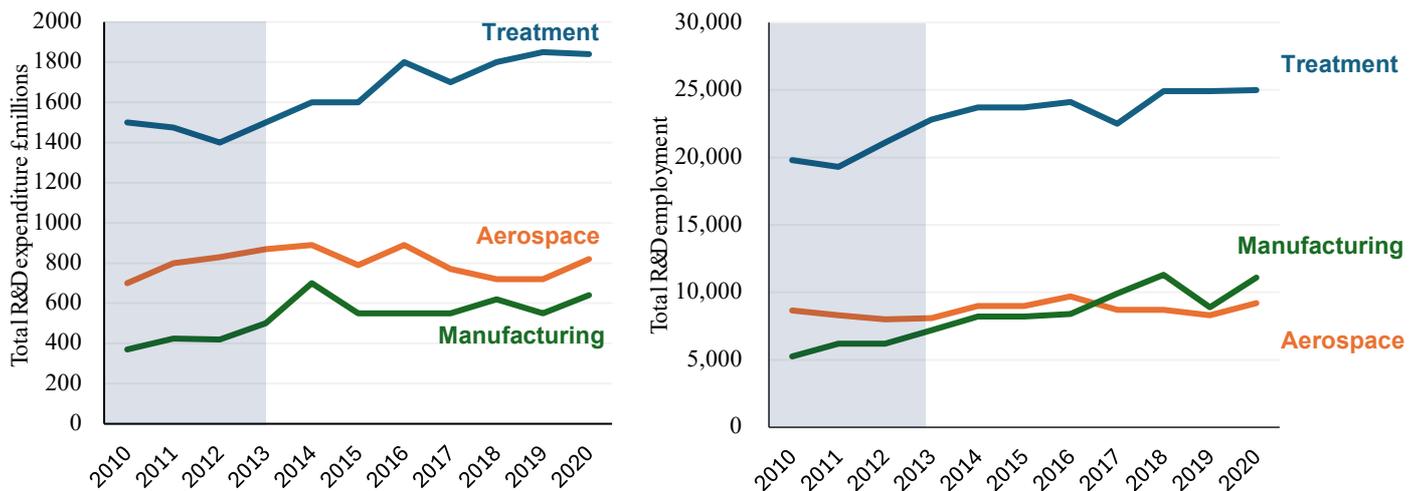
4. Direct outcomes and impact on R&D activity

The findings from this evaluation represent qualitative analysis from interviews, focus groups and survey conducted in 2024 and quantitative analysis up to 2020/2021 (the latest available data). As such, the quantitative results represent a limited time span, seven years post the programme start. This section presents analysis of the effect of the ATI Programme on leveraging additional expenditure on new aerospace technologies, development of infrastructure used to undertake R&D, and creating or safeguarding UK R&D jobs. Findings from the analysis are presented by evaluation question. In each case, the analysis makes use of a mixture of supporting evidence, including econometric analysis, programme documentation, case studies, and perspectives of beneficiaries. The econometric results presented are from staggered difference in difference estimations using the pipeline approach unless explicitly stated, a full set of quantitative findings is presented in the technical annex.

Q1 - Impact on new R&D activity

Figure 5 shows annual R&D expenditure and employment across firms that were and were not awarded ATI Programme grants. This indicates that R&D expenditure and employment of beneficiaries expanded after the programme was launched in 2013, while stagnating amongst companies within the aerospace and wider manufacturing sectors. A notable exception is the expansion in R&D employment in the manufacturing sector over this period, which outweighs the employment growth in the treatment group.

Figure 5. R&D expenditure and employment over time



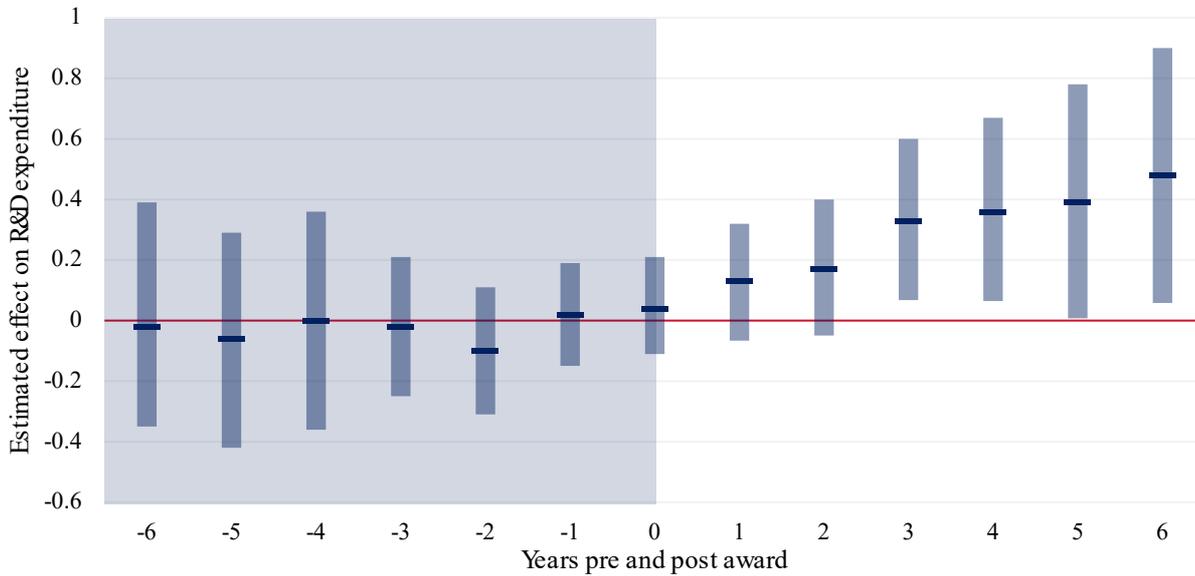
Source: Business Expenditure on Research and Development Survey, adapted by authors. Note: Shaded area is pre-ATI Programme funding.

The econometric analysis provided evidence that the programme led to a 24% increase in average annual private R&D spending of ATI funded companies, compared to companies that had not yet received funding. The findings imply that over the lifetime of the programme, the programme led to an increase in R&D expenditure of £2.7bn by 2023, showing that 76% of the total £3.5bn spending would not have occurred without the support of ATI Programme grants.

The estimated £2.7bn in additional private R&D expenditure was leveraged through £1.9bn of public spending, indicating that the programme leveraged £0.39 of additional private R&D spend per £1 of public sector spending by 2023. The estimated leverage is similar to comparable programmes focussed on other sectors, such as automotive manufacturing. Nonetheless, considering that the commercialisation timelines in the aerospace sector are typically longer than other sectors, it is expected that this analysis underestimates the true effect and that the full impact of the programme will likely be greater in the long-term.

These effects appeared to accumulate three to four years after the grant award was made, indicating that that benefits start to be realised towards the end of projects (the average project lasting approximately three years), Figure 6. The effects also appear to persist up to six years after receiving funding, substantially longer than the average project period. This suggests that the programme has led to additional R&D activity beyond the initial project.

Figure 6. Persistence of effects on R&D expenditure



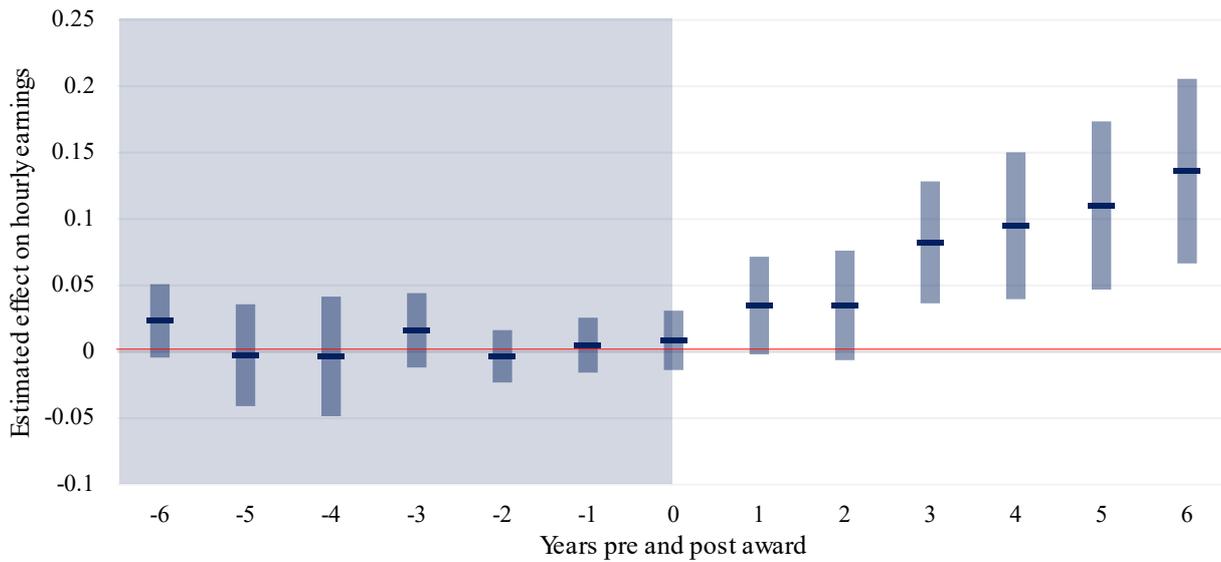
Source: Estimated impacts from econometric modelling by authors.

However, the impacts on additional private R&D expenditure compared to companies funded later in the programme were only observed mainly in companies leading projects. There was no evidence to suggest that collaborators saw additional increases in R&D expenditure, indicating that the benefits of the programme were likely concentrated within a subset of companies. Results showed that R&D-focussed employment was 6% greater due to the ATI Programme. Again, this impact was only evident in project leaders but started to accrue one year on from receiving an ATI Programme award. The effect appears to persist in the medium term showing that the increase in R&D focussed employment out lasts the project period, perhaps representing a more permanent change.

Figure 7.

Despite the quantitative results indicating that only project leaders saw additional increases in R&D activity, qualitative evidence presents a more balance view, showing benefits not other members of the project consortium. Speculatively, therefore, it is expected that changes in the quantifiable outcomes, such as R&D expenditure, may take some time to be realised in collaborating companies. This then will be a focus for future evaluations.

Figure 7. Persistence of effects on R&D employment of project leaders



Source: Estimated impacts from econometric modelling by authors.

From focus groups and interviews, portfolio companies echoed this sentiment, noting that without ATI Programme funding, R&D activities would have necessitated a narrower focus, potentially restricting the exploration of new markets or the expansion of existing ones.

"ATI [Programme] funding has been a game-changer, enabling us to accelerate our research and development efforts."

There is evidence to suggest that the increased volume of R&D has strengthened the supply chain through two mechanisms:

- 12) By strengthening relationships with existing suppliers. Working more closely with existing suppliers (and with larger volumes) has enabled organisations to benefit from economies of scale, co-optimize processes, and transfer expertise. Large, funded companies reported that ATI Programme funding increased the efficiency of collaboration with suppliers, while SMEs emphasised the role of the programme in providing exposure to new products and capabilities.
- 13) By creating a greater degree of diversification within supplier networks. SMEs served a connective role within ATI Programme-funded projects, often bridging the gap between aerospace primes and specialist suppliers. Aerospace primes highlighted their intention to nurture UK suppliers where possible through the programme, resulting in more UK-based SMEs being approached for their services. It enabled larger organisations to understand the local capabilities in the UK and provided them with the confidence to subsequently engage with SMEs on future R&D collaborations.

The ability to bring onboard specialist SMEs helped to create a well-connected aerospace ecosystem. It enabled SMEs to get involved in innovative and challenging projects through the ATI Programme funding, creating new opportunities for SMEs to implement new technologies and improve their knowledge base in the aerospace industry.

"There's a lot of hidden intangible benefits of actually working with companies as partners or even vendors. If you get to know or get a feeling as to their competence and how well

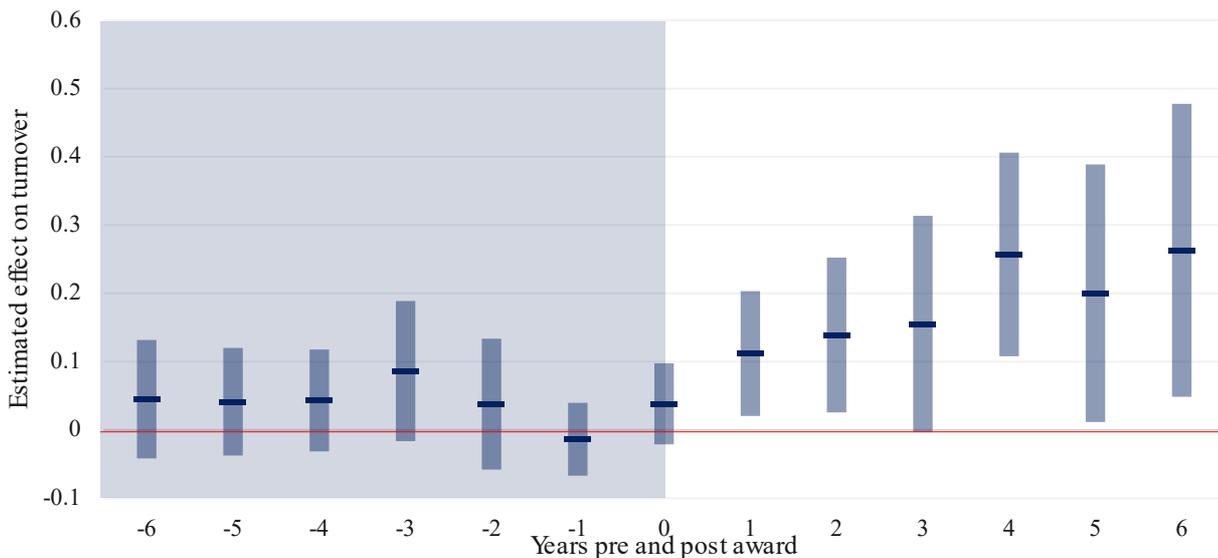
and how easy they are to deal with, that is a major influence in being able to give them production contracts in future."

All SMEs interviewed¹⁴ highlighted that the volume of collaborative opportunities improved because ATI Programme funding helped them to identify new UK based companies to work with. Involvement in ATI Programme projects has enabled SMEs to be proactive in their strategic thinking, bringing services to the supply chain rather than waiting for opportunities to come to them. It has shifted the focus from creating customised products on demand to proactively anticipating market needs and embracing the technologies enabled. However, some SMEs suggested that they have limited resources and funds to get the most out of the ATI Programme as it can be difficult for small organisations to manage large projects. This means that commitments to large changes in R&D, supply chain and post project activities were more challenging.

Impact on turnover, GVA, and productivity

The econometric results showed that the programme has created positive impacts on company performance. They found that total growth in turnover was 14% higher for ATI Programme-funded companies, compared to companies not yet funded. It is expected that increases in turnover would be seen only once the technology was commercialised, perhaps several years beyond completion of the project. However, Figure 6 suggests that increases in turnover accrue shortly after receiving ATI Programme awards. The evidence for this increase in turnover was stronger for companies leading ATI Programme funded projects, with significant impact on collaborators in models 1-4 only.

Figure 8. Persistence of effects on turnover

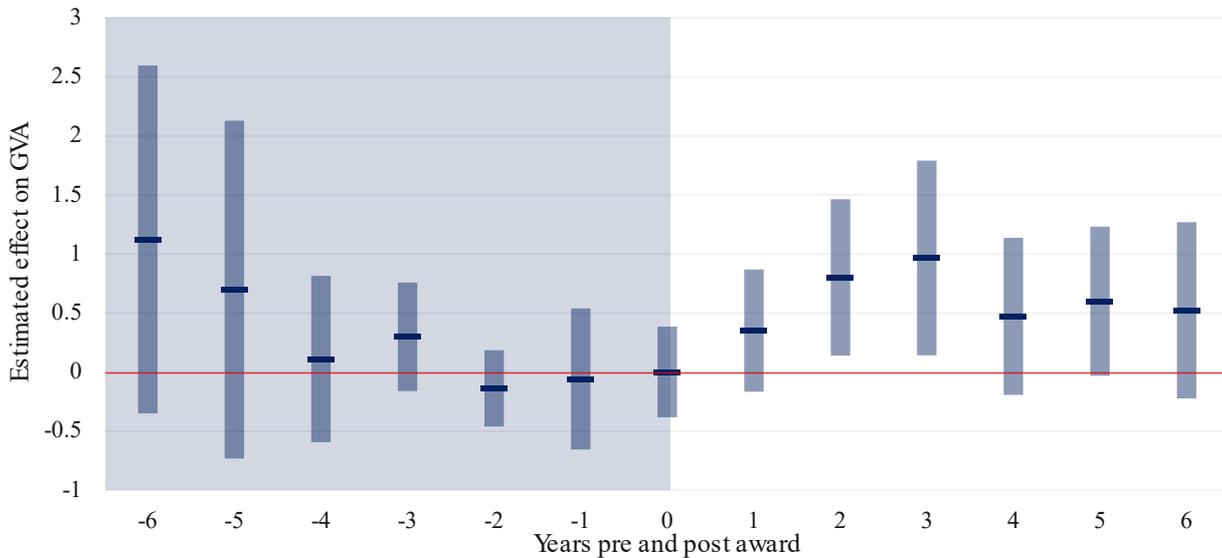


Source: Estimated impacts from econometric modelling by authors.

Results suggested that the ATI Programme increased company GVA by 5% for project leaders only. The results found no statistically significant increase in GVA for collaborating partners. Figure 9 shows that this impact arises two to three years after a company has been awarded an ATI grant but is not persistent over time, fading from four years post. This presents evidence to suggest that the ATI Programme has had an impact on the GVA of companies leading ATI projects.

Figure 9. Persistence of effects on GVA - project leaders

¹⁴ 6 respondents.



Source: Estimated impacts from econometric modelling by authors.

The programme led to increases in the wages of workers employed by beneficiaries by 3% compared to non-funded companies. However, this does not necessarily reflect a change in productivity; the econometric results showed no evidence to support additional productivity growth, measured by GVA per worker, compared to non-funded companies.

From focus groups and interviews, beneficiaries suggested that the grants awarded have had a positive and significant impact on firm performance, specifically noting growth in company turnover. The increase in turnover appears in part to be caused by creating new capabilities which stemmed from working on ATI programme projects.

"When we started [...] we were probably a less than 10 million turnover organisation. This year we're looking at [between] 100 and 115 million in turnover. So we've grown significantly, each project helps you grow because it attracts more customers and it demonstrates more capability. So you win more projects but also bigger projects."

The majority of organisations reported that ATI Programme projects fostered a culture of learning and development. Employees were encouraged to stay up to date with the latest technological advancements and applied new knowledge to their work, leading to ongoing improvements in performance and productivity. Several projects reported productivity improvements, emphasising that improvements arise not only from upskilling employees but also streamlining production, reducing downtime, and reducing planned maintenance frequency.

"Our workforce has benefited immensely from the skills and training opportunities provided through ATI [Programme] projects. It has elevated their expertise and productivity to new heights."

Examples of productivity increases generated by ATI Programme grants

ARCADE: *"The facility recapitalisation of WP1 will have a long-term benefit to the competitiveness of the business, by reducing downtime and planned maintenance frequency, and thus improving*

productivity. The capability improvements will likewise have an impact, by offering to the market niche capabilities not available elsewhere. Both will make the offering more attractive to customers.”

MAXIMAL: *“The outcome of this project will lead to the upskilling and training of 10-15 people, and help to boost their productivity and achieve the required order ramp rates.”*

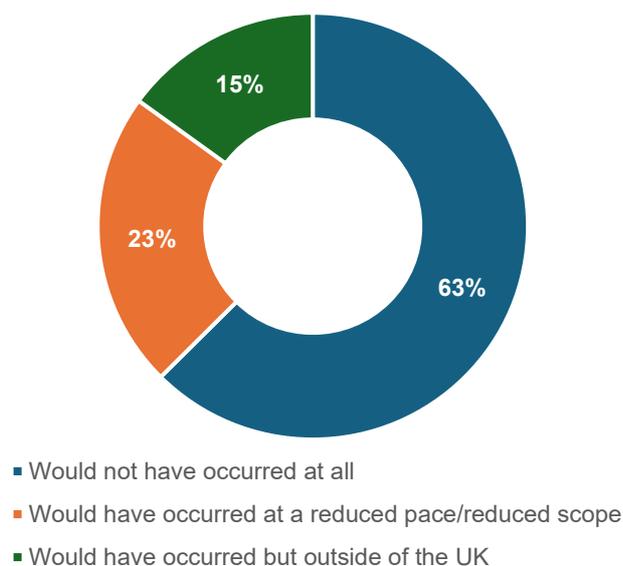
Flexible Robotic Machining: *“... this will enable increased productivity, ramp-up production, and reduce the cost of manufacturing. [there is a] need for the project after carrying out three years of robot machining research for major aerospace companies and high-end automotive manufacturers.”*

Additionality of R&D activities

The central econometric estimate for additional private R&D expenditure implies that the overall impact of the programme on R&D spending of £2.7bn by the end of 2024 financial year. Monitoring data indicated that the total project cost by the end of 2024, including government and industry spending, was £3.5bn. Therefore, over the lifetime of projects 76% (£2.7bn/£3.5bn) of R&D spending would not have occurred in the absence of the programme (implying deadweight of 24%).

When asked 'how likely is it that research and development (R&D) would have taken place in the absence of ATI Programme funding?', 63% of respondents stated that the research would not have occurred at all, Figure 10¹⁵. 23% of respondents highlighted that R&D without ATI programme funding, the R&D activities would have been at a reduced pace and or a reduced scope. 15% of respondents stressed that their projects would have occurred outside the UK without the programme. Beneficiaries noted that the protection offered by the funding programme had been pivotal for organisational planning and decision making, providing additional value by enhancing planned projects, as well as by enabling new projects.

Figure 10. Stakeholder responses outlining the most likely outcome to their project without ATI Programme funding.



¹⁵ Source: interview and survey responses. 40 responses from project leads and partners.

Portfolio companies also reported that they use international funding streams to supplement ATI Programme funding. There are two possible opposing mechanisms by which this could impact the additionality of the ATI programme.

- If ATI Programme funding is insufficient to fund UK-based research efforts, and other funding was also applied, then not all the benefits of the research efforts can be attributed to the ATI programme.

“International funding has provided a significant boost to our research efforts. It has allowed us to scale our projects and collaborate with global experts, enhancing the overall quality of our innovations.”

- If ATI Programme funding is used to leverage additional international funding opportunities, the benefits of the ATI Programme extend beyond the directly enabled projects. Indeed, a portfolio company used ATI Programme funding to secure access to a regional development fund in Singapore, supporting a range of its global R&D projects. The portfolio company claimed that this funding complemented ATI Programme funding, although it is unclear whether any benefit accrued to the UK in this case. However, beyond this single case, there was no evidence that this mechanism did materialise.

A portfolio company claimed that significant post-pandemic financial challenges severely restricted its ability to invest in new technologies independently. It reported that, without ATI Programme funding, the organisation would likely have faced significant challenges in securing the resources needed to undertake ambitious projects. It is likely that the pressures faced by portfolio companies were different to other ATI Programme-funded organisations, with greater exposure to complex global supply chain issues and larger-scale workforce challenges. The consensus among portfolio companies was that this led to a high level of additionality, although it is unclear whether this was true throughout the length of projects, or just post-pandemic.

A portfolio company highlighted the impact funding had on their appetite for R&D risk. The company claims ATI Programme funding enabled it to undertake high-risk, high-reward projects that have the potential to drive significant technological advancements. By providing a financial safety net, it is likely that ATI Programme funding has mitigated the risks associated with these ambitious projects, allowing the company to pursue innovative solutions without compromising financial stability.

“The financial strain post-pandemic has been immense. Without the backing of ATI [Programme], our hands would have been tied, limiting our capacity to innovate.”

Other beneficiaries highlighted additional mechanisms through which ATI Programme participation created additional value: it addressed multiple risks within these organisations, such as the limited opportunities to form partnerships and the lack of technical knowledge. ATI Programme funding enabled ambitious projects go ahead and encouraged collaboration between academia, research catapults and private organisations. As a result, innovative projects were undertaken that would not otherwise have been possible.

Encouraging UK-based R&D

When asked ‘*how far does ATI Programme funding influence your decisions on R&D location?*’, 77% of respondents highlighted that ATI Programme funding encouraged R&D to remain in the UK. There was evidence from interviews that suggested companies had encouraged the use of UK facilities and skills to exploit the benefits of proximity and spillovers. Portfolio companies noted that ATI Programme funding had a significant influence on the location of their keeping R&D operations in the UK, highlighting the connections to local expertise provided by the support as a key factor in this decision.

"The ATI [Programme] partly gives us money not just for our own security in the UK but also to ensure that our design engineers do not migrate to other countries."

The portfolio companies also described the funding provided by ATI as an important incentive to keep R&D activities in the UK. However, they stopped short of claiming that R&D would have moved elsewhere had the funding not been provided. It is, therefore, difficult to conclude that the programme resulted in additional UK R&D activity through this mechanism: the funding may have just made portfolio companies more comfortable that their R&D activity was well-placed in the short term.

"The local focus encouraged by ATI [Programme] funding has been crucial in building a strong innovation ecosystem within the UK".

Securing spending in the UK

The ATI Programme, by design, encourages the development of the UK supply chain. Companies that benefit from ATI Programme funding must explicitly justify the use of a foreign supplier and are encouraged to use UK-based suppliers wherever possible.

The econometric analysis investigated the extent to which the ATI Programme increased intermediate purchases inside and outside the UK. The consensus of primary and secondary results was that there was no statistically significant impact on either purchases inside the UK, or purchases outside the UK. As a result, there was no quantitative evidence that there was a shift in the balance of spending towards or away from the UK.

There was evidence from stakeholder responses to suggest that this has indeed increased the use of UK-based suppliers. The majority¹⁶, (63%) of survey respondents agreed that ATI Programme funding incentivises their organisations to focus their efforts on using UK supply chain companies.

"UK suppliers are used wherever possible, assuming capability and competitiveness are equal."

Interviewed companies reported that sourcing components and technologies domestically has provided several benefits, including:

- Improved quality of output.
- Reduced logistical complexities.

Choosing UK-based suppliers not only benefits the project, but also strengthens the overall aerospace supply chain within the UK. It is a positive externality of the ATI Programme: all UK aerospace companies benefit from supply chain effects when supplier quality improves. As a result, companies reported being dedicated to ensuring funding can improve the UK aerospace sector, which contributes to strong aerospace primes forming in the UK and boosts the competitiveness of the UK aerospace sector.

¹⁶ 25 respondents out of 40.

Q2 - Infrastructure used to undertake R&D

Stimulating additional investment in the UK aerospace sector that leads to improving infrastructure is key to future developments in technologies aligned with a path to Net Zero. Econometric analysis examined the effect of the programme on R&D infrastructure through two metrics: net capital investment and R&D employment. Results from the preferred model (5) showed not statistically significant increase in capital expenditure in funded companies compared to companies funded later in the programme. Results from other model specifications (1-4) suggested the programme increased capital expenditure by between 5% and 7% per year in companies leading on ATI Programme funded projects.

Using the average of these estimates (6%), the annual average treatment effect of capital expenditure would be £195,000 over and above the expenditure found in pipeline businesses after controlling for confounders. Across the 315 treated businesses, this amounts to £61.6m additional capital expenditure per year; more than £550m over the 2013 - 2021 period.

Results suggested the programme increased R&D employment by 6% in companies leading ATI Programme projects, there was no evidence to support such increases in project collaborators. This is equivalent to an increase in R&D employment of between 1,870 and 2,490 R&D job years across the duration of the programme. In interviews and focus groups, beneficiaries reported that the ATI Programme enabled the development of new R&D infrastructure and that the impact was significant.

Through interviews and focus groups, beneficiaries highlighted not only that infrastructure improvements have occurred because of the programme but also the extent to which improvements in R&D facilities have enhanced capabilities. This indicates that there is evidence to suggest the programme has had significant impacts on the infrastructure used to undertake R&D.

"Investment in new laboratories and testing facilities through ATI [Programme] funding has significantly enhanced our research capabilities."

Q3 - Creating or safeguarding high value jobs

There is an array of quantitative and qualitative evidence to suggest that ATI Programme funding has led to an improvement in employment outcomes in the UK, by:

- Increasing the volume and quality of employment opportunities by promoting upskilling and fostering a culture of continuous learning and development.
- Ensuring aerospace production capabilities, and therefore jobs, remain in the UK in the long term.

Generating employment opportunities

Econometric results using information from the Business Structure Database show that ATI Programme - funded companies were estimated to have created or retained 12% more jobs than control companies on average between 2013 and 2021. The average employment in ATI-Programme funded companies was 260 jobs per company. Using the estimated impact on employment implied that 29 jobs were created or safeguarded per company, associated with the ATI Programme. This, in turn, suggested that the programme created or safeguarded 59,400 additional job years up to 2023, assuming that the impact was spread evenly across time. The evidence for this increase in employment was stronger for companies leading ATI Programme funded projects, with significant impact on collaborators in models 1-4 only.

Stakeholder responses also suggested the programme had positive impacts on job creation and retention. Respondents believed that the ATI Programme projects they were involved in have considerably improved the size of the UK workforce, contributing to the direct creation of new jobs and the safeguarding of existing

jobs. The funding has put the development of in-house employees at the forefront. The cutting-edge nature of the projects has necessitated upskilling and training, resulting in a more capable and innovative workforce.

The projects have created new opportunities for career growth and development, fostering a culture of innovation and continuous improvement. The ATI Programme funding has enhanced employment prospects in the industry while making sure the existing labour force were continually stimulated with new challenges and projects. As a result, the labour force naturally become more skilled and experienced, leading to reduced time and cost to produce outputs.

Example 2: Stakeholder responses addressing the Impact of ATI programmes on employment opportunities - Large Organisations

"We want to preserve jobs in the UK. We can only do that if we remain competitive, that's the only way, by developing new technologies making our products leaner, cheaper and more reliable we allow us to remain competitive and therefore to continue those manufacturers in the UK."

"In terms of skills, it's really exposed people to new technologies...it allows them to look at new technologies and embeds them in in the current design process. So not only did it develop our internal design process, but it also develops the understanding people have about it and made them more knowledgeable."

"we've increased our workforce because of this ATI Programme. We're taking on people and we're training people and they're gaining experience and learning about liquid hydrogen. So there is definitely both an increase in the number of people we're employing and an upskilling of the workforce."

"What this project has done is... it's opened the eyes of everybody within the business of what can be achieved. There's a lot of experience here and working on ATI [Programme] projects has really opened that up."

For larger organisations, growth in their workforce is not new and is often expected. Even though larger organisations benefited from an increase in their labour force, they saw greater benefit through the ATI Programme by enabling the existing workforce to learn and develop their knowledge in aerospace. The innovation and technologies provided opportunities for career development and upskilling. It invited interesting and thought-provoking innovation into the business and stimulated employees. The ATI Programme projects offered an opportunity to explore new capabilities and learn new skills, software and manufacturing methods. Therefore, ATI Programme funding became a key enabler for employees to expand their knowledge base and further their career prospects.

Example 3: Stakeholder responses addressing the Impact of ATI programmes on employment opportunities - SMEs

"I believe it has actually led us to strengthen the aerospace team in the company. we've now taken on more people in the engineering team but also on the shop floor, technician grade people, people in testing and that's allowed us really to strengthen our business and support the aerospace section of the business which we couldn't have done without some of the funding."

"As part of the grant, we took on a specific foundry engineer who wanted to learn how to run 3D simulation software and we've got well advanced with this at this early stage of the programme. This is also a new technology for us."

"Previously, before we started on this ATI [Programme] journey, we had a very small core of experienced engineers, and then we flex the work with contractors, but now all of our employees are permanent staff. we can develop them, and we can build their careers, and they come along the journey with us and we build that in house capability, which makes for a much more engaged workforce."

All SME stakeholders interviewed mentioned growth in their employees as a direct result of the ATI Programme. It played a vital part in attracting high-skilled personnel, notably engineers. It also gave SMEs the confidence to employ people on a permanent basis as opposed to periodic and temporary contracts. The funding offered them security and certainty in the expected work streams and contributed to a bigger pipeline of future opportunities. Taking this into account, SMEs were able to strengthen their aerospace capabilities and in turn improve their performance in the sector.

Example 4: Stakeholder responses addressing the Impact of the ATI Programme on employment opportunities - RTOs

"The ATI [Programme] project started in 2014, I think we were 350 people or so during that time and now we're nearly at 1000 employees. what these programs have allowed us to do is build their capability and our reputation."

"We went from a team of 12 people in 2014 to about 70 people by 2018 in that group. So the capability that we developed in that program and the adjoining ATI programme helped us grow hugely. The group today stands at a 100 staff, and that's not including our expansion into Wales and northwest with similar technologies and skillsets transferred across the business. So, we're probably about 200 people in that skill space now."

"ATI [Programme] funding has enabled us to build the capabilities and expertise we need. We have 400 people in the organisation now, where only 10 years ago that was down at about 30. This rapid growth has largely been a result of aerospace programmes and a huge proportion of those aerospace programmes have been ATI [Programme] funded."

RTOs experienced significant growth in the number of employees during the period of the ATI Programme. Even though RTOs are diversified into many other industries, the aerospace industry represents a large portion of the work they are involved in. Stakeholders highlighted that ATI Programme funding provided a larger volume of aerospace research programmes for RTOs to get involved with, allowing for internal capabilities to grow. The density of specialists, particularly around composites, wings and propulsion systems improved and became an asset for the UK aerospace sector. This has helped to foster highly competent engineers and technicians that can continue to solve complex aerospace challenges in the sector.

Example 5: Stakeholder responses addressing the Impact of the ATI Programme on employment opportunities - Universities

"As a result of the ATI Programme, we now have three people who are being upskilled in Artificial intelligence (AI) software. The engineering department has also recently advertised a large number of new academic positions and we're in the process of recruiting several new people."

"It (ATI Programme project) has given us a case study that we can then use for our students. It's given us an opportunity to show and demonstrate to our students the broader application of computer aided engineering. It has given us an opportunity to look at working with the manufacturer processes and alternative processes to what was originally proposed to try and save costs for production."

Universities largely benefitted from training existing employees and building stronger internal departments. One university highlighted that the ATI Programme project was not challenging enough for them, they want to be able to take on more difficult projects but to do so they need the right personnel and expertise available. Therefore, ATI Programme funding is being used as a platform to expand engineering facilities, capabilities and provide opportunities to employ and upskill staff.

ATI Programme participation has also changed organisations' approaches to recruitment. Multi-year security ATI Programme projects mean organisations can make more informed decisions around the size of the workforce. There is a proactive approach to hiring resulting in organisations becoming more interested in the

possibility of building a full capability within the company. They have visibility of the potential capabilities that will be required in the future and can navigate personnel requirements accordingly.

"Clarity on work requirements and consistent project timelines mean steady opportunities are available for future hiring."

Transparency and certainty in outlining future employment plans has multiple benefits. It allows organisations to understand what capabilities require careful attention and it also helps them plan recruitment activities efficiently. At the same time, it provides current employees with confidence that the organisation is headed in the right direction and can potentially reduce employee turnover and improve internal productivity and output.

Locating production in the UK

The influence of the ATI Programme on production location decisions was very different for different organisations. For some organisations, the ATI Programme had a significant impact on whether production was UK-based. These organisations cited the ATI Programme's impact on the UK supply chain, strong industry partnerships, and the UK's skilled labour as key drivers for producing in the UK. In many cases, organisations retained their production in the UK as a result of the ATI Programme. More rarely, the organisations made plans to move or expand production to the UK to build on the capability generated throughout the programme.

Portfolio companies were among those for which ATI Programme had a positive impact. One notable economic benefit derived from ATI Programme funding was the ability to bring more work back into domestic plants, particularly in the UK, thereby enhancing overall productivity and cost-effectiveness.

"The ATI [Programme] funding has allowed us to bring more work back into our plants, particularly in the UK, which has significantly enhanced productivity and cost-effectiveness."

One portfolio company has strategically utilised ATI Programme funding to shift workloads from Derby into the United States and vice versa. The company claimed this strategic redistribution of work was crucial for maintaining a high level of productivity in plants that might otherwise face closure due to falling below economical operational thresholds. However, it also involved reallocating work back into the United States to reduce the company's cost base. While this increase in throughput optimised the use of resources at the company level, it was a single case, and it is unclear whether it was of overall benefit to the UK.

Some organisations viewed the ATI Programme as a small factor in deciding the location of their manufacturing facilities. These organisations stated that UK-wide factors, such as the relatively high cost of labour and land, and the difficulty to build new manufacturing facilities, as well as global factors, such as Covid-19, were much more influential. As a result, the evidence is mixed: in some cases, the ATI Programme was sufficient to attract increased UK production, while in others it was insufficient.

Overall, stakeholder evidence highlights that ATI Programme funding has led to significant improvement in employee growth and skills development. It has enabled employees to improve their existing knowledge and provided opportunities for further career progression. The impact of funding on future production locations was less clear, although some stakeholder respondents did suggest that ATI Programme funding did persuade their production plans to be based in the UK, to align with the rest of the programme and to improve the UK aerospace landscape.

5. Development of new civil aerospace technology

Q4 - Development of new civil aerospace technology

This section outlines the different types of technologies and innovations ATI Programme funding has helped to develop. There is strong evidence that ATI Programme funding has enhanced aerospace technologies and led to advancement in the industry due to:

- Creation and application of new and innovative technological developments.
- Progression through TRLs.
- Development of intellectual property (IP).

Creation and application of new and innovative technological developments

ATI funding has facilitated the development of innovative technology, ranging from product-specific developments such as: high-speed electric motors; wings; fan blades and nacelles, to software developments such as software integration; computer-aided design (CAD) and digitalisation; and testing capabilities. Examples of some of the broad technology areas, impacts and resulting TRLs addressed during stakeholder consultation are detailed in Table 4.

Table 4. Examples of technology area, impact and TRL progression from stakeholder responses

Technology area	Example application	Technology impact on organisation	TRL progression
Hydrogen technologies	Advancement of a whole series of hydrogen technologies to design and implement the conversion of an existing aircraft to a gaseous hydrogen fuel cell propulsion system.	Provided the opportunity to delve into a new market and technology area that otherwise would not have occurred.	Hydrogen fuel cell propulsion system: TRL 0 to TRL 6
Power electronics/ electric motors	Development high speed or ultra-high speed electric motors suitable for turbo machinery. This enabled construction of a turbo compressor unit consisting of a turbine on one end and a compressor on the other end with the motor in the middle. Allowing regeneration of power back from the fuel cell to maximise efficiency with the turbine.	Facilitated follow-on testing in the form of environmental tests, vibrational tests, and conformance to aerospace best practice. Gained valuable learning in relation to the processes required to commercialise and certify compressor units.	Turbo compressor unit: TRL 0 to TRL 5.
Digitalisation and software development	Digitalisation of the design process to understand the geometry, design, rationale and characteristics behind a product through visual programming.	Improved expertise in implementing large language models in the aerospace engineering sector.	n/a
Composite fan manufacturing and development	Development of a lightweight composite fan system as enabling technology for large ultra-high bypass ratio (UHBR) turbofans.	Developed intellectual property (IP) through knowledge gained and processes undertaken.	UHBR turbofans: TRL 3 to 6
Composite wing manufacturing and development	Development of fully integrated folding wing tip mechanical joint for a high span single aisle sized ultra efficient high aspect ratio wing.	Developed IP through knowledge gained and processes undertaken.	Folding Wing Tip Joint and Structure: TRL 3 to TRL 4/5

Key projects and innovations

Some of the key ATI funded projects discussed during consultation with portfolio companies are discussed below:

- 14) The **UltraFan** project is an example of the significant innovation supported through ATI Programme funding. The UltraFan is a high-bypass ratio gas turbine engine, representing a major departure from the traditional Trent family of engines. The UltraFan represents a new generation of high-bypass ratio gas turbine engines, designed to deliver a 25% improvement in fuel efficiency over existing models. This innovative engine incorporates a range of advanced technologies, such as the power gearbox allowing the fan to operate at optimal speeds independently of the low-pressure turbine, enhancing fuel efficiency and overall engine performance.

The success of the UltraFan project to date has been through both the skills, capabilities and tenacity of Rolls-Royce and partner company teams and the financial support received not only through company and partnership funding but government agency support specifically in the UK, the ATI [Programme] funding, which provided the necessary financial support and collaborative framework to bring these advanced technologies to fruition. "The UltraFan project encapsulates our commitment to innovation and sustainability. The support from ATI has been key in making this ambitious project a reality."

- 15) ATI funding helped to spearhead innovation in materials testing and the assessment of turbine blade life. A hallmark project involved the development of the **Direct Current Partial Potential Difference (DCPD) technique** to measure crack growth in situ. This technique allows for in situ crack growth measurement, providing real-time data and enabling extensive testing over prolonged periods. *"The DCPD technique has set a new standard in materials testing, thanks to ATI [Programme] funding"*. This has revolutionised the testing process by enabling extensive and continuous testing over long periods, a capability that was previously unachievable.

The ATI Programme funding facilitated the installation of a fourth testing rig, significantly enhancing the organisation's capacity to perform high-volume testing and develop novel techniques. *"ATI [Programme] funding has allowed us to push the boundaries of what's possible in materials testing"*, a viewpoint which underscores the transformative impact of this financial support.

This innovative approach has not only improved the accuracy and efficiency of testing processes but also opened new avenues for research and development. Commitment to advancing materials testing technology reflects its broader strategy to remain at the forefront of the aerospace industry, leveraging ATI Programme funding to drive technological progress and maintain a competitive edge.

- 16) The **Reinstate program** is a £21 million budget project encompassing a range of advanced technologies, including robotics, improved coating methods, turbine repairs, and digitisation. The project aims to revolutionise the way the organisation conducts field inspections, component repairs, and health monitoring.

In addition to Reinstate, the organisation has several other projects under the ATI Programme umbrella, such as the exploration of digital twinning and health monitoring systems. These projects were designed to enhance aftermarket services, ensuring that the organisation can provide customers with the highest levels of efficiency and reliability.

- 17) The **Smarter Testing** project aims to develop a novel end-to-end digital testing and certification process to support the reduction of product development plan and promote predictive virtual testing (PVT) as a validated certification means of compliance.

The project will focus on developing the verification and validation (V&V), and uncertainty quantification (UQ) capabilities required to increase the credibility of simulation, reduce the number of physical tests and deliver hybrid tests.

18) The **Wing of Tomorrow (WoT)** Programme is an extensive set of wing research projects that are funded by the ATI Programme. The purpose of WoT is to develop and mature next generation wing technologies. Three sample projects are outlined below.

a) **Wing Integrated Assembly Demonstrator (WIRED)** – This project looked at the development of engineering and industrial technologies to enable a high-performance composite wing, using new composite technologies including dry fibre. The main challenges addressed were:

- Development of engineering and industrial technologies to enable a high-performance composite Wing.
- Production ramp and rate capability.
- Digitalisation of development and production.

This project was a first for the organisation to utilise these new composite technologies for commercial aircraft wing structure. The composites were a key enabler to the performance targets due to their improved properties. They also opened the door to high levels of parts integration and a reduction in the number of fasteners and bolts required. However, using a new material presented obstacles in design and assembly, and new methods had to be developed. In addition, new design approaches had to be developed to enable the higher levels of parts integration. These challenges and new approaches were successfully incorporated and enabled the designs of the structural components of the Wing of Tomorrow full-scale demonstrators.

TRL results - All technologies began the project at proof of concept, and by the end of the project, every technology was either laboratory tested or a working prototype. In total, 18 unique technologies were developed across the span of the project, with a median TRL progression of 2.

b) **Wing Structure & System Integration (WSSI)** – The project involved developing the technology of a folding wing joint for a narrowbody, ultra-efficient, high aspect ratio wing. It also addressed:

- Large scale systems installation sub-assemblies to enable high-rate assembly.
- Advanced fluid and electrical systems installation components for high rate equipping and foreign object reduction.
- **TRL results** - In total, 14 distinct technologies were developed. These technologies progressed, on average 2 TRLs through the duration of the project. The majority of components began the project at concept phase and most progressed to at least validation of the technology.

c) **Wing Lean Innovative Future Technology (WingLIFT)** - The key aim for this project was to reduce manufacturing cost and lead time for next generation aircraft programmes through innovative automation and wing assembly technology. A scaled production concept for large, complex aircraft assemblies of the future was delivered as part of the project that has provided the organisation with the ability to safely demonstrate performance, durability, and integrity of future technology solutions. This has resulted in accelerating research and development on some of the key technologies and areas of interest.

The development of advanced fastening solution has been one of the major achievements within this project. This has resulted in the development of a faster, cleaner and more accurate bolting process, which is a fundamental technology required for high rate assembly processes.

TRL results – The WingLIFT project developed 13 distinct technologies, progressing, an average of 2 TRLs throughout the project. The technologies began the project at either concept or proof of concept

stage. By the end of the project, the vast majority has progressed to at least validation of the technology in a representative environment.

Progression through TRLs

Overall, 63% of respondents (27 out of 43 respondents) provided information on TRLs relating to various innovations and technologies undertaken during the project. The TRLs provided ranged from 1 to 6. The average TRL progression was recorded to be from TRL 2 to 5. Not all stakeholders provided data on TRLs as some interviewees were not aware of their TRL progress or did not have accurate TRL information to hand.

The progression in TRLs provided an enhanced research and technology (R&T) infrastructure base in the UK that was utilised for multiple projects. This reduced the time and cost to commercialise new technologies, improving efficiency and scale of operations in the UK aerospace sector. For example, progression in emerging zero carbon technologies, such as hydrogen propulsion, may be helping the UK safeguard its long-term future while also supporting the global aviation's sector aim to achieve a true zero emission flight.

ATI Programme funding has enabled organisations to drive technological advancement with efficacy and flexibility. Respondents highlighted that ATI Programme funding has given them the freedom to test and understand what works to ensure technological developments have transformative impacts in the industry. Progression through TRLs has facilitated follow-on developments and benefitted companies in the form of improving in-house testing capabilities and expertise.

ATI Programme support provides the capacity to test technological advancements systematically to understand benefits and shortcomings. It ensures organisations can take a concept design through maturation to develop an engineered solution.

From the respondents that provided TRLs¹⁷, 85% highlighted that TRLs improved by at least two or more levels as a result of ATI Programme funding and one-third indicated TRLs increased by 3 or more levels. Responses from a portfolio company—which include the WoT projects listed above—indicated that 72 components had been developed across seven ATI Programme funded projects, with each component progressing 2 TRLs, on average. More than a third¹⁸ of these components were at concept phase before the ATI Programme funded project began (TRL 2 or below), and three quarters of components improved by two TRLs or more, mirroring the wider survey. In almost 30% of cases, components progressed by three levels or more, and in rare cases (5 of 72), components progressed four or more levels. The increased R&T spend, improvement in existing capabilities, and the ability to iterate technological processes was the key factors enabling TRL progression. Case study 1 highlights the TRL progression experienced through multiple work packages implemented during an ATI Programme funded project.

¹⁷ 27 respondents

¹⁸ 27 of 72 components

Case study 1: SANTANA**Priority area:** Propulsion and power

Technology: SANTANA (System Advances in Nacelle Technology Aerodynamics) is a collaborative programme focused on developing aerodynamic technologies for the design of advanced Ultra High Bypass Ratio (UHBR) power plant nacelles¹.

Impact: From the 5 partners involved in the project, we interviewed a total of 2 organisations (lead partner and partner). The lead partner highlighted there was limited internal investment available to fund this specific technology. Therefore, ATI Programme funding proved to be imperative in continuing the focus on nacelle technologies. At the time development of wings were seen to me more attractive than nacelles due to bigger investment in resin transfer infusion. However, the funding re-ignited the development of nacelles.

A TRL tracker was implemented for each of the technology work packages (WPs) involved in the project. It saw most WPs progress from TRL 1 to TRL 3/4 during the project. However, two WPs progressed to levels 5 and 6. Examples of the project WPs, TRL progression and justification is provided in **Table 5**.

Table 5. Examples of technology work packages and their TRL progression for project SANTANA

Project stage description	Start of project TRL	End of project TRL	Technology description
Super Hydrophobic coatings	1	6	Coatings proved effective in lab tests.
Optimisation of anti-icing simulation techniques	1	3	Transient methodologies for droplet impingement developed.
Variable Area Fan Nozzle (VAFN) aerodynamic stability	1	3	Methodology for meshing design and geometry and application of correct turbulence model to measure unsteady flow over the VAFN.
VAFN icing study	1	3	Computational fluid dynamics (CFD) analysis studies on VAFN completed with useful conclusions.
Develop and validate CFD techniques to accurately assess excrescence drag	1	3	CFD analysis studies on VAFN completed with useful conclusions.
Prediction of the accumulation of ice on the slat	1	3	Validation of 2D and 3D methodologies to predict accumulation of ice on a slat and neighbouring area around engine nacelle.
Thrust reverser performance validation for low pressure ratio fans	1	5	Scaled wind tunnel testing was completed to validate computational results.

As a result of the technological innovation and R&D implemented through SANTANA, the partner, a UK based engineering SME that specialises in fluid dynamics and thermodynamics were able to gain increased exposure in the aerospace sector. The SME cited that most of their work is in the defence industry and is commercially sensitive. However, SANTANA being publicly funded, provided them with a platform to demonstrate their capabilities in nacelle technologies, thrust

reverse systems, and testing capabilities. The improved knowledge in technological and design processes meant the SME could extend their offering to current and future customers. The project helped them to attain further contracts and gain valuable connections in the sector. This enhanced their reputation in the industry and improved their overall contribution to the aerospace sector and UK economy.

The lead partner also benefitted, highlighting that significant costs were saved by using the UK SME to help with technological advancements and testing capabilities. The lead partner quoted *"for an aerodynamic test on the thrust vector we did, if we had gone to France or gone to the United States it would cost around three-quarters of a million dollars but it's 10% of that if you do it at [UK SME company]"*. This highlighted the importance of exploring local partnerships to improve cost effective technology advancements.

Intellectual property (IP)

68% of respondents¹⁹ indicated that patents were created due to the direct involvement in ATI Programme funded projects and as a result they were able to protect their IP and differentiate their products and services in the market and to their customers. ATI funded organisations responded that patents were particularly effective at strengthening positions in the aerospace industry and led to exploitation gains and increased market share. This enabled organisations to address gaps in their technology and manufacturing processes.

Respondents stressed that ATI Programme funding has helped contribute to the creation of various IP in their businesses. IP was confirmed to be developed in the creation of components, composite development, manufacturing processes, and software development. Only one respondent referred to the number of total patents that were created by their organisation. For example, a lead partner highlighted that a patent portfolio was managed for each technology project they undertook within the company. They recalled that for one ATI Programme funded project, 24 significant ideas were put forward, from which 16 patent applications were filed which are now fully embedded into the company portfolio. This provides evidence to support the increase in the proportion of aerospace technologies and ideas that ATI is helping to stimulate. In addition, partners involved in ATI projects also managed to create IP in novel methods that were previously not explored (see example 6).

Example 6: UltraFan programme

Technology: UltraFan is the world's largest aero engine technology demonstrator containing a suite of new technologies that deliver greater engine performance and fuel efficiency. It features light-weight composite materials and incorporates the world's most powerful aerospace gearbox providing a new architectural design¹.

Impact: Partners involved highlighted that the blade manufacturing processes for the UltraFan programme comprised of composite manufacturing methods that were completely novel. Although the technology had been applied in other places in the past with relatively low TRL, this was the first time it had been applied to a complex fan blade product. This led to IP generation in the creation of composite fan geometry methods and in the reinforcement of materials and mechanical properties to withstand impact (e.g. a bird strike), and multiple patents being launched in relation to the blade manufacturing methods. This is an example of how ATI funding has provided UK organisations with the ability to take technologies through a full process and in doing so, develop valuable trade secrets and patents.

Analysis of responses from stakeholder consultation conclude that there have been major advancements in the range of technologies being supported through ATI Programme funding. It has provided organisations with the financial backing and support to embark on innovative aerospace challenges. Additionally, the

¹⁹ 21 out of 31 respondents

technologies supported have also successfully moved through TRLs to ensure basic principles and concept formulas were being experimented, validated, and demonstrated in aerospace environments. On average TRLs improved by at least 2 or more levels across the projects mentioned by respondents. They also confirmed that the programme supported projects helped to generate new ideas and methods that led to the creation of IP, particularly through the manufacturing of processes and products developed during ATI Programme funded projects. Therefore, ATI Programme funded projects enabled organisations to push their limits and create an environment that promotes innovation. Overall, this has contributed to the improvement in the performance of UK aerospace organisations and lead to a higher proportion of aerospace technologies being produced in the UK. Analysis of responses from stakeholder consultation conclude that there have been major advancements in the range of technologies being supported through ATI funding. It has provided organisations with the financial backing and support to embark on innovative aerospace challenges. Additionally, the technologies supported have also successfully moved through TRLs to ensure basic principles and concept formulas were being experimented, validated, and demonstrated in aerospace environments. On average TRLs improved by at least 2 or more levels across the projects mentioned by respondents. They also confirmed that ATI supported projects helped to generate new ideas and methods that led to the creation of IP, particularly through the manufacturing of processes and products developed during ATI projects. Even though there were challenges to technology development with regards to the usage of new materials and compliance of quality standards, these were identified and swiftly resolved as the projects advanced.

In summary, there has been sufficient evidence to suggest that ATI Programme funded projects have helped to advance new technologies, approaches and methods in the aerospace sector. It has enabled the aerospace industry to explore the possibilities of hydrogen technologies – a novel technology venture, as well as advance the capabilities in composite manufacturing, electronics and digitalisation in the sector. 85% of respondents highlighted those technologies progressed by at least 2 or more TRLs as a result of ATI funding. Progression was related not only to developing the main components or services involved in the project but also in the supporting infrastructure, testing and manufacturing processes that resulted from the project. A large proportion of the finishing TRLs reported lie between levels 3 and 5. Therefore, ATI Programme funding has helped new technologies move through critical early stages of its cycle and facilitated steady progress. However, more could be done to prioritise TRL reporting as 37% of respondents did not provide TRLs potentially due to data availability or inadequate data collection. IP was also developed throughout different stages of ATI Programme funded projects, especially in creation of components, composite development and manufacturing processes. This has played a key role in improving the pace of technological advancements and effectiveness in practice as new ideas and methods provide efficiency in operations.

6. Collaborations and partnerships

Q5 - Development of partnerships and collaboration

There is substantial evidence that ATI funding has fostered a cooperative and close-knit aerospace ecosystem in the UK that is benefitting from collaborative engagement facilitated through ATI Programme funded projects. The main ways through which ATI Programme funding has enhanced collaboration are:

- Formation of new collaborative ties and strengthening of existing partnerships.
- Partnerships between industry, academia, and research base.

New collaborations formed and existing collaborations strengthened

The collaborative efforts have not only accelerated the pace of innovation but have also expanded the scope of research by integrating diverse perspectives and expertise. This synergy has enabled organisations to tackle complex challenges and develop solutions that have a broad range of applications, further enhancing the impact of ATI Programme funded projects.

"The cross-pollination of ideas and expertise from different ATI [Programme funded] projects has been invaluable in driving our R&D efforts."

The general outlook from stakeholders was that the ATI Programme reinforced new collaborations to take place within the UK. If not for funding, there was a high likelihood that collaborations would have occurred with other international companies outside the UK. The strengthening of existing collaborations and the creation of new partnerships were the key outputs contributing to improved productivity and efficiency. Collaboration played a significant role in stimulating growth and performance of UK aerospace firms and contributed to the development of stronger UK aerospace primes. Without the cross-company interactions facilitated by ATI Programme funding, there would be missed opportunities for mutual learning and technological advancements among companies. Therefore, collaboration became vital for continuous learning and development and provided additional opportunities for future employment and career prospects in the industry.

All 43 stakeholder respondents highlighted that the ATI Programme has led to an influence in forming new collaborations and/or strengthening existing partnerships and relationships. There is clear acknowledgement that even though organisations may have continued to sustain existing relationships, involvement in the ATI Programme took their synergy to the next level. It changed the nature of the relationships for the better, in a way that would not have happened without the ATI Programme's support. The arrangements afforded by the ATI Programme simplifies collaboration by defining a feasible and predetermined process. Achieving the same level of collaboration by inter-company commercial agreements would be expensive and time-consuming due to competition between organisations.

75% of stakeholders agreed that collaboration was a fundamental factor in increasing the volume of R&D opportunities and the quality of final outputs. To achieve ambitious project targets, companies had to come together and build effective partnerships to solve difficult manufacturing or technological challenges. Large organisations were able to make use of tailored expertise in specific aerospace subdivisions – boosting performance and market exposure of lesser-known companies and SMEs. The collaborative outcomes from the project VIEWS shed further light on this impact (see case study 2).

Two respondents implied that there can also be negatives to the collaborative nature of ATI Programme funded projects. They acknowledged that it is difficult to win ATI Programme funded projects as a single entity and UK-based collaboration is seen as necessary to ensure funding can be attained. They suggested that there were non-UK companies who may have been better suited to undertake the specific services required but were encouraged to pick a UK supplier to secure the ATI Programme funding for their firm.

"There is a lot of pressure for it (the partner) to be UK, even if it means the technical answer is not brilliant".

However, encouraging UK collaborations has major benefits because companies are obligated to form new partnerships and ties with UK organisations, the same organisations they may have overlooked without the funding programme. The design of the ATI Programme was built on encouraging collaborative R&D and supporting UK-based companies develop tech in the UK. It provides UK businesses with the opportunity to improve their expertise, expand their service portfolio and enhance their reputation in the industry by producing high-quality outputs. Nevertheless, there is a trade-off as the organisation seeking the services may lose out on superior knowledge or lower-cost services if other international collaborations are less likely to be pursued because of ATI Programme funding requirements. However, there is also nothing stopping organisations collaborating with international partners, it is a global market after all. The downside being that such collaborations will not be eligible for ATI Programme grant funding. Therefore, companies must make the best-informed choice regarding the most effective collaboration route. The attractiveness of the ATI Programme funding and the follow-on opportunities seem to outweigh any possible shortcomings in the technical capabilities of choosing UK suppliers or partners. The ATI Programme encouraging regional and local collaboration plays a vital role in safeguarding and enhancing the quality and volume of current and future aerospace technologies that are produced in the UK.

There is sufficient qualitative evidence to suggest that ATI Programme funding has increased the volume of collaborative relationships. The framework associated with obtaining the funding has been a central part of sustaining and promoting new collaborations to remain in the UK. This has created a well-informed UK aerospace environment, encouraging shared learning, joint opportunities and collective improvement.

Collaboration beyond the aerospace sector

Respondents believed that ATI Programme funded projects had a positive influence on partnerships by fostering a collaborative ecosystem that includes large organisations, universities, RTOs, and SMEs. The funding has proven successful in facilitating new collaborations with research catapults and universities, helping to strengthen ties between industry and the research base (see case study 2). However, there is no further evidence from stakeholders that new academic research is focussed more explicitly on industry needs.

Case study 2: VIEWS

Priority area: Aerostructures

Technology: VIEWS (Validation and integration of Manufacturing Enablers for Future Wing Structures). The project aimed to bring promising wing design, manufacturing, and assembly technologies nearer to market readiness, whilst selecting some novel technologies for further development²⁰. Key target of the project was to reduce the cost of wing manufacture and assembly by 20% and process time by 80%.

Impact: One of the key takeaways from project VIEWS was the knowledge transfer and strengthened collaborative ties created between industry, academia, and research. From the 16 different organisations involved in the project, we interviewed 6 (2 large companies, 3 RTOs and 1 university) enabling us to understand the nature of collaborative impacts from each organisation's perspective.

Large organisations

Project VIEWS was a key enabler for organisations to form strong partnerships with different catapult centres across the UK. It enabled larger aerospace companies to become tier one members of catapult centres, contributing to strengthened aerospace ties between research and

²⁰ [ATI Programme Funded Project Portfolio - SharpCloud](#)

industry. Larger organisations were also happy to work with academia, even if it proved to be challenging because some universities were keen to own IPs. University partnerships under the VIEWS programme provided valuable expertise in technology simulation, digitalisation, and modelling. It helped to bring a good balance to tackling the different work packages involved in the project because it allowed larger organisations to seek the right partnerships for areas they are less knowledgeable in.

Large organisations also encouraged smaller businesses to contribute to the innovation developed through VIEWS. The project led to four smaller composite manufacturing companies flourishing over and beyond the period of the project, resulting in further growth and manufacturing opportunities post project completion.

RTOs / Research catapults

The partnerships fostered through VIEWS provided an influx of opportunities for RTOs to implement their knowledge across a variety of work packages. Through VIEWS they were able to provide support in areas such as: winglets, automated assembly, reconfigurable drilling systems, bush insertion processes and software development. Continued strength of collaboration between private businesses and RTOs throughout this project led to a reduction in the time to manufacture wing structures.

RTOs emphasised the importance of the ATI Programme funding in developing a strong pipeline of work and providing a strong mechanism for bringing the whole aerospace network together. There was also further engagement with the supply chain outside of the initial consortium established under the project. The successful collaborative links formed with ATI Programme funding stimulated follow-on developments and discussions. One RTO suggested that follow-on discussions led to the partnership with a UK based integrator leading to the development of a successful machine tool integrator. *"In the UK, we don't have many integrators. It's a real weakness of the UK, but the programme (VIEWS) helped build one, not from scratch because they've been around for a little while, but it created a very credible machine tool integrator"*. The integrator has since been applied to many other projects and programmes to help the aviation community manage the ever-increasing complexities. This reaffirms the importance collaboration has had in enhancing regional manufacturing capabilities. It has facilitated the advancement of aerospace applications to new heights and improved the UK's position in the aerospace industry.

Finally, RTOs indicated that the collaborative nature of ATI Programme funding was a big advantage in driving the UK aerospace sector in an upward trajectory, a luxury that is not available to other sectors (e.g. wind and nuclear) due to the absence of an influential and cooperative funding programme. This support ensures the aerospace sector continues to progress.

University

Project VIEWS required the university to assess the structural integrity of a superplastic forming press through computing and finite element analysis. It enabled the university to undertake collaborations with suppliers that had previously been on the university's radar but never had the opportunity to initiate a working partnership, until VIEWS. More importantly for the university, partnerships originally formed due involvement in VIEWS led to further collaborative ideas that supported undergraduate and postgraduate programmes. The partners approached the university seeking support with various product development proposals. These proposals were then assigned to students as individual or joint projects under their course curriculum. This was an attractive agreement for both parties. It provided private businesses with a stream of innovative ideas at zero cost and it exposed students to valuable practical learning and engineering application.

Additionally, universities have integrated ATI Programme funded projects and tasks into their curriculum, benefiting both undergraduate and postgraduate students: This extensive network of partnerships has been critical in driving innovation and technological advancements within the sector. Case study 3 provides an example of the impact on industry, academia, and the research base.

Case study 3: Aerospace Electric Propulsion Equipment, Controls & machines (AEPEC)

Priority area: Propulsion and power

Technology: Encompasses all aspects of electrical power systems and energy usage on future technology aircraft. Scope covers generation, control, starter-generator function and electrical actuation for more electric aircraft, and variants in regional Jets, biz jets and advanced rotorcraft.

Impact: The SME involved in this project highlighted that because of this project, they managed to integrate and work closely with a university. The SME integrated directly with the university and came to a collaborative agreement to create a design centre based in the university campus. This design centre acted as separate office from the manufacturing sites owned by the SME. Only through ATI Programme funding was this relationship with the university formed. It led to follow-on opportunities for the SME because they were able to utilise campus space in a mutually beneficial manner. It became a design hub and a development lab for the SME, and it also became a facility for university students to apply their knowledge.

This extensive network of potential partnerships has been critical in driving efficiency, innovation, and technological advancements within the sector. The collaborative nature of ATI Programme funded projects has facilitated knowledge sharing and the exchange of best practices among different organisations, enhancing the overall quality and impact of the research project and development efforts.

"Our partnerships with academic institutions and SMEs have been significantly bolstered by ATI [Programme] funding"

Portfolio companies revealed the scale of ATI-induced partnership, with one company claiming it had collaborated with between 200 and 500 UK organisations through the programme. These partnerships, they report, have been instrumental in pooling resources, expertise, and knowledge, leading to more robust and well-rounded research outcomes. The collaborative environment fostered by ATI Programme funding has facilitated the exchange of ideas and best practices, driving innovation forward.

Furthermore, the impacts from nurturing good partnerships were long lasting, they provide follow on opportunities and projects that would never have materialised without the initial ATI Programme collaboration. Therefore, these partnerships allow organisations to further enhance the breadth of their own expertise and capabilities, enabling them to be better equipped to tackle future complex aerospace challenges. This results in a stronger and more resilient UK aerospace sector.

However, there is some evidence that the benefits of collaboration accrue only to ATI Programme funded project leads. There is evidence that the ATI Programme has boosted R&D employment, R&D expenditure, capital expenditure, and GVA for ATI Programme funded project leads; but notably, there is no evidence that these metrics have risen for non-leads. It suggests that, while all types of stakeholders report that the ATI Programme has collaborative benefits, these benefits were not evenly distributed, or were less visible for non-lead companies.

In summary, academic institutions and research bodies also benefit from the collaborative opportunities accruing from ATI Programme funded projects. It creates knock-on opportunities for growth and expansion and gives organisations the confidence to take on new challenges that previously would not have been

possible. It improves cohesion and knowledge sharing within and across organisations and enhances the overall quality of the UK aerospace sector.

Q6 - Additional benefits of forming consortiums

The collaborations enabled by ATI Programme funding created opportunities to leverage the knowledge and skills of partners. Forming consortiums rather than bilateral (or similar) agreements enabled the funding for universities, research organisations, and industry partners throughout the supply chain tiers to mutually benefit from the collaborations. Such benefits may have included de-risking, creating demonstration technologies, or demand aggregation. However, the evidence from interviews and focus groups suggested that beneficiaries valued access to research expertise, learning and development, and matching between suppliers and customers.

Involvement of research and academic institutions

Although approximately 80% of grant funding was awarded to large firms, academic and / or research organisations were part of the consortium in 60% of the projects and were positioned as the lead partner in 5% of projects (capital infrastructure projects only). Evidence from interviews and focus groups highlighted a widespread view that the inputs of the research base were valuable in enabling access to the latest research and methodologies that have helped to develop innovation in processes and technology.

"The involvement of academic institutions has provided access to cutting-edge research and advanced analytical tools, enhancing the overall innovation process."

"Collaboration with universities has been instrumental in driving technological advancements, as we benefit from the latest academic research and expertise."

"Research institutions bring a wealth of knowledge and innovative methodologies, which are crucial for the development of next-generation technologies."

There appear high levels of skills and transferability between firms and sectors. Beneficiaries noted that consortium partnerships have aided upskilling of aerospace labour force through exposure to new, and collaborative research. Ultimately this would lead to growth and retention of the UK aerospace skills base.

"Consortium partnerships have provided valuable opportunities for learning and development, allowing us to tap into a broader range of expertise."

Collectively, these views highlighted that open communication, knowledge sharing, and problem solving between the consortium members was of key importance to enable firms to make best use of the research base. Moreover, the academic institutions involved in ATI Programme funded projects are some of the highest performing universities in the UK, by research output, showing that the projects can attract the interest some of the best researchers available.

Whilst the evidence available demonstrates considerable depth to the benefits to firms from forming consortiums, this was limited to the projects that include research and academic institutions, around 60% of all ATI Programme funded projects. Furthermore, there remains little evidence of the benefits received by the research organisations, for example, whether the projects helped researchers to generate new knowledge and academic publications, or further industry-focused activities.

Involvement of firms across different tiers of the supply chain

From project information available from Innovate UK, aerospace prime and tier 1 companies were awarded approximately 60% of the programme funding.²¹ The prime contractors are the designers, manufacturers and assemblers of aircraft including BAE Systems, Airbus Space and Defence, Leonardo, and Hybrid Air Vehicles. Tier 1 companies manufacture and supply final parts to the prime companies, such as engines, wings, landing gear or fuselages. These companies include Rolls Royce, Bombardier and GKN Aerospace. Approximately 20% of the programme funding was awarded to other parts of the supply chain (tier 2 and 3), enabling a mixture of companies from various supply chain tiers to engage within the consortiums.

Through interviews and focus groups, beneficiaries described that interactions with the supply chain were considered valuable for matching between suppliers and customers and streamlining processes. Aerospace prime companies particularly noted the value of engaging with tier 1 and 2 suppliers in increasing efficiencies in their supply chain processes. Companies in lower tiers of the supply chain noted the engagement had developed their abilities to meet customer demand more effectively.

"Involvement of tier-one and tier-two suppliers in the ATI [Programme funded] consortium has streamlined our supply chain processes, leading to increased efficiency and reduced costs"

"Working closely with suppliers across the supply chain has enhanced our ability to meet customer demands more effectively and promptly"

Beneficiaries noted that engagement with broader tiers of the supply chain had aided the development of new solutions that would otherwise not have arisen. Although, the value of innovation derived from engagement with suppliers was concentrated in the highest parts of the supply chain.

The diverse expertise of suppliers from various tiers has been invaluable in addressing complex challenges and developing innovative solutions"

The evidence of additional benefits is limited to areas that can be broadly described as efficiency gains. There was no evidence to support other additional benefits that might arise from forming a consortium, such as, de-risking, creating demonstration technologies, or demand aggregation.

Whilst the evidence supports benefits of mixing supply chain tiers and that these benefits are not exclusively concentrated within the prime and tier 1 companies, there remains little evidence to suggest the extent to which one tier may have benefited more than others.

Q7 - Spillover benefits in the UK

ATI Programme funded projects have enabled the aerospace industry and other industries to take advantage of the technologies, developments and knowledge created. The spillover impact themes identified relate to:

- Spillovers within the aerospace sector.
- Cross-sectoral spillover benefits into other sectors.

Spillover within the aerospace sector

The interconnected nature of ATI Programme funded projects has produced benefits within the aerospace industry. Technologies and products developed were used inter-changeably within organisations to contribute

²¹ UKRI (2024). [Innovate UK funded projects since 2004](#).

to other ongoing aerospace systems and processes in the business, boosting internal efficiency and operations. For example, insights and follow-on developments from ATI Programme funded projects resulted in companies implementing mini-internal projects. This involved utilising the innovation developed through the ATI Programme to improve their own products and services.

This applied in particular to portfolio companies, with large and diverse capabilities. In one such company, ATI Programme funding has encouraged collaboration between various departments, particularly in the research and development sectors. By providing financial support for interdisciplinary projects, the funding has enabled engineers, scientists, and researchers to work together on innovative solutions that span multiple technical domains. This collaborative approach has led to the development of integrated technologies that combine advancements in aerodynamics, thermodynamics, and materials science, resulting in more holistic and effective solutions.

"The funding has enabled engineers, scientists, and researchers to work together on innovative solutions that span multiple technical domains."

Further examples were identified across other ATI Programme funded organisations: the replacement of steel to composite alternatives, and leveraging the technology developed from a mechanical wing tip to develop high voltage switching control systems for use in military aerospace applications. It is imperative that organisations can continue to leverage the knowledge, technologies and processes developed through ATI Programme funded projects across their existing portfolios. Implementing continuous improvement where possible will increase competition in the UK aerospace industry and lead to better quality of outputs across all domains of aerospace.

Cross-sector spillover

The ATI Programme has produced various cross-sector spillovers, influencing innovation and progress in other industries. The cross-pollination of ideas and technologies has enhanced each organisation's ability to address a wide range of challenges and develop solutions that are applicable across various sectors.

"ATI [Programme] funding has been instrumental in fostering collaborations that drive innovation across multiple sectors."

The development of IP, filing of patents and creation of R&T infrastructure has been the key outputs from the ATI Programme stimulating spillover opportunities. Knowledge and product spillover from aerospace activities has had great impact on industries that struggle to attain funding in their own sector. Therefore, the ATI Programme is indirectly addressing shortcomings in other industries and enabling UK companies outside of the aerospace sector to benefit. This offers reputational accolades for the aerospace industry and contributes to increasing the UK gross value added (GVA).

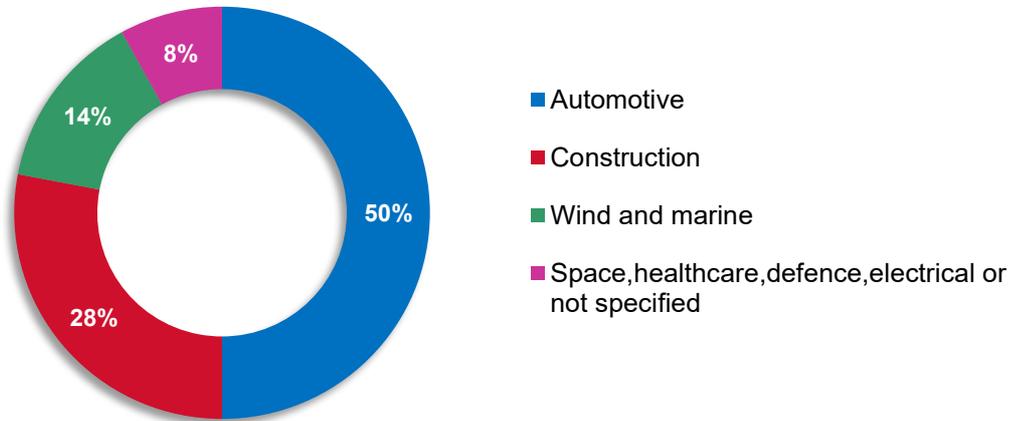
"Integrating technologies from various sectors has been a game-changer. It has enabled us to explore new possibilities and push the boundaries of what is achievable in aerospace engineering."

From the stakeholder responses that confirmed cross-sectoral spillover benefits²², Figure 11 provides an overview of the key industries that benefitted. 50% indicated that the automotive industry benefitted the most,

²² 36 respondents.

supporting electrification, fleet logistics, and technologies for large off-road vehicles. This was followed by the construction industry (28%) and the wind and marine industry (14%) realising spillover benefits in manufacturing materials and wing blade development, respectively. The remaining respondents (8%) alluded to knock-on impacts in space, healthcare, defence, and electrical industries or did not specify an industry.

Figure 11. Industries benefitting from spillover because of ATI funded programmes.



The automotive spillover was not realised in the mainstream automotive sector, but in specialist areas such as fleet management operations and technologies for large vehicles. Knowledge transfer and technological cross-over from ATI Programme funded projects has assisted in generating momentum in this area. Heavy duty automotive industry has taken a keen interest in the hydrogen electric technologies developed from the ATI Programme because these industries face similar challenges relating to emissions and efficiency. Developments from spillover in the electrification space are still ongoing and remain at its inception stage but ATI Programme funding has played a role in expanding the pace of early operations.

Similarly, the construction industry has seen benefits. Robotic systems and visualisation software developed through the ATI Programme have been implemented in manufacturing other goods and services. Furthermore, the knowledge, skills, and qualifications gained by engineers and technicians who worked on funded projects has been transferrable to assist with non-destructive testing (NDT) and other quality assurance practices in the construction industry.

“Working alongside other ATI [Programme] funded projects has been immensely beneficial. The shared knowledge and resources have accelerated our progress and broadened our technological horizons.”

Portfolio companies identified a different set of spillover effects, stemming mostly from civil engine development, benefitting wider defence and business aviation applications. For example, improvements in combustion technologies and CFD methods have been leveraged in the development of defence engines, enhancing their performance and efficiency. Additionally, technological advancements initially developed for large civil engines have been adapted for use in business aviation engines, resulting in performance enhancements and efficiency gains. Portfolio companies also identified two additional spillover benefits, echoing the sentiment of other ATI- Programme funded organisations:

19) Universities involved in ATI Programme funded research projects often incorporate project findings and advancements into their teaching and research programmes. This integration of cutting-edge research into academic curricula enhances the educational experience for students and ensures that they are exposed to the latest technological developments.

- 20) The methodologies and best practices developed through ATI Programme funded projects have been applied to other projects. For instance, advanced project management techniques and innovative R&D methodologies developed through ATI Programme funded projects have been adopted in other areas of the company, enhancing overall operational efficiency and effectiveness.
- 21) The funding has also supported the dissemination of research findings and technological advancements through high-quality publications and conferences. This dissemination is crucial for enhancing the visibility and impact of portfolio companies' innovations in the broader scientific and engineering communities. By sharing their research outcomes, portfolio companies not only contribute to the advancement of knowledge in the aerospace industry but also reinforce their reputation as leaders in technological innovation.

"The methodologies developed through ATI [Programme] -funded projects have been adopted in other areas of the company, enhancing overall operational efficiency and effectiveness."

In addition, ATI- Programme funded organisations highlighted the wind energy sector as a growing industry where aerospace developments could have large significance in the coming years. One beneficiary suggested that large scale composite manufacturing capabilities, that were developed as part of funded projects, could have direct application on the design and construction of wind turbines, suggesting potential future benefits may observed in the wind energy sector. However, the depth of insight offered from interviews and focus groups was dependent on participant's wider industry knowledge and what possible opportunities might arise in the near future.

To conclude, there has been positive sentiment on the impact of spillover from funded projects. It plays a key role in generating additional internal opportunities and improves efficiency in existing systems and processes. Additionally, ATI Programme funding also supports cross-sectoral benefits, especially supporting other sectors that obtain little to no funding. This ensures developments through ATI Programme can offer a wide variety of solutions and provide greater value for money to the wider economy.

7. International comparisons

Q8 – The UK’s share of the global aerospace market

There is evidence to suggest that ATI Programme funding has enabled the UK aerospace industry to advance at a greater pace and gain global recognition. This was enabled through:

- Enhanced reputation and acknowledgement in the industry.
- Follow-on investment and growth opportunities for organisations.

Reputation and exposure in the industry

Companies that received ATI Programme funding reported that the programme facilitated exposure to opportunities that would not have occurred via a traditional commercial route. It provided companies with the right exposure to gain acknowledgement in the industry for the innovative technologies and processes they were working towards.

"Every project we do helps build our reputation. Simply because you're getting to know a lot of different people inside the industry, it's an incremental way in which we build and then demonstrate our capability."

Portfolio companies identified increased global competitiveness as one of the most significant strategic benefits of ATI Programme funding. By undertaking high-profile R&D projects supported by ATI Programme funding, the company claims it has demonstrated its commitment to innovation and technological excellence. This commitment has bolstered the company's reputation as a leading innovator in the aerospace industry, attracting positive attention from customers, partners, and stakeholders. In this case, it is unclear whether the reputational benefits accrue to the UK aerospace as a whole, or just to portfolio companies.

"ATI [Programme] funding has bolstered our reputation as a leading innovator in the aerospace industry, attracting positive attention from customers, partners, and stakeholders."

The global footprint of portfolio companies provided an ability to seek funding from other regions, such as the European Union and Germany, making the ATI Programme essential for maintaining competitiveness and supporting the UK economy. Given the share of UK aerospace market that portfolio companies hold, it is likely that R&D aerospace activities could be lost to competing nations without the ATI Programme's requirements to focus on the UK based supply chain.

Smaller organisations also benefitted from increased competitiveness within the UK aerospace community. All SME stakeholder respondents highlighted that ATI Programme funded work enhanced their relevance, reputation, and recognition in the aerospace industry. They reported that ATI Programme funded projects acted as a platform for companies to promote their services and gain credibility in their area of expertise. It also supported technologies or internal departments that needed additional support to mature. A strong reputation instils confidence in buyers, partners, and investors, increasing competitiveness. It allows companies to distinguish themselves from their competition and it brings financial benefits in the form of increased demand and private investment.

From the stakeholder respondents, this was particularly evident for universities and RTOs. The ATI Programme enabled them to show prospective clients and collaborators that they have the capability to solve difficult engineering challenges and make a significant contribution to the aerospace sector. The Doors Programme funded through ATI (see Example 8) provides an understanding of the reputational impact it can

have on a university. Example 8 below details a specific case in which the ATI Programme enabled a funded university to enhance its global influence.

Example 8: University digital transformation

Technology: Computational engineering and digitalisation to enable major breakthroughs and changes to the way companies design, manufacture, and support the next generation of aerospace products.

Impact: The university involved was able to develop capabilities in large engineering language models and visual programming methods, a department that received very little attention prior to the programme. ATI Programme funding opened the doors for the university to generate meaningful output through computer aided design (CAD) models to decipher geometric and mechanical information of aerospace wings, doors and other components. Due to this programme, the university managed to gain great exposure in this field and have since published several papers in digital engineering models. As a result, the engineering reputation and prestige of the university was enriched, helping to attract new students and staff from around the globe, such as the USA and the Middle East.

The ATI Programme's impact on competitiveness has enabled the UK to attract a wider talent pool and expertise, as well as growing the UK aerospace industry through enhanced exposure and name recognition.

Further opportunities for investment and growth

As the evidence so far suggests, ATI Programme funding has played a significant part in the increased volume of UK based aerospace activity, in turn helping to strengthen the quality of services being provided in the UK. The extensive nature and coverage of the funding allows all types of organisations in the UK to benefit. Organisations can utilise the funding to gain a competitive edge and improve their standing in the industry. One of the smaller companies interviewed suggested that the type of work attained through ATI funding led to additional private investment opportunities. They implied that the "*original £7 million worth of ATI [Programme] funding crowded in £25 million worth of investment*" and in addition, they were on the "*verge of closing another of closing another £20, potentially £30 million*". This in turn will help further enhance their reputational standing and business opportunities and increase the likelihood of being recognised on a global scale. Therefore, the ATI Programme is proving to be highly beneficial to UK companies that find it difficult to acquire work naturally. ATI Programme funding has provided them with a springboard to promote and diversify their aerospace offering.

"ATI [Programme] funding has significantly bolstered the UK's reputation in the global aerospace market, showcasing our commitment to innovation and excellence."

"The technological advancements driven by ATI [Programme] funding have made us more competitive on the global stage, attracting new business and investment."

"Our increased prominence in the global market can be directly attributed to the strategic use of ATI [Programme] funding, which has enabled us to stay ahead of industry trends."

The structure and allocation of ATI Programme funding is such that it helps to address multiple areas of aerospace, helping to improve the holistic picture rather than one technology, component or subdivision. This structure adds great value to the UK, in relation to helping safeguard or create new jobs, products and technologies within the UK region. Furthermore, funded projects encourage UK-based partnerships, suppliers and other related activities in the UK. It leads to improved sales activity and new orders in-turn contributing to improved turnover - boosting the UK market share. One RTO indicated that the ATI Programme has enabled

them to become a world leader in wing technology and manufacturing capabilities, although this strength of claim was uncommon among other RTOs. Highly skilled Individuals from all over the world are seeking employment in the UK to work with them on developing wing technologies. It has given them the credibility and opportunity to build wing related technologies to a world class level.

"ATI [Programme] funding has played a critical role in enhancing the UK's market share in the aerospace sector, positioning us as a leader in the field."

In summary, there is a range of qualitative evidence that ATI Programme funding has had an impact on growing UK's aerospace capability and global stature. The evidence suggests that the programme brought about benefits to UK-based organisations and increased their competitiveness in the global market. It does not imply, however, that the ATI Programme has increased the UK's share of the global aerospace market. Non-UK aerospace companies benefit from similar schemes in other countries (see Q9) that are expected to bring about similar outcomes as the ATI Programme. Indeed, the econometric analysis failed to find any statistically significant evidence that the ATI Programme had an effect on purchases inside or outside the UK. This indicates that there was no shift in the balance of spending towards or away from the UK, a finding that is consistent with a constant market share.

8. Conclusions

The objective of this evaluation of the Aerospace Technology Institute (ATI) Programme was to collect evidence for and analyse the impacts of the programme since its launch in 2013. The findings from this evaluation represent qualitative analysis from interviews, focus groups and survey conducted in 2024 and quantitative analysis up to 2020/2021 (the latest available data). As such, the quantitative results represent the first quantitative assessment the ATI Programme and covers a limited time span, seven years post the programme start.

Evidence from econometric analysis showed that the programme has led to substantial benefits that include additional leveraged R&D activity, jobs created or safeguarded, progression through TRLs, and establishment of new partnerships and relationships. All completed projects took place within the last nine years, therefore, it was expected that these short-term outcomes would be observed. The main results (model 5, pipeline approach) showed the additional impact of projects that concluded earlier in the programme compared to those that finished later. This supports the assertion that aerospace is a long term industry with limited exploitation paths due to the market refresh rate and it could be expected that those projects closing more recently will start to see observed benefits in the next 3 to 5 years.

The theory-based evaluation affirms that the programme has made significant contributions to improving the economic outlook, technological progress, collaborative opportunities, and cross-sectoral contribution through its funded projects. One of the most prominent impacts highlighted by beneficiaries has been the formation of new collaborations and the strengthening of existing partnerships. The nature of the programme promotes knowledge sharing between consortium partners, enhancing the overall quality and impact of the research and development efforts. This has accelerated collaborative benefits in the sector by facilitating and integrating diverse perspectives and expertise. Qualitative evidence suggested that large organisations, universities, research organisations, and SMEs were able to operate in an environment that leveraged expertise and capabilities, drove innovation and strengthened ties between industry and academia.

Furthermore, the programme has been pivotal in the development of new technologies and has driven progression through TRLs, guiding organisations to push innovation towards commercialisation stages. The programme has been vital to the creation and exploitation of new patents positioning a higher proportion of aerospace technologies to be produced in the UK.

The quantitative results showed weaker evidence of benefits for collaborating partners in additional company turnover, employment and employee earnings. Results showed no evidence of benefits for collaborating partners in additional R&D expenditure, R&D employment, capital expenditure, or GVA. Thus, the majority of these quantifiable impacts created by the programme were concentrated within a subset of companies, those companies leading ATI Programme funded projects.

However, the commercialisation timelines in the aerospace sector are typically ten or more years. As all completed projects took place within the last 9 years, the full commercial benefits are likely to be long-term. Therefore, this evaluation may not capture the ultimate effects of the ATI Programme, such as productivity increases, strengthening of the UK aerospace supply chain, and commercialisation of new technologies. The long-term value of the programme will likely be seen by a persistent increase in productivity of funded companies, an area that should be of key interest to examine within the next quantitative evaluation.

In answering the evaluation questions, the analysis uncovered evidence of varying strengths for each of the programme outcomes outlined in the theory of change. Table 6 summarises the strength of evidence uncovered for each ATI Programme outcome in this evaluation. The strongest evidence (highlighted green) was identified by a combination of strong qualitative information and robust statistical results. This was true for outcomes that include leveraged R&D expenditure, company turnover, employee earnings, and jobs created or safeguarded.

Table 6. Strength of evidence supporting programme outcomes (Red/Amber/Green)

ATI programme outcome	Evidence Strength (RAG)	Description
Research and development activity	Green	Leveraged additional private R&D expenditure
	Amber	R&D employment
Strengthening the UK supply chain	Amber	Use of UK supply chain.
	Red	Magnitude of change or persistence over time
Economic growth	Green	Company turnover Employee hourly earnings.
	Amber	Capital investment Employee hours worked Gross value added
	Red	Productivity, GVA per worker
	Green	Jobs created or safeguarded
Jobs created or safeguarded	Red	Displacement of jobs from other industries
	Amber	Progression through TRLs
Development of new civil aerospace technology	Amber	Upskilling IP generation
	Red	Commercialisation of completed technologies
	Amber	Benefits within aerospace and to other industries
Spillover benefits in the UK	Red	Cluster or agglomeration effects
	Amber	Benefits to lower tiers Benefits from collaboration with research organisations and supply chain
Development of partnerships and collaborations	Amber	Collaborator benefits
	Red	

Notes: Green represents 'strong' evidence.

This helps identify opportunities to further the understanding of the programme impacts in future quantitative evaluations. Of particular interest for future examination to help strengthen the future evidence base is a focus on the following areas:

- 22) Analysing company performance outcomes as new technologies reach the market, to identify the impact of commercialisation of new aerospace technologies developed with the programme projects.
- 23) Identifying the extent to which additional jobs created or safeguarded within beneficiary companies have been displaced from other industry sectors, providing an analysis of the overall employment benefit to the UK economy.
- 24) Identifying the extent to which outcomes vary by the makeup of the consortia. This could be useful for understanding targeting, i.e., should the programme focus on university-firm collaboration or otherwise.
- 25) Identifying the extent to which company size impacts the outcomes using a difference-in-difference pipeline approach. The effect of company size was included in two-way fixed effects estimation but not explicitly reported using the difference-in-difference pipeline approach (project leads / collaborators was investigated instead).
- 26) Capture the longer-term benefits of the programme by future investigation into outcomes of projects the completed early in the programme schedule.

Appendix A – Interview and focus group questions

Table 7. stakeholder evaluation questions used for interviews and focus groups.

<p>Strategic Benefits</p>	<p>1. How likely is it that research and development (R&D) would have taken place in the absence of ATI funding?</p> <p>a. Without funding would the project ...</p> <p>i. Have continued as is</p> <p>ii. Have been delayed (how? In what ways?)</p> <p>iii. Have been cancelled</p> <p>iv. Proceeded in a diminished form (in what ways?)</p> <p>v. Have moved overseas? (where, what scheme, why?)</p> <p>2. How far does ATI funding influence your decisions on R&D locations? (if applicable)</p> <p>3. How far does ATI funding influence your decisions on the location of post project activities including the commercialisation of relevant technologies and related manufacturing? (in what ways?)</p> <p>4. How far does ATI funding incentives influence your decisions to use UK supply chain companies for supplying the future technologies/components for your product?</p>
<p>Economic Benefits</p>	<p>5. In what ways has participating in ATI effected your workforce? (skills, productivity, further opportunities)</p> <p>a. What skills has your workforce developed through the project?</p> <p>b. How do will these skills benefit your organisation in the future?</p> <p>6. How has the project influenced your decisions on hiring and future investment?</p> <p>a. How was this further investment accessed? And how will it be used?</p> <p>7. In what ways has the innovation contributed to a change in market position for your organisation? (i.e. competitiveness, exports, orders, de-risking)</p>
<p>Technology Benefits</p>	<p>8. Can you please provide a brief introduction to the Project and the innovation your organisation has carried out with ATI funding?</p> <p>a. What technology areas did your organisation develop with ATI funding?</p> <p>b. Was any IP created as a result of the project? (What was created? How has it been used since the project has been complete?</p> <p>c. Indication of starting and finishing TRL levels?</p>
<p>Collaborations and partnership benefits</p>	<p>9. How far have ATI projects influenced the partnerships your organisation is a part of? (existing, new, future)</p> <p>a. Was the project built on existing relationships with partners?</p> <p>b. What new relationships were created during the project?</p> <p>c. How has your involvement in the project led to further collaboration with ATI projects outside of this project?</p> <p>d. Have you worked with the project partners on other ATI projects following the completion of {case study project}?</p>

	<p>i. If no: How likely would you be to continue working with these partners in the future?</p> <p>10. Has the project led to or required collaboration with other projects funded under ATI? (how, what, why)</p> <p>a. Has your project used any technology developed with ATI funding? b. Is the technology developed during this project being used in the development of other technologies funding through ATI?</p>
<p>Spillover benefits</p>	<p>11. Has the innovation funded through ATI contributed to any cross-sector collaboration? (spill overs and spill-in, working with partners in different sectors)</p> <p>a. Have you made use of any technology innovations developed in different sectors? - b. Has the technology developed during this project been exploited in other sectors? (How? Which sectors?) c. Have you developed the technology through public funding in other sectors?</p>
<p>International Comparisons</p>	<p>12. Has your organisation made use of any international funding streams to develop aerospace technologies? (What stream? Why?)</p> <p>If yes: a. How has the support process differed from ATI? b. How has your organisation used this funding?</p>

Appendix B – Survey questions

Q1

This section asks for details on the original ATI funded project so that we can link your answers to our existing records.

Project Name _____

Project Number _____

Name of Company _____

Name of employee filling out this form _____

Contact email address _____

Year of project closure _____

Q14

Does this project relate to any other project funded by Innovate UK

(For example: Has your organisation worked on another project where this technology has been developed?)

Yes

No

Q2m

This section focuses on further collaborations that have taken place as a result of the original project since it closed. This allows us to understand where the learnings gained from the project may 'spillover' into other companies or new applications. This demonstrates the wider impact of the project.

Collaboration occurs when two or more participants agree to take responsibility for a task or series of tasks associated with the project, and information is shared between the parties to facilitate the agreement.

Since the project has completed, have you had any new collaborations with any of the following as a result of this project?

With other consortium partners

With potential customers

With a private investor

With government or public funders

With research and technology

With regulatory bodies

With suppliers

Other (please specify) _____

No new collaborations

Q2_1_1n

How many new collaborations that have occurred as a result of this project since it has completed?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10+
- Don't know

Q2_1_2_1oe

Please provide a short description of the new collaborations. Where possible, include the collaborator's organisation and explain how the original project supported this collaboration.

Q25

For the following organisations, please indicate whether you worked with them on this (closed) project (excluding consortium members) or have worked with them previously on a different project:

Please tick all that apply.

	This Project	Previously	Never	Never
Knowledge Transfer Network (KTN)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enterprise Europe Network (EEN)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catapults	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Innovation and Knowledge Centres (IKCs)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Research and Technical Organisations (RTOs)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UKTI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design Council	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Growth Hubs or LEPs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Universities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Investors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Devolved Administrations (Northern Ireland, Scotland, Wales)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ATI Advisory or working groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q26

For those you worked with on the current project, do you expect to continue working with these organisations in the future?

- Yes - All of them
- Yes - Some of them
- No - None of them

Q33

Has involvement in this project created an academic spin out, or is it expected to create an academic spin being formed (for example a business created to enhance the results of university research activity and scientific knowledge)?

- Yes, created
- Yes, expected
- No
- Don't know

Q34

Please provide the company name and CRN.

Q2_2

This section focuses on the follow-on activities that have occurred since the original project was completed. This helps us to understand the wider impact that the project has had.

Have there been any unexpected outcomes that were not described at project closure?

- Yes
- No

Q2_2_1oe

Please provide further details on the unexpected outcomes and how the project supported this work.

Q2_3_1n

If the original project has led to any further projects, or been combined with an existing project to produce a product/process/service, please indicate the number and provide the details of the associated projects that have been created as a result.

Please only include projects that were not described at project closure and have taken place after the original project has completed. Include both publicly funded and commercial projects.

- 1
- 2
- 3
- 4
- 5
- 6

- 7
- 8
- 9
- 10+
- Don't know

Q2_3_1a

Project 1

Project name _____

Estimated project completion date _____

Project lead (organisation) _____

Funding or contributing agency _____

IUK project number if applicable _____

Q2_3_1b

Project 2

Project name _____

Estimated project completion date _____

Project lead (organisation) _____

Funding or contributing agency _____

IUK project number if applicable _____

Q2_3_1c

Project 3

Project name _____

Estimated project completion date _____

Project lead (organisation) _____

Funding or contributing agency _____

IUK project number if applicable _____

Q2_3_1d

Project 4

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_3_1e

Project 5

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_3_1f

Project 6

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_3_1g

Project 7

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_3_1h

Project 8

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_3_1i

Project 9

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_3_1j

Project 10

Project name _____
Estimated project completion date _____
Project lead (organisation) _____
Funding or contributing agency _____
IUK project number if applicable _____

Q2_4_1

Please provide further details on the additional public funding accessed. How was this funding used and why was it necessary?

Q2_3_2

How did the knowledge or capability generated by original project contribute to the projects listed above?

Q2_4

Have you been successful in accessing additional public funding to fund any post-project expenditure?

- Yes
- No

Q19

How did funding for this project result in the development of your work force in the following areas, if at all?

Please tick an option for all the skills listed below.

	Vastly improved	Slightly improved	Made no difference	Had a negative effect	Don't know
Technical Skills/Knowledge	<input type="checkbox"/>				
Problem Solving	<input type="checkbox"/>				
Business Planning	<input type="checkbox"/>				
Strategic Thinking	<input type="checkbox"/>				
Project Management	<input type="checkbox"/>				
Fund raising	<input type="checkbox"/>				
Leadership	<input type="checkbox"/>				
Collaborating and partnering	<input type="checkbox"/>				

Q3_1

This section focuses on the environmental impact of the technology developed by the original project. This helps us to understand the full impact of the project.

Has the original project resulted in technology improvements that will result in environmental benefits when adopted on aircraft platforms?

- Yes – the technology is already achieving environmental benefits
- Yes – the technology will have environmental benefits, and there are plans to adopt this technology on an aircraft platform
- Partly – the technology did result in potential environmental benefits but there are no plans to adopt this technology in the future
- No – the technology was targeting environmental benefits, but these were not achieved
- No – the technology will not result in environmental benefits

Other (please explain) _____

Q3_1_1

Has the original project resulted in technology improvements that will result in environmental benefits when adopted on aircraft platforms?

Select all that apply

- More energy-efficient aircraft
- Optimising aircraft flight operations
- Optimising aircraft ground operations
- More sustainable manufacturing
- More sustainable through-life engineering services
- Exploiting alternative energy sources
- Other (please specify below) _____

Q3_1_2

Please provide a description of these improvements already achieved

Q3_1_2b

Please provide figures for any quantifiable benefits.

Q3_1_2c

Please provide a description of these improvements already achieved.

Q3_1_3

Please explain why the environmental benefits were not achieved.

Q4_1

This section aims to determine if any of the new knowledge generated by the R&D project has led to R&D spillover benefits and/or enabled you to enter new markets since project completion. This helps us to understand the full impact of the project.

When you as a company undertake R&D activity, it is not just you who benefits. The wider aerospace sector, other sectors and society as a whole can also benefit from the R&D activity. These wider benefits are referred to as a 'spillover'.

Since the project completed, are you aware of any new spillover benefits?

Select all that apply.

- R&D/product developments for other aerospace applications
- R&D/ product developments in another sector that is not aerospace
- R&D/ product developments by catapult centre(s)
- R&D/ product developments by academic or other research establishments
- Dissemination of knowledge through publications and/or university education
- Creation of new infrastructure to be used outside your organisation
- Other (please specify)_____
- No new spillover benefits

Q4_1_1

Please provide a brief description of how the new knowledge generated by the project has enabled 'spillovers' or entry into new markets.

Q17

Is this "New to Firm" or "New to Market"?

New to Firm: New to the firm, but not new to other organisations.

New to Market: Something created by the firm that has not already been done by other organisations.

- New Product to Firm
- New Product to Market
- New Process to Firm
- New Process to Market
- New Service to Firm
- New Service to Market

Q4_2

Has participation in this project enabled your organisation to enter new markets since project completion? If so, please specify which market.

Select all that apply.

- Aerospace (SIC 30)
- Manufacture of motor vehicles (SIC 29)
- Engineering activities (SIC 71)

- Scientific research and development (SIC 72)
- Marine (SIC 30)
- Rail (SIC 30)
- Energy – electricity, gas and steam (SIC 35)
- Other (please specify) _____
- No new markets

Q5_1

This section focuses on intellectual property generated by the original project. This helps us understand how the learnings from the project are being shared and demonstrates the wider impact of the project.

Please provide the number of new academic publications and reports that have been produced as a result of the project. Provide your answer to the nearest whole number.

Peer-reviewed publications, including pre-print papers _____

Industry report _____

Conference paper _____

Q5_1_1

Where possible, please provide the title(s) and/or URL link(s) of the publications produced as a result of the ATI funded project.

Q5_2

Since the project has closed, have you submitted or been granted any new trademarks, designs, copyrights, or patents as a result of the original project?

- Yes
- No

Q5_2_1

Please select the appropriate options

	Considered IP Rights	Applied for IP Rights	Granted IP Rights	Not formally protecting IP	Not applicable
Trademark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Registered Design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Copyright Material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q5_2_2

Please provide details of the relevant IP granted. Include the patent number, year the patent was granted and the patent authority.

Q39

Do you expect to introduce any new products, services or processes as a result of this project?

	Within a year	1-3 Years	3-5 Years	5+ Years	Never	Don't know
Products	<input type="checkbox"/>					
Services	<input type="checkbox"/>					
Processes	<input type="checkbox"/>					

Q44a

How does your organisation plan to ultimately exploit the product, service or process being developed?

UK

Please tick all that apply.

- Create (spin out) a new commercial entity to develop the innovation further
- Sell the IP to another organisation or business

- Enter into licensing agreements with another organisation or business
- Produce and sell the product or service using contracted manufacturers
- Produce the product or service using own manufacturing facilities
- Process innovation to reduce costs
- Process innovation to improve performance/production volume
- Process innovation to improve business offering
- Provide services to other businesses
- Provide services directly to customers
- Other, please specify _____
- N/A - Not expecting to release a new product, process or service

Q44b

How does your organisation plan to ultimately exploit the product, service or process being developed?

Overseas

Please tick all that apply.

- Create (spin out) a new commercial entity to develop the innovation further
- Sell the IP to another organisation or business
- Enter into licensing agreements with another organisation or business
- Produce and sell the product or service using contracted manufacturers
- Produce the product or service using own manufacturing facilities
- Process innovation to reduce costs
- Process innovation to improve performance/production volume
- Process innovation to improve business offering
- Provide services to other businesses
- Provide services directly to customers
- Other, please specify _____
- N/A - Not expecting to release a new product, process or service

Q45

What barriers to exploitation remain?

Please tick all that apply.

Please tick all that apply.

- Further Technical, Scientific or Engineering challenges
- Availability of Finance
- Cost of Finance
- Accessing UK based markets/customers
- Accessing export markets
- Lack of qualified personnel/skills
- High levels of competition from new market entrants
- UK Government Regulations
- EU Regulations
- Lack of or inappropriate industry standards
- Protecting or exploiting IP
- Market dominated by established business
- Other, please specify _____
- None of these

Q46

Do you plan to invest further funding as a result of this project (or have you already done so) in order to commercially exploit or improve the R&D outcomes?

- Yes
- No

Q50

How are you planning on financing this R&D?

Please tick all that apply.

- Business Funds
- Debt Finance
- Business Angels
- Venture Capital
- Crowd-funding
- Existing investors
- Innovate UK support
- Other UK public support

- EU support
- Other, please specify

Q80

Have you accessed any of the following funding sources?

- EU – Clean Sky/Clean Sky 2
- International Civil Aerospace Association – CORSIA
- France – CORAC
- Germany – DLR
- Germany – LuFo
- Italy – CIRA
- Spain – PERTE
- Other scheme from EU member state (please specify below) _____
- USA – FAA CLEEN
- Other scheme from non-EU member state (please specify below) _____
- None of these

Q81

How did your ATI funded project compare to the other funding sources you have accessed for the following measures?

	ATI much better	ATI slightly better	ATI slightly worse	ATI much worse	Don't know / not sure
The clarity of information on how to apply	<input type="checkbox"/>				
The application process	<input type="checkbox"/>				
The progress reporting process	<input type="checkbox"/>				
The amount of 'red tape'	<input type="checkbox"/>				
The final reporting process	<input type="checkbox"/>				
The time taken between submitting the application and	<input type="checkbox"/>				

receiving funding
(move this to be the
third sub-question)

The grant size you could apply for

The scope/breadth of technology areas that can be funded

The frequency of funding rounds

Q6_1

This section seeks to understand if there have been any negative commercial outcomes as a result of the project. This helps us to understand the full impact of the project.

Have there been any negative commercial consequences or commercial opportunities foregone as a result of participation in the project?

Yes

No

Q6_1_1

Provide further details on the project's negative impact on commercial outcomes.

Q21_1

What is the average Technology readiness level (TRL) of the technologies being developed?

Q21_2

When do you aim to reach TRL 9?

Q55

Please state how many full time equivalent (FTE) jobs were safeguarded in your organisation as a result of participation in this project?

A safeguarded job needs to have existed in your organisation before the start of the project and would have been lost in the absence of the project being undertaken.

Please report the maximum number of jobs on a cumulative basis. (i.e: please include any jobs that still exist from 'During the project' and 'Expected in 1,3 or 5 years' figure.)

	RD - R&D Jobs	Manu - Manufacturing Jobs
Maximum safeguarded during the R&D project (4)	_____	_____
Expected safeguarded in 1 year (1)	_____	_____
Expected safeguarded in 3 years (2)	_____	_____
Expected safeguarded in 5 years (3)	_____	_____

Q58

Did your organisation export any goods or services prior to involvement in this project?

- Yes
- No

Q60

Has participation in this project increased the likelihood of your organisation exporting goods or services?

	Yes	No	N/A
Goods <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Services <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q63

Have you diverted resource away from other activities in order to complete the funded project and if so what proportion of this project's total costs were diverted?

Please state the % amount

- Yes from other R&D activities _____
- Yes from non R&D activities _____

Q70

As a result of your participation in this project, has your organisation been able to raise further funds, in addition to the match funding?

Please tick all that apply.

- Internal Funds
- Existing Investors
- Debt Finance
- Business Angel
- Venture Capital
- Corporate Venture Funds
- Initial Public Offering
- Other, please specify _____
- No

Q72

What was this further funding for?

Please tick all that apply.

- Further R&D on the same project
- Production capacity related to the project
- Delivery and/or Process capacity
- Market Testing/Launch related to this project
- General investment in the business
- Other, please specify _____

Appendix C - Q9 International aerospace business support schemes

This section provides comparisons between the ATI Programme and other funding schemes across the world. The aim is to understand how the impacts of the international schemes differ from the impacts of ATI Programme funding.

This provides an overview of the country specific global aerospace funding schemes and compares the similarities and differences of its expected Impacts to the impact of the ATI Programme funding. Since there is a lack of data outlining the actual impacts from international funding schemes, the best comparison possible is to assess the available data on expected impacts set out by the international scheme to actual impacts evidenced through the ATI Programme. Even though this does not provide a direct comparison of impacts, it helps gauge the key initiatives and outcomes international schemes are trying to achieve compared to the ATI Programme.

Similar to the ATI Programme, funding schemes such as LuFo and DLR in Germany aim to strengthen aerospace research development and facilitate technological innovation in aerospace industry, as well as boost economic growth. However, unlike the ATI Programme, DLR also focuses funding on space and weather evaluations. The CORAC scheme in France has a core focus on decarbonisation and reducing the environmental impact of fuel consumption, polluting emissions and noise. ATI Programme funding also promotes clean growth and has seen benefits from improvements in sustainable fuels, especially in advancing hydrogen technologies. Finally, both CIRA (Italy) and PERTE Aerospace (Spain) differ from ATI through their considerable involvement in space and autonomous systems, however much like the ATI Programme, digitalisation, innovation and sustainability remain key impact areas.

The ATI Programme was estimated to create or safeguarded 59,400 additional job years to date. This is substantially greater than the employment figures reported for LuFo and PERTE Aerospace, expected to generate around 17,000 and 16,000 jobs respectively, albeit jobs safeguarded is not included in this projection.

Table 8. Comparison of global funding schemes to the ATI funding programme.

Scheme	Overview	Intended or expected impacts	Comparison to impact of ATI Programme funding
LuFo (Germany)	<p>€300m budget per year</p> <p>Reduction of primary energy needs and resource consumption by cutting weight and improving the efficiency of propulsion systems, other systems and the aerodynamics.</p> <p>Alternative climate-neutral propulsion systems.</p>	<p>Forecasted estimates of GVA of €2.49bn.</p> <p>Employment increases of more than 17,000.</p> <p>Strengthening innovation and expertise in research, development and production in Germany.</p> <p>Generating value creation in Germany for other sectors.</p>	<p>Similar focus on SMEs and supply chain development.</p> <p>Significant impact on employment opportunities.</p> <p>Similar focus on future mobility.</p>
DLR (Germany)	<p>Budget of €1.3bn but €300m allocated to aeronautics.</p> <p>R&D in aeronautics, space, energy, transport, security, and digitisation.</p>	<p>Avoid aircraft pollutant emissions, reduce aircraft noise.</p> <p>Enhance research and development activities and advance automation, electrification, and digitalise the aviation industry.</p>	<p>Unlike ATI Programme funding, DLR has direct focus on space and weather evaluations.</p>
CORAC (France)	<p>€800m for development of low carbon plane.</p>	<p>Make French and European industry the pioneer of the decarbonisation of air transport.</p>	<p>Similar focus on sustainable fuels and hydrogen.</p>

		<p>Develop a Technology Roadmap which coordinates the innovation strategy to synchronise key technology maturation.</p> <p>Ensures technologies to reduce the environmental footprint of the current aircraft and bring to market new aircraft which are highly carbon-free.</p>	<p>Similar aim to reduce development cycles by investing in the supply chain.</p>
CIRA (Italy)	<p>Promote research and technological development in the fields of space and aeronautics to match that of other European countries.</p>	<p>Improve the research and application of autonomous and high-speed flying for aeronautical craft and space crafts.</p> <p>Development of innovative systems to reduce environmental impact of aircraft, increase flight safety, and improve the management of air traffic.</p> <p>Development of technologies for the space transport systems of tomorrow.</p>	<p>Greater focus on uncrewed/autonomous piloted systems than ATI Programme</p> <p>CIRA features space transport.</p>
PERTE Aerospace (Spain)	<p>Introduced post COVID to reduce pandemic impact.</p> <p>Focus on particular industries that required specific investment to recover from the pandemic and focus on future innovations and challenges.</p>	<p>Economic projection of the program is €31.7bn increase in GDP in 10 years.</p> <p>Estimates to create 1,899 direct jobs and 14,079 indirect and induced jobs.</p> <p>Promote innovation, sustainability, and digitalisation within manufacturing; promote training and education within sectors.</p>	<p>Heavy focus on space.</p> <p>PERTE has less focus on sustainable fuels and alternative propulsion method.</p> <p>Significant impact on employment opportunities.</p> <p>Similar focus on digitalisation and manufacturing methods.</p>

Through the inclusion of questions on international impacts and comparisons in the survey and interviews, we could obtain some views on which schemes respondents were aware of, have used, and how they compare to the ATI Programme.

Of the schemes summarised in this chapter, Clean Sky 2 was referenced most by survey respondents and interviewees. Respondents cited that Clean Sky 2 contains a high level of bureaucracy compared to ATI and other similar schemes. One respondent stated that a proposal cannot even begin to start without hiring a separate entity to manage the process of applying for funding through Clean Sky 2.

LuFo (Germany) and CORAC (France) were mentioned as having similar principles and adopting a similar approach to ATI in terms of applying for funding and reporting on progress. However, it was stated that ATI generally has a smaller management burden than other European schemes. One respondent liked the “batched” approach the ATI Programme takes, and that this gives a road map to follow and which technologies within that road map are being prioritised in any given year. However, there was thought to be a greater sense of autonomy with European projects that provided a broader framework within which to apply for funding and there are more options in supply chain and collaboration across Europe.

More broadly, Brexit was raised by several respondents as having made European collaboration much more difficult, noting that it can impact supply chain options. One respondent stated this means the pull of the European funding is not as attractive as it used to be.

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