O'HERLIHY & Co. Ltd.
MANAGEMENT CONSULTANTS
INNOVATION • STRATEGY • CREATIVITY

AEROSPACE
UNLOCKING POTENTIAL

Final Report

Evaluation of Aerospace UP

06 June 2023

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1. Introduction

1.1. Introduction

This report presents the findings of a summative evaluation of the ERDF funded Aerospace Unlocking Potential (Aerospace UP) Programme led by the University of Nottingham and delivered in partnership with the Midlands Aerospace Alliance (MAA). The evaluation was completed between January and April 2023.

1.2. Context for the Programme

The Aerospace Unlocking Potential (Aerospace UP) Programme aims to improve the performance of the Aerospace sector in the Midlands which is recognised globally as a centre of Aerospace expertise and innovation.

The Programme targets SMEs - both those currently supplying to the Aerospace sector and those who have the potential to do so - through delivering leading edge business information and advice combined with access to state of art facilities at the University of Nottingham and in selected cases, grant support for collaborative[1] innovation projects in companies.

The proposal builds upon previous Aerospace programmes delivered by both the Midlands Aerospace Alliance and the University of Nottingham including:

- Advanced Manufacturing Technology East Midlands
- The Institute for Manufacturing
- ATEP that was subsequently adopted nationally and renamed NATEP
- Institute for Aerospace Technology

Aerospace UP used existing industry focused organisations to maximise its reach:

- The MAA has 300 member organisations and the MAA CRM database contains 1,400 Midlands organisations identified as potentially interested in the Aerospace industry
- MAKE UK, the manufacturer's organisation with which the MAA is formally affiliated, has 1,330 members in the Midlands - MAKE UK agreed to inform them of the Aerospace UP opportunity on MAA's behalf so as to maximise the engagement of suitable firms in the initiative.

The project commenced on the 1st July 2020 and runs to the 30 June 2023.

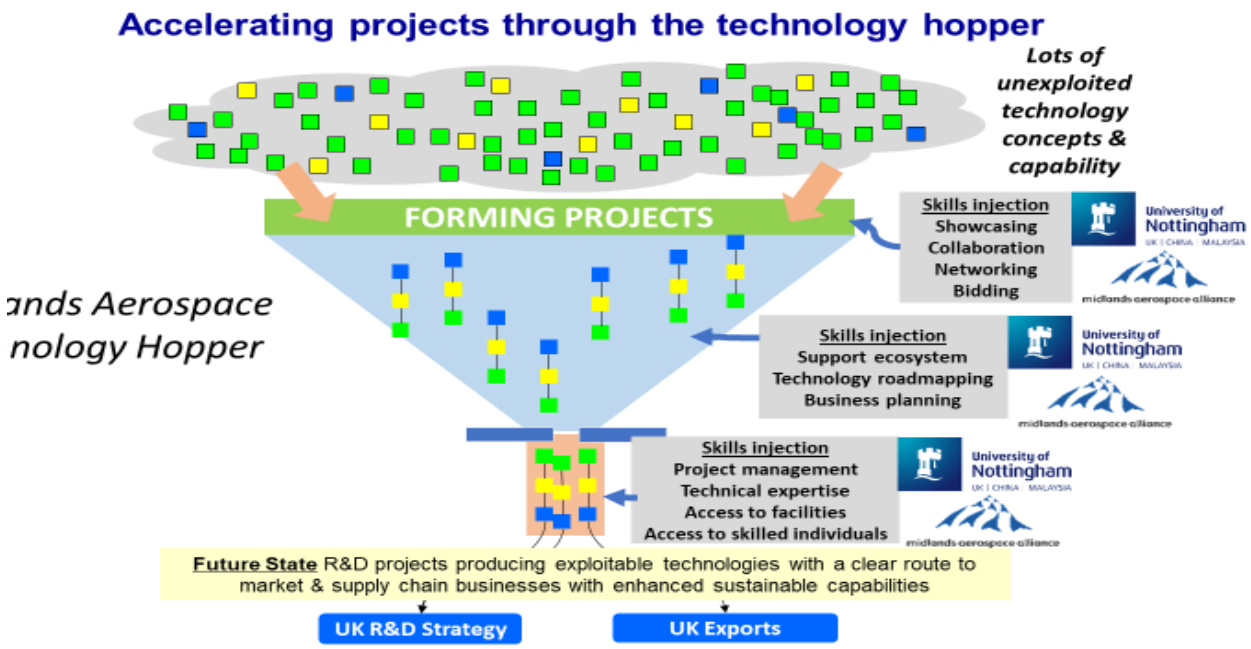
Aerospace UP complemented existing initiatives when launched. The UK Government invested £1.9bn on a series of large-scale R&D programmes for the Aerospace industry. The national funding (Aerospace Technology Institute (ATI)/Innovate UK) supports fewer larger projects that achieve the large scale strategic aims depicted by the UK Aerospace Growth Partnership.

Although complementary, Aerospace UP is quite distinct from the NATEP. It is led by a university rather than a national trade association and it developed and applied the expert knowledge base of the university to support both companies that are working on CR&D/innovation projects and (unlike NATEP) an additional broad grouping of companies. With the evolution of NATEP, the MAA Board and MAA Technology Development Group suggested there was a widening gap in the innovation ecosystem for bottom-up and intensive regional (and local) cluster based support to help smaller companies move up the value chain or diversify into Aerospace. This was a core focus of Aerospace UP.

[1] The requirement for firms to collaborate was relaxed due to COVID-19 restrictions. This change was approved by the Managing Authority

1.3. Programme Aims

Aerospace UP is a programme comprising business innovation support activities aimed at connecting and supporting businesses in the Midlands to gain the skills, capabilities and resources to help them grow,



improve productivity and prepare for the challenges of the 21st century.

Aerospace UP aims to provide a cohesive framework, an industry network and a set of targeted support services to enable the development and delivery of new product and process innovations in the lower supply chain tiers of the Aerospace sector. This will create jobs and improve productivity.

1.4. Programme Design

The stakeholder representation inherent in the Programme's design is somewhat unusual in that it is a combined submission comprising an aggregation of nine individual ERDF applications - including eight from the local enterprise partnerships covering the East and West Midlands. Consequently, the design was felt to be representative of the Aerospace-related business profile in each area.

The project can best be described by way of a "project funnel" as shown above.

The project committed to delivering 54 Collaborative R&D (innovation) projects, each anticipated to last around 18 months and engaging 109 firms (i.e. each collaboration would comprise two firms). These would focus on developing innovative products and processes within the Aerospace supply chain. Suitable firms would be invited to propose project topics to pursue.

The application proposed that there should be three "calls" for CR&D/innovation projects delivered over the 36 month Programme duration. Due to the impact of COVID-19 on both the Aerospace sector and on the partners' ability to implement the project, delivery was adapted through introducing a rolling programme of applications. The rapid response times for applications was one of the Programme's characteristics cited by firms in our survey (Chapter 3) as being notably beneficial.

The application proposed the engagement of an industry-led Project Advisory Group to appraise the CR&D/innovation project proposals put forward and to identify those deemed to be appropriate for funding. In practice, the MAA Technology Development Group (now the Regional Advisory Panel) acted as a Project Advisory Group, reviewing applications that were deemed to be of high value or offering significant impact potential. On occasion, firms were invited to present to the Group and the members gave feedback and their views on the projects' suitability. These views were then be taken into account by the representatives for MAA and University of Nottingham when considering whether the project should be approved and the firm receive grant support.

A key goal of the project was to increase the proportion of supply-chain business to Aerospace end-user companies serviced by Midlands' SMEs. The Midlands has a notable cluster of Tier 1 companies (Rolls-Royce, Collins Aerospace, Moog Aircraft Group and Meggitt amongst others). The project aimed to facilitate contact between (potential) suppliers and these end users.

It was recognised that not every firm would participate through a CR&D/innovation project. Those not engaged in a CR&D/innovation project were to be offered Innovation Business Support packages that introduced new innovations to their businesses and thereby improved their competitiveness. All firms were eligible to benefit from the Business Support packages (grey boxes in figure above).

The innovation support comprised: expert input (guidance and mentoring) from the MAA's advisors; access to the University of Nottingham's Precision Manufacturing Centre (as well as access to other R&D activities if appropriate) for specialist manufacturing advice and prototype development; access to undergraduate, postgraduate and industrial placements.

Support was to be targeted at SMEs that are already serving the Aerospace sector and those with competencies that are suited to Aerospace but who are not yet supplying to the sector.

Offers to business are summarised below.

1.4.1. Workshops, seminars networking events and specialist visits:

These were provided to firms using a range of "group" support that included:

- Network events, delivered on-line during lock-downs so as to maintain contact with firms and provide lifeline support
- Seminars on key process and technology requirements of relevance to the Aerospace OEMs/Primes and higher Tiers of the supply chain – these sessions were designed to inform lower level suppliers of the standards to which they should aspire
- OEM visits to companies such as GKN
- Specialist facility visits such as the Advanced Manufacturing Research Centre
- Representation at major events such as the Farnborough Air Show.

1.4.2. Technical 1:1 support

This was available from Universities and specialist research bodies and offered advice on product and process design and development as well as in areas of material properties and general "manufacturability". These were independent of the CR&D/innovation project described below.

1.4.3. CR&D/Innovation Projects

These took the form of grant support designed to help businesses develop products new to market and to introduce new processes to their business that would increase their capability of servicing the Aerospace sector. Grants were only provided to those firms that could demonstrate a well-formed project idea. These

ideas had to be coherently presented in a project application form which underwent appraisal by the Project Advisory Group panel.

The limitations on societal freedom of movement had a profound impact on the implementation of this aspect of the Programme. CR&D/Innovation Grants were anticipated to engage two or more firms. Due to COVID-19, as firms could not meet, visit each others' premises or generally collaborate in a way that would make the original project design viable, the Project Team notified the Managing Authority of a proposed change whereby financial support would be provided to single firms that met the innovation potential threshold of the Project Advisory Group.

Grants of up to £100k were available, but average and median values were much lower in practice (£41,000 and £32,000 respectively).

1.4.4. Student and graduate placements

It was anticipated that student and graduate placements would be supported. However, the impact on freedom of movement caused by the COVID19 lockdowns made such placements all but impossible to deliver. We understand that a small number were supported and two host firms were interviewed in our survey.

2. Project Progress

2.1. Project Targets

The table below shows the targets that were set for the project at the point funding was awarded.

Table 2.1			
Output Target	Description	Metric	Notes
C1	Enterprises receiving support	355	At least 12 hours In person / online / by phone Consultancy / advice / workshops / technical support
C2	Number of enterprises receiving financial support (grants)	109	This is a subset of indicator C1 The funding provided to the business must come from the project budget and not be repaid
C4	Enterprises receiving (non-financial) support	328	At least 12 hours In person / online / by phone Consultancy / advice / workshops / technical support
C8	Employment increases in supported enterprises	214	FTE above baseline set at the start of the project
C26	Enterprises cooperating with Research Entities	163	Collaborations that transfer good ideas, research results and skills between the knowledge base and firm
C28	Enterprise supported to introduce new to the market products	109	This is a subset of indicator C1 The Enterprise must introduce one of: Product – when it is at either pre-launched or launched to the market Process – when it has been introduced to the business Service – when it has been introduced to the market
C29	Introducing New Products, Processes or Services to the firm	109	This is a subset of indicator C1 'New 'refers to functionality or technology fundamentally different to that already produced Intended new products that are ultimately unsuccessful can still be counted

The targets set out in the table relate to the whole Programme and were to be delivered by the UofN and MAA. We observe that activity levels are comparatively high, especially for activities that involve in-person interactions between firms and firms-universities. These types of interactions were largely forbidden between March 2020 and January 2022.

We would also note that when restrictions were finally lifted in early 2022, individuals and firms were comparatively slow to re-engage. Indeed, anecdotal feedback on attendances at large events and conferences suggests that participation rates have still reach pre-2020 levels.

2.1.1. Progress against target

Table 2.2 below summarises both the most recent progress update from the project team.

Table 2.2 – Progress against target			
Output Target	Description	Target	Completed/In-Progress at 23.04.23
C1	Enterprises receiving support	365	174
C2	Number of enterprises receiving financial support (grants)	109	126
C4	Enterprises receiving (non-financial) support	328	159
C8	Employment increases in supported enterprises	214	-
C26	Enterprises cooperating with Research Entities	163	32
C28	Enterprise supported to introduce new to the market products	109	55
C29	Introducing New Products, Processes or Services to the firm	109	81

Key points to note:

- Progress against the C1 and C4 targets is behind profile. It is anticipated that progress will be made between now and the end of the Programme (July 2023), but it is unlikely the target will be met by the end of the Programme.
- For the C2 target, the implementation has comprised innovation grant support of up to £100k, with
    - the average project value is lower (£86,023)
    - the median value is £64,053
    - the total value of projects supported was just over £11million
    - SME matched funding amounting to £6.12 million
- Grant values were well below the maximum figure
    - the average grant value is £41,000
    - the median value is £32,000
    - The mode is £10,667 (indicating a skew to lower value awards)
    - A total of £5.24 million of grant monies were disbursed.

- C29 targets are a subset of C1/C4 – thus they are counted within C1/C4 target and are not additional
- The impact of the COVID-19 lockdowns on the airline industry is well documented. UK airports saw passenger levels fall 99% on pre-pandemic levels while the industry lost an estimated £250bn globally. This collapse in global flight activity has had an impact on both OEMs within the UK's Aerospace sector and lower supply chain Tiers supplying to it.
- Consultations with the project team indicate that impacts from COVID on group meetings, networking and general mingling continued well into 2023 and these have impacted on all activities involving interactions of people
- Projected progress against the C2 target is substantially ahead of profile - C2 activity is more intensive and our beneficiary survey indicates that it is more impactful. At first sight, this finding would indicate that the Programme had less "reach" than expected, but that it had more intense and deeper engagements with those firms presenting innovation projects that were meaningful for their future business growth.
- The project team took active measures to ensure good projects put forward by firms could be supported. We understand the timing profile of innovation projects supported was back-end loaded – this was a direct impact of COVID-19 as it was particularly challenging to engage firms, that had significant exposures to the Aerospace sector, when the industry was closed globally. By consequence of timing and in recognition that certain firms' projects warranted lower levels of financial support, the project team introduced a lower value grant initiative during the last six months of delivery. This was effective in engaging firms that might otherwise have been excluded due to their projects being of smaller scale.
- Given the restrictions that were in place during the lockdowns, the anticipated over-achievement of C2 targets will be a notable result.

3. Project Delivery & Management

3.1. Sample profile

The sample size was 40. Table 3.1 below summarises the sample of statistical characteristics in terms of employment and turnover. In selected instances, interviewees differentiated between the turnover for their group as a whole and the turnover for the site benefiting from the Aerospace UP support. Mostly, we used the latter.

It can be seen that the sample is skewed, with typical turnover levels of around £3.5-£4 million and workforces of around 30.

Table 3.1		
	Employment	Turnover
Mean	31	£3,985,429
Median	25	£3,250,000
Mode	35	£4,000,000

The lowest turnover was nil (this company was a technology based start-up that had attracted very significant private seed corn funding) while the highest was £22 million. All were SMEs.

3.2. Participation

Fig. 3.1 – Participation Profile

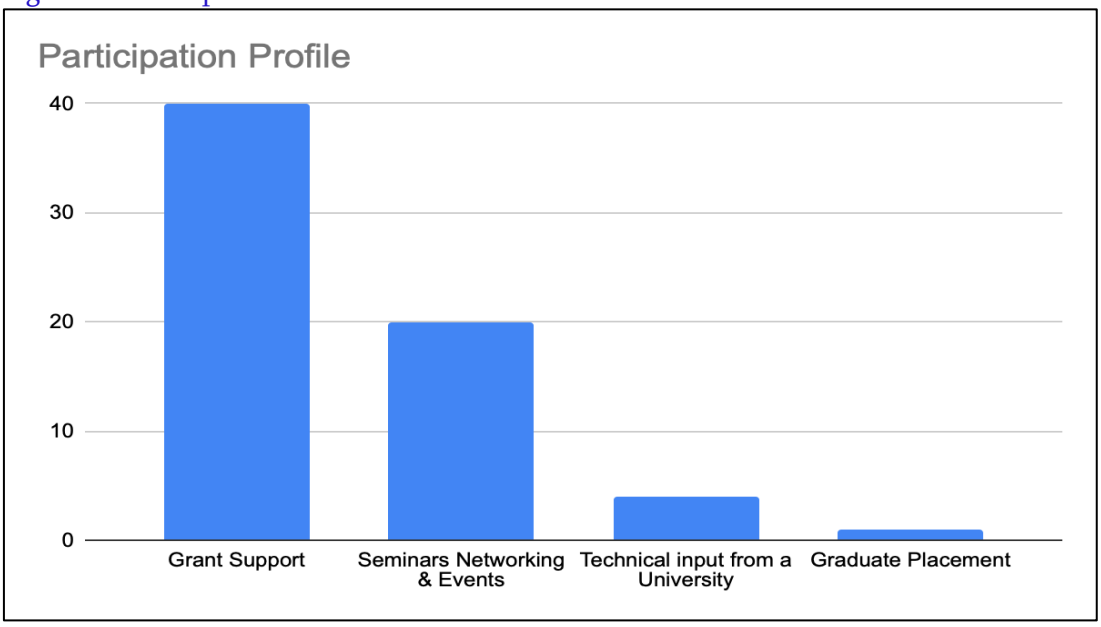


Figure 3.1 indicates that all firms had received an innovation grant to support an innovation project.

Half of respondents indicated that they had participated in seminars and networking events. In reality, we think that this proportion is unduly low as firms frequently referenced interactions with the wider MAA membership and other Aerospace groups, but did not attribute this to an engagement on an Aerospace UP event even when prompted.

3.2.1. Seminars, events and networking

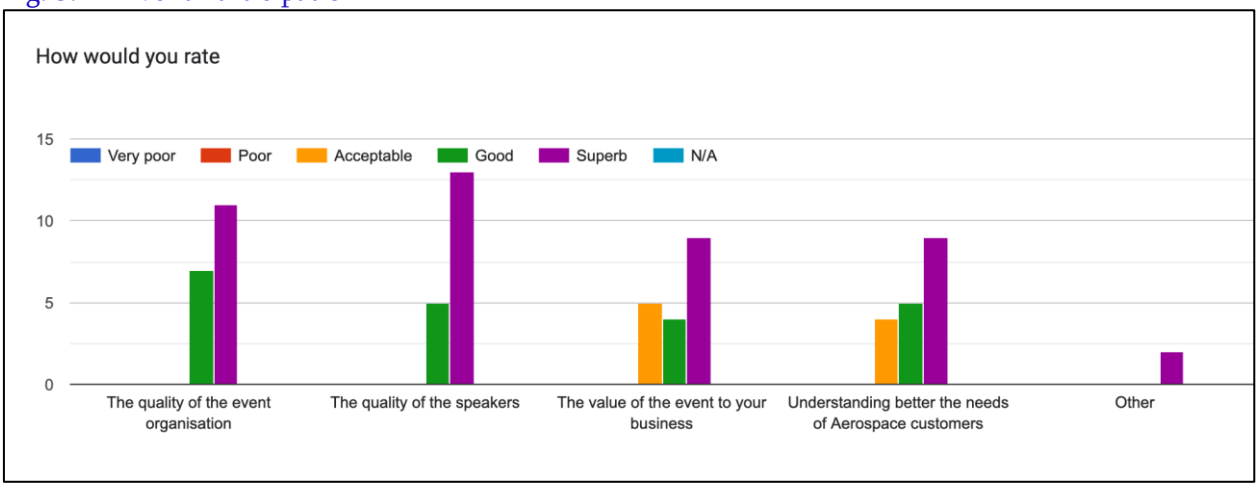
A total of 20 respondents specifically identified participating in an event. As mentioned above, we consider this to be an under-representation given responses to other questions in our interviews that indicated wider participation in networking meetings, attendance at conferences and presentations, and general sectoral interaction.

Technical seminars and general networking were the two most prominent modes of engagement. In addition, site visits to AMRC (Sheffield) and other specialist centres were noted as being valuable. The Programme also facilitated firms' understanding of OEMs' and higher supply-chain Tiers' needs through arranging company visits. Interviewees responded very positively to events organised with GKN Aerospace and Ricardo amongst others.

In addition, Aerospace UP and the MAA had a presence at the Farnborough Airshow, as well as large-scale Aerospace manufacturing events at the NEC. These were well received by firms and considered to be of value.

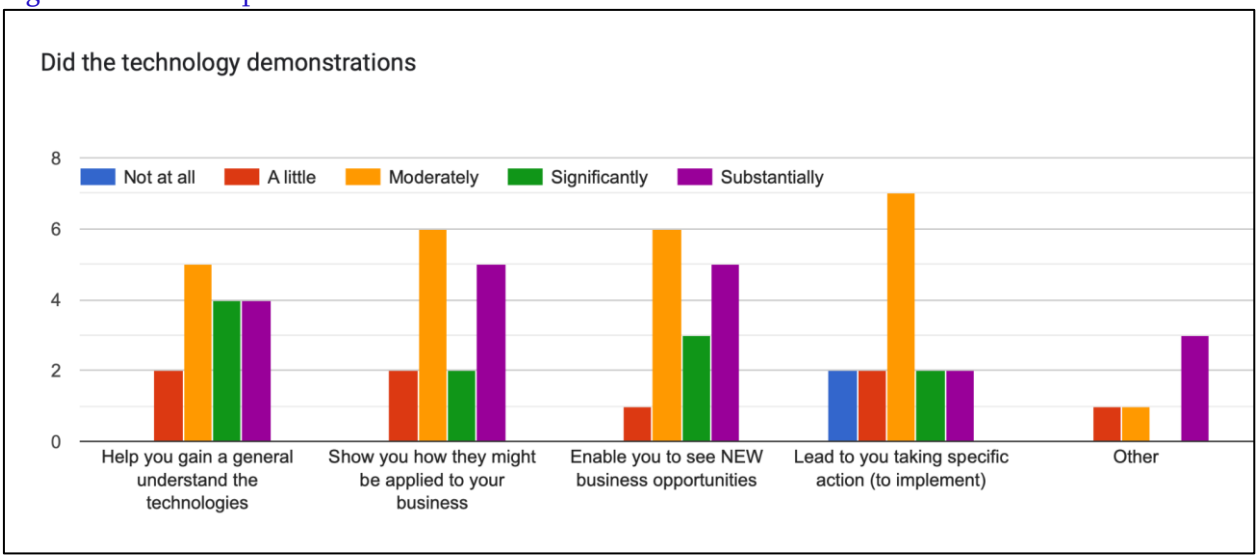
Figure 3.2 indicates that events were highly rated in terms of: quality of speakers; their organisation; and delivery.

Fig. 3.2 – Event Participation



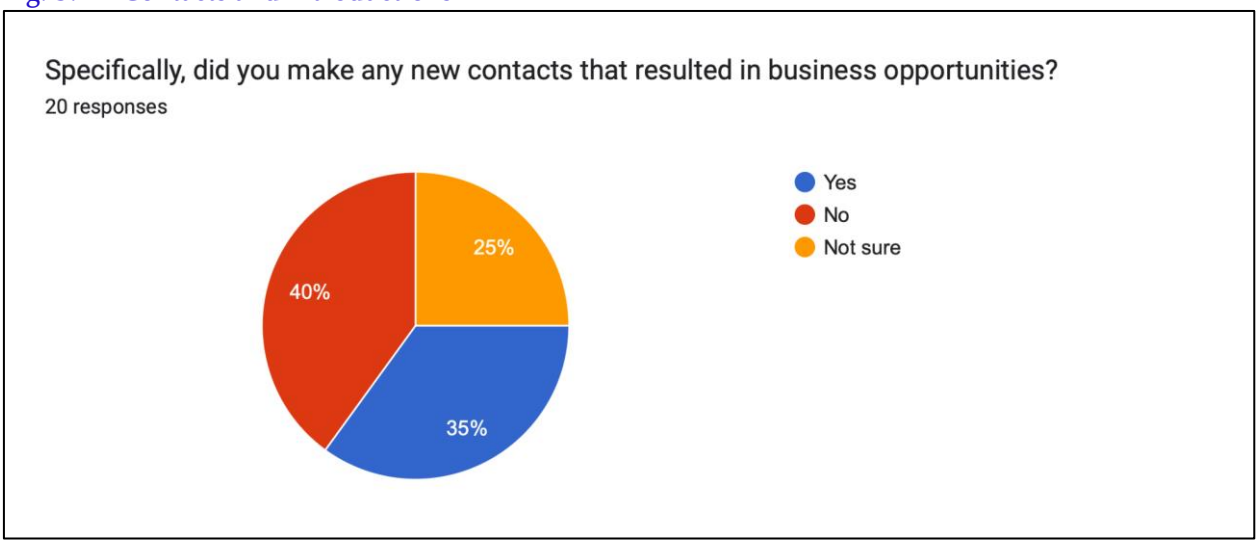
Feedback was more broadly spread when considering direct benefits to the business (Figure 3.3).

Fig. 3.3 – Value of specialist site visits



This mirrored the more general feedback that the events were informative and helpful. They provided insights on current trends and the status of the sector in the UK at a time when the sector was in a state of extreme flux, rather than delivering directly beneficial business leads. Firms were very happy with this positioning.

Fig. 3.4 – Contacts and introductions



Specific comments included:

- [Company visit] *It was transformational. I could see their "cooperative" approach. I started to look at firms I had previously viewed as competitors and considered how they might be future collaborators.*
- [Visit to GKN]. *Engineers were extremely interested to talk to my firm about our work and experience.*
- *Superbly run. Access to a broad range of relevant technical staff. Can see their processes and operations, not just technical but also HR. Very useful.*
- *We attended many of the networking events and several of the specialist speaker events and made some very good contacts. The events were well run and the opportunities to meet others were welcome, especially during COVID-19. We participated online initially. Since then, we have placed orders to get machining work completed with one of the contacts and we have asked for quotes from another.*
- *The whole engagement process "lit a fire under us" and has transformed our approach to business and our motivation. I had no idea that the Aerospace sector in the UK offered as much potential as it does. The combination of the workshops, site visits and the Innovation Grant have been transformative for us*
- *We don't supply any product to Aerospace yet. The events were very effective in enabling us to meet potential customers and discuss with them how our product might be of value. They were very good.*
- *It was a full day visit to the PMC (University of Nottingham). It was excellent, really insightful and got us buzzing about how technologies like these might be applied to our business. Really impressive.*

3.3. Advice and technical mentoring input

When designing our questionnaire, we anticipated that firms would have received technical and mentoring inputs as part of the overall Aerospace UP support. In practice, firms wished to speak about their innovation grant and the projects these supported. It was clear during interviews that the Technology Managers provided technical and managerial guidance to firms that could be classed as mentoring support. Firms commented that the input from the Technology Manager helped them to design and manage a project implementation process that was much better than what they would have pursued on their own. Technology Managers were unanimously rated very highly both for their technical and their sectoral knowledge - this combination was considered to be unique and very valuable.

Ten interviewees indicated that they had specifically received advice and mentoring from a Technology Manager. Most of this input formed part of the wider innovation grant project support which we cover in more detail later.

A cross section of individual perspectives included:

- *General project and company growth advice at a time when we were facing very significant challenges through Covid 19. The company was virtually bankrupt and the Technology Manager's reflections and input were immensely valuable and got us back on track*
- *General advice on the project, intellectual property and guidance with the project delivery*
- *The Technology Manager was incredibly valuable in providing direction both for the project and for the business. In many ways, the advice was as valuable than the funding, although the funding was essential for the project to proceed. All of the MAA team helped to identify suitable contacts and they arranged meetings with different airport groups to talk about the potential application of our robotic cleaning equipment*
- *The Technology Manager was really supportive, very responsive, being knowledgeable on both the grant process and technical issues (intellectual property). And they were friendly. Overall superb.*
- *The Technology Manager was just brilliant. They gave us real clarity, direction and good advice*
- *The Technology Manager's knowledge of the industry, flexibility, and being able to tailor their input to specific issues or situations, and just being able to understand the challenges we face as a business, made it an excellent experience*
- *It wasn't mentoring support but the Technology Manager was superb. They have been supportive throughout the process and their guidance was extremely valuable.*

There was just one suggested improvement put forward - *maybe more content on IPR.*

3.4. Technical Input from a University

Firms could use Aerospace UP to engage a University for technical input. Six firms noted University engagement in the sample and their feedback is summarised below.

The University of Nottingham Precision Manufacturing Centre (PMC), was the most frequently cited (3). In addition, firms received assistance from:

- The Advanced Forming Research Centre, part of the Advanced Manufacturing Catapult at the University Of Strathclyde.
- University of Cambridge.

- Aston University
- Manufacturing Technology Centre (part of the Advanced Manufacturing Catapult) based in Coventry.

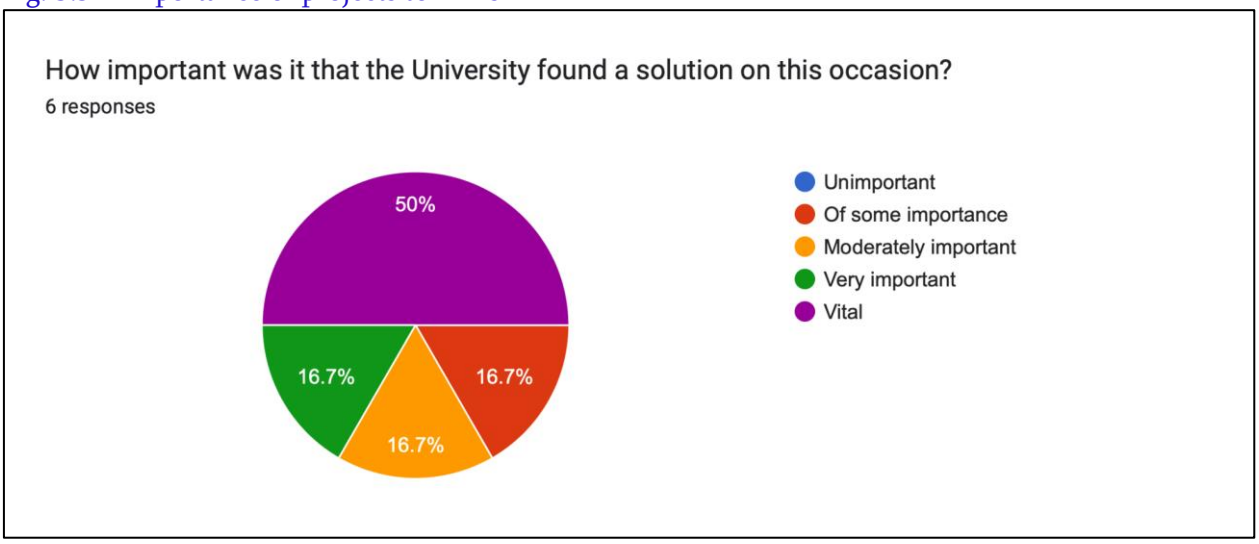
Project topics included:

- Specialist advice on machining novel precision components for a lightweight engine with applications in Aerospace
- Advice on manufacturing and the use of new manufacturing processes to recycle titanium from Aerospace waste
- Digital twin design for a new manufacturing facility.
- Specialist metallurgy advice
- Technical input on a process for converting bio-oil to bio-kerosene.
- Technical and economic due diligence of a technology.

The majority of respondents indicated that the Universities' inputs enhanced their ability to supply to the Aerospace sector in the future.

Projects were deemed to be "important" for firms with half indicating that finding a solution was "vital".

Fig. 3.5 – Importance of projects to firms



The output was meaningful and satisfaction with the Universities' inputs was high as all firms:

- Felt that the Universities' outputs addressed their goals "completely".
- Indicated that they would be acting on the Universities' findings/output.

Key observations by firms included:

- *Their output and expertise allowed us to produce a prototype that could be showcased, principally for the Aerospace sector. We are presently getting surface coating work completed and then the prototype will be assembled.*
- *This was a complementary input to the other support we received on intellectual property protection. The input was mainly around manufacturing advice for the design of an electrolyser.*
- *The University provided digital twin design for a new factory layout. This will allow us to have a ready-made template for new manufacturing facilities that will allow us to produce batteries at volume once the prototype has been proven to work.*

- *We have already acted upon the University's output. We have used it to support negotiations with a licensee based in Asia.*

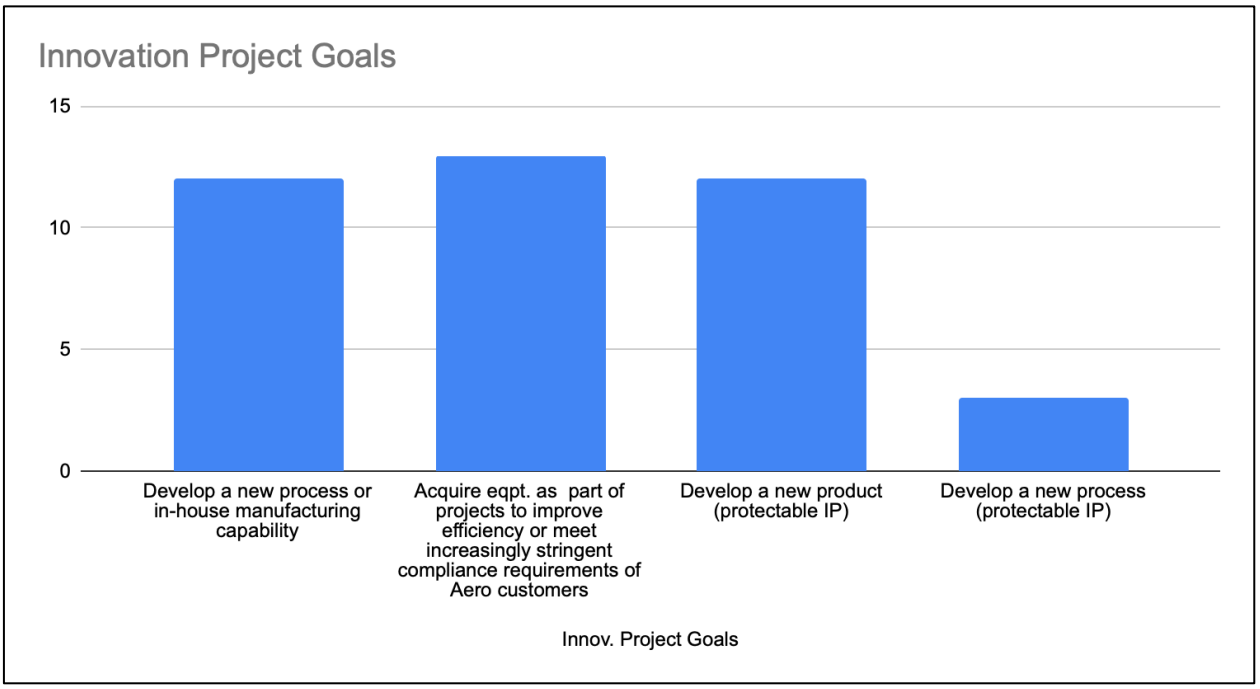
3.5. Innovation Projects

All of the sample (40) benefited from financial support to implement a CR&D/innovation project. This was the most significant element of the Aerospace UP offer for firms.

The 40 projects fell within one of four main groupings:

- Developing a new process or in-house manufacturing capability
- Acquiring equipment as part of projects designed to improve efficiency or meet increasingly stringent compliance standards for Aerospace customers
- Developing a new product (protectable IP)
- Developing a new process (protectable IP).

It can be seen below that the distribution of projects is uniformly distributed across the first three of these categories.



3.5.1. Develop a new process or in-house manufacturing capability

Develop or improve the process used to manufacture an existing component that enabled the firm to do something new in response to a request from a key Aerospace customer. These projects focused on how the firm undertook its activities for its existing customers, how the manufacturing facility was currently organised, and how the facility/process needed to change in order to meet new Aerospace customers' requirements.

3.5.2. Acquire equipment as part of projects to improve efficiency or meet increasingly stringent compliance standards for Aerospace customers

There was an inherent theme within these firms' responses indicating they were under pressure from OEMs and key Tier 1 customers to improve the quality, reliability and/or transparency of their manufacturing operations. Computerisation of manual systems played a role in certain instances. This "pressure" also manifested itself through being required to provide real time data capture on material

flows, material and ambient temperature measurements, tolerances and machining inputs (supporting a move to Industry 4.0). The reopening of the Aerospace sector after COVID-19 has accelerated these demands as the industry focuses on recouping lost profits - but firms in the lower Tiers of the supply chain have struggled. This is due to these companies being forced to contract significantly during the COVID-19 pandemic as a result of the global shutdown of air travel. It was frequently stated by interviewees that their firms had lost reserves and consequently their capacity to respond quickly. The Aerospace UP Programme provided essential financial support to enable the firms to take action, especially where equipment had to be acquired as part of the innovative project. Consequently, levels of deadweight were low.

Separately, interviewees also identified internal pressure to improve efficiency and profit margins as they expanded. This pressure was compounded by labour market supply constraints where staff recruitment was proving difficult - firms needed to make the best use of staff they currently employed.

These two pressures have resulted in an increased focus on the role of capital investment (in equipment) to increase productivity and improve product consistency and process repeatability.

Projects included the formation of clean areas, dedicated areas for painting, the introduction of manufacturing cells and bespoke assembly zones.

3.5.3. Develop a new product (protectable IP)

New product development support led to ambitious Aerospace UP projects being selected. These projects contributed to the development of a broad range of product types - from lightweight (electric) power units for high performance drones, to a patented design of filter that improves the quality of molten alloys through to the development of pilot plants for Aerospace bio-fuels.

Projects had clear applications for the broadly defined Aerospace sector, with applications in aircraft engines, cockpits, cabins and airport facilities.

3.5.4. Develop a new process (protectable IP)

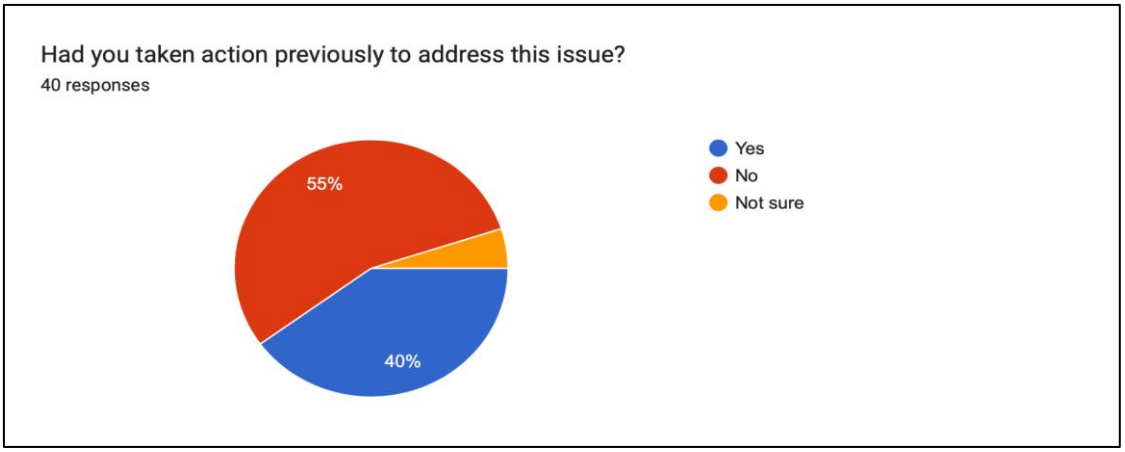
In selected cases, firms developed a new process (that was often capable of being protected in terms of intellectual property). An example would be a process for bacterial decontamination of aircraft cabins and airport waiting areas.

3.5.5. Maturity of projects on commencement

Although some firms had undertaken relevant projects previously, firms did not have well-formed project proposals to take forward – they had challenges they needed to address, but did not have a well-developed or clear plan for action. The MAA Technology Managers played an important role in helping firms gain clarity. This generally required a around two months of interactions but, in some cases, these inputs required up to a year of conversations with the firm. The input of the Technology Managers was felt to be extremely valuable by firms.

3.5.6. Firms' previous actions

Fig. 3.5 – Previous actions

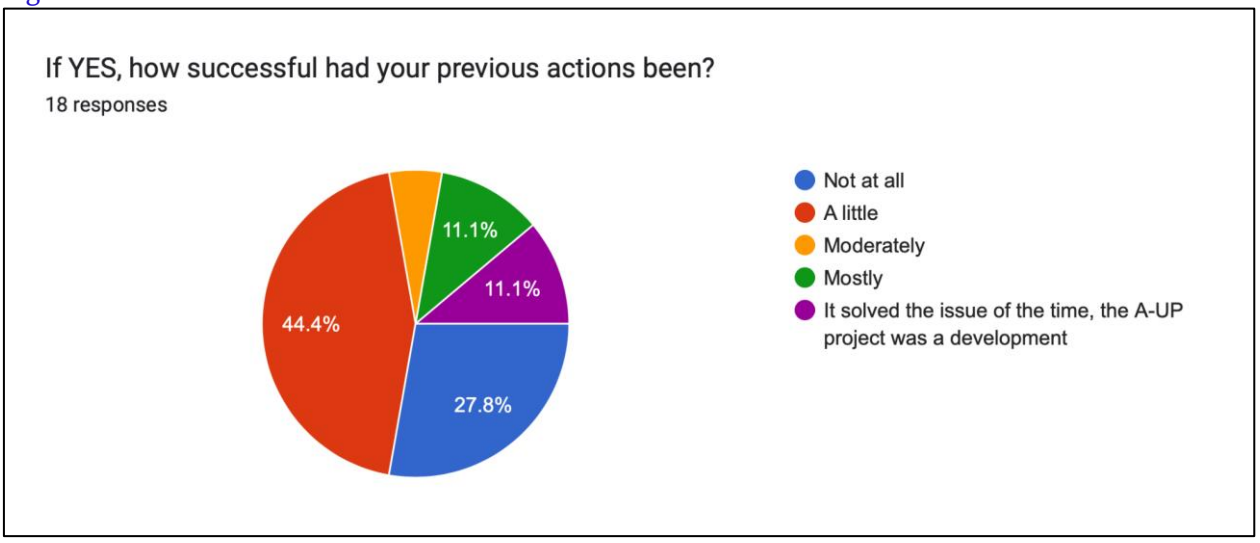


Just over half of firms had taken some form of action previously in an area that was relevant for the Aerospace UP project. While this might seem to be at odds with firms' separate feedback indicating a lack of clarity on what they needed to do and also the critical role the Technology Managers played in helping firms to frame appropriate project definitions for Aerospace UP, it can be explained by:

- Previous actions comprising lower TRL or foundational activities - in some instances, firms had received funding from Innovate UK, Department of Transport, UK Space Agency or private funding sources to take these actions
- Previous actions having been undertaken for the most part prior to the COVID-19 pandemic – the pandemic fundamentally disrupted (or eliminated) their markets and firms were consequently in much more challenging operational and commercial positions than they had been previously.

Previous actions had been of mixed success - and all fell short of what firms needed now. Over two thirds indicated that the previous actions have been unsuccessful.

Fig. 3.6 – Previous actions' success



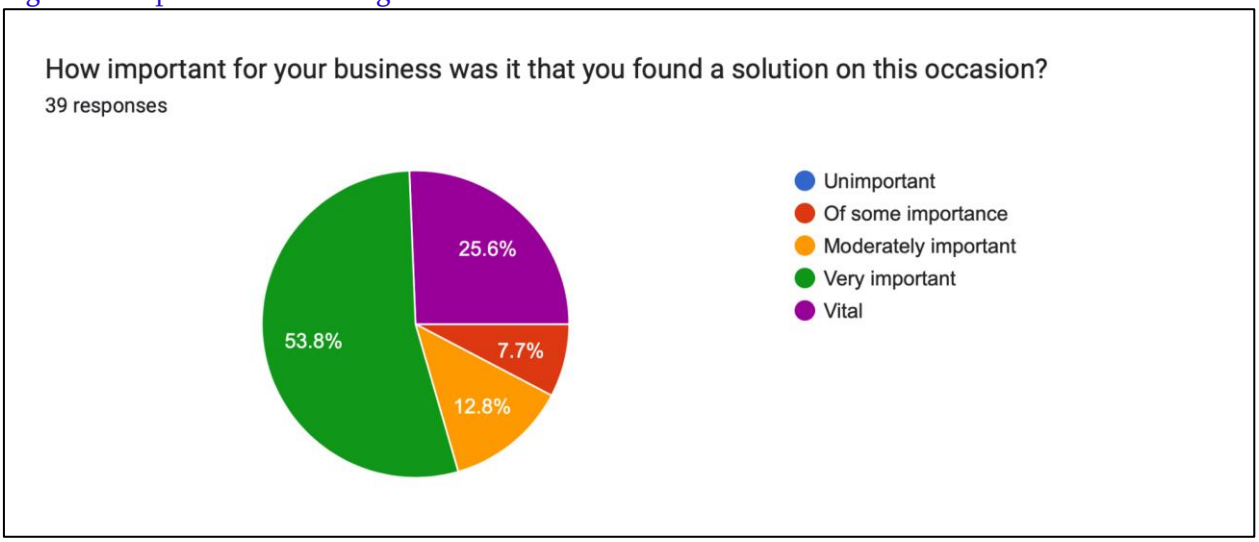
In terms of firms' status when considering availing of support from Aerospace UP, it is clear from feedback that they needed to take action quickly, but were:

- Lacking financial resources due to reserves having been utilised by COVID-19

- Lacking staff resources in the post COVID-19 environment.
- Under operational pressure due to having to grow their business but with limited available financial and people resources
- Wary of expanding too quickly given the pandemic related challenges they had encountered over the previous two years.

3.5.7. Importance of finding a solution

Fig. 3.7 – Importance of finding a solution



Firms needed to find solutions to the challenges put forward for their Aerospace UP project activities. They were generally very busy with day to day, urgent activity at the point where they committed to embark upon a project. Around half described their project ideas as being early stage or unstructured (the remainder could cite unsuccessful prior activities as described above).

The Aerospace UP application process forced firms to form clearly developed proposals - they felt that the structured project definition process required by Aerospace UP was a valuable part of the Programme. Taking time to get the design right at the outset and identify the resources necessary for successful implementation was considered to be a core factor that led to projects being successful subsequently. Given that over a quarter of firms' prior activities had been "not at all successful", this indicates a key area of need amongst firms - they know they need to take action and generally know what forms those actions might take, but they do not know how to prosecute those actions successfully. It will be seen below that Aerospace UP helped them to design and implement successful projects.

All projects required the firm to submit a grant application. Applications were appraised independently by the Project Advisory Group. Project implementation was broad ranging and the supported activities were chosen to suit each firm's needs. Activities included:

- Developing a new capability to manufacture components and implement new manufacturing procedures (Industry 4.0)
- Acquiring software and hardware, specifying bespoke software to be written and developing potential solutions - for process control (manufacturing process management/ERP) and for data capture from individual machines/cells
- Research, design, prototype manufacture testing and development (existing and new products and processes)
- Specifying, tendering and acquiring equipment, its commissioning and integration
- Expert advice on IP protection
- Engaging external experts and University research units to provide specialist inputs (metrology and tolerance assessments, material assessments, plant layout, manufacturing process advice etc).

3.6. Project deliverables

The projects delivered:

- Step change improvements in manufacturing performance for firms
- Protection/retention of business sales with key Aerospace customers whose requirements had become more demanding and where the firms were struggling to respond
- The ability to supply Aerospace customers for the first time
- Novel and innovative products that would be attractive to Aerospace customers
- Improved competitiveness for firms.

Firms indicated that projects were very successful.

Fig. 3.7 – Projects' success

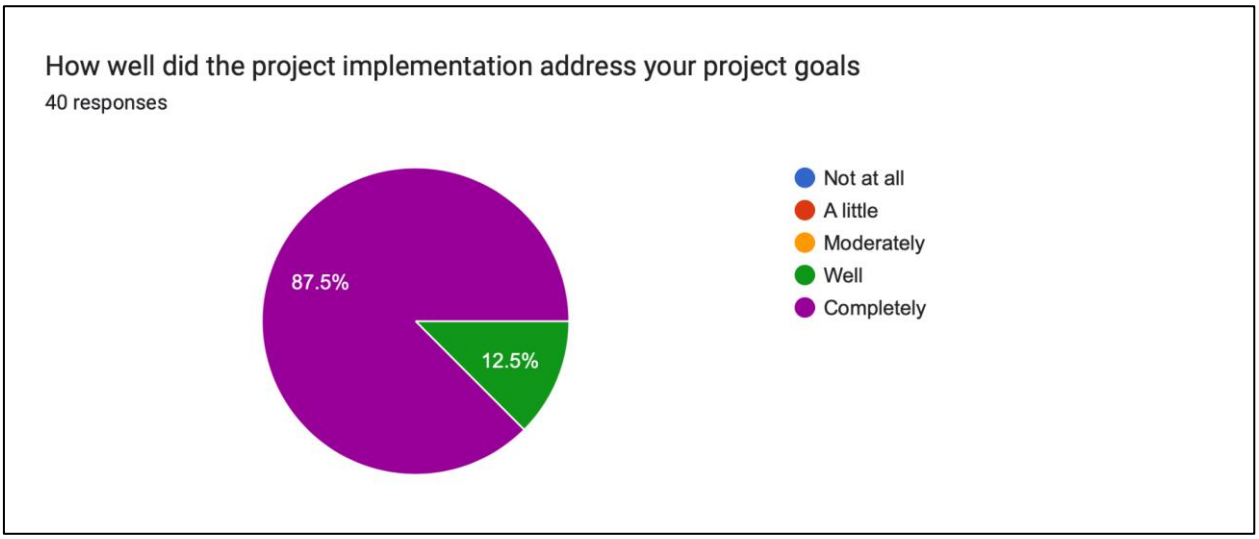
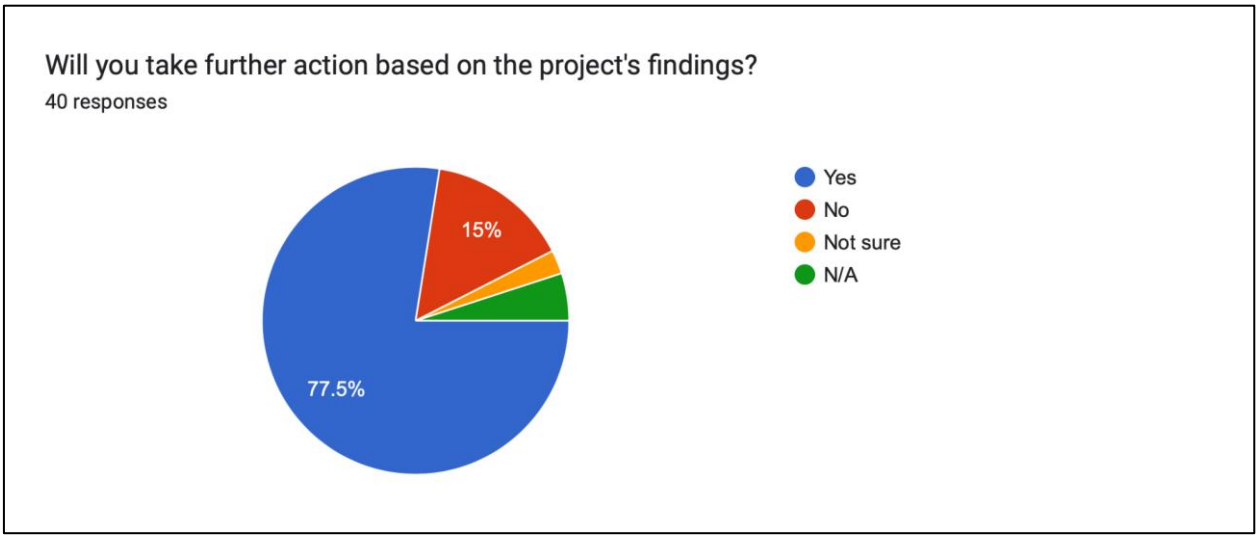
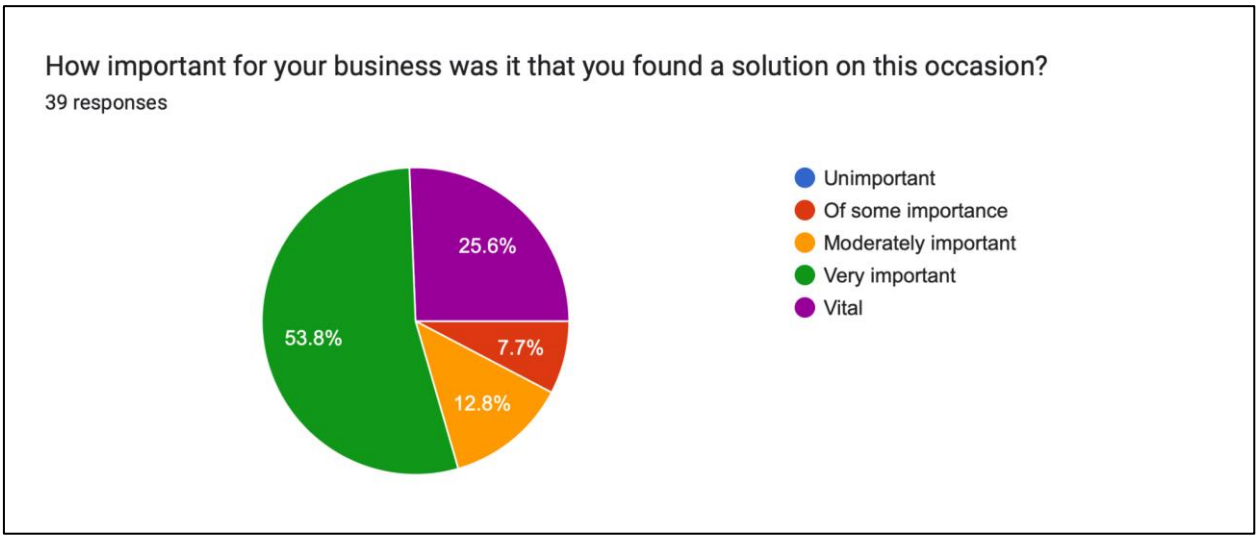


Fig. 3.8 – Projects' suitability for supporting future actions



Over three quarters of respondents indicated that they were planning to undertake follow-on activities based on the projects' outcomes. Those *not sure* or for whom it was *not appropriate* generally comprised firms where the project had delivered the desired result and their problem was now "solved".

Fig. 3.9 – The importance of finding a solution



Firms identified that it was important for the project to deliver a solution for a broad range of reasons - namely that it:

- Addressed a fundamental commercial/operational problem
- Enabled the firm to respond to an opportunity
- Enabled firms to enhance their competence by meeting increasingly challenging industry standards or demands (notably where these had changed in the period between early 2020 and the reopening of the sector in 2022)
- Provided firms with an opportunity to invest in process improvement that differentiated them and made them more competitive
- Enabled the firm to build on or consolidate benefits of an earlier action (for example, protection of IP)
- Led directly or indirectly to the development of a new product
- Protected existing sales or contract arrangements - in one case up to 80% of the sales protected accounted for the firm's turnover.

Virtually all (97.5%) of respondents noted that Aerospace UP had strengthened their ability to supply to the Aerospace sector. This reinforces their other responses indicating that projects were successful.

3.6.1. Deadweight (Non-Additionality)

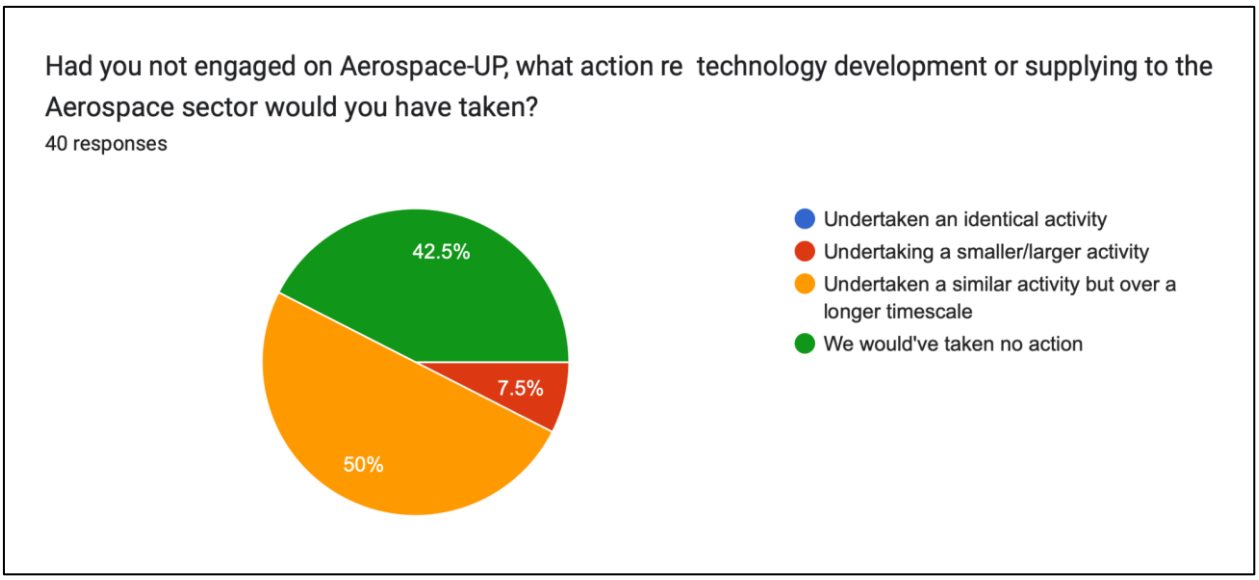
Two forms of deadweight were assessed

- First, the extent to which the firm would have undertaken a similar activity (scale and content) – this discussion also identified whether the activity had been brought forward in time or whether it would have been undertaken on a smaller scale or in a lower quality form

- Second, regardless of the activity supported by the Aerospace UP project, would the firm have achieved a similar level of impact within the same timeframe through undertaking a different activity independent of Aerospace UP?.

The results of these assessments are shown in Figure 3.10 and 3.11. They indicate very low levels of overall deadweight.

Fig. 3.10 – Deadweight - activity

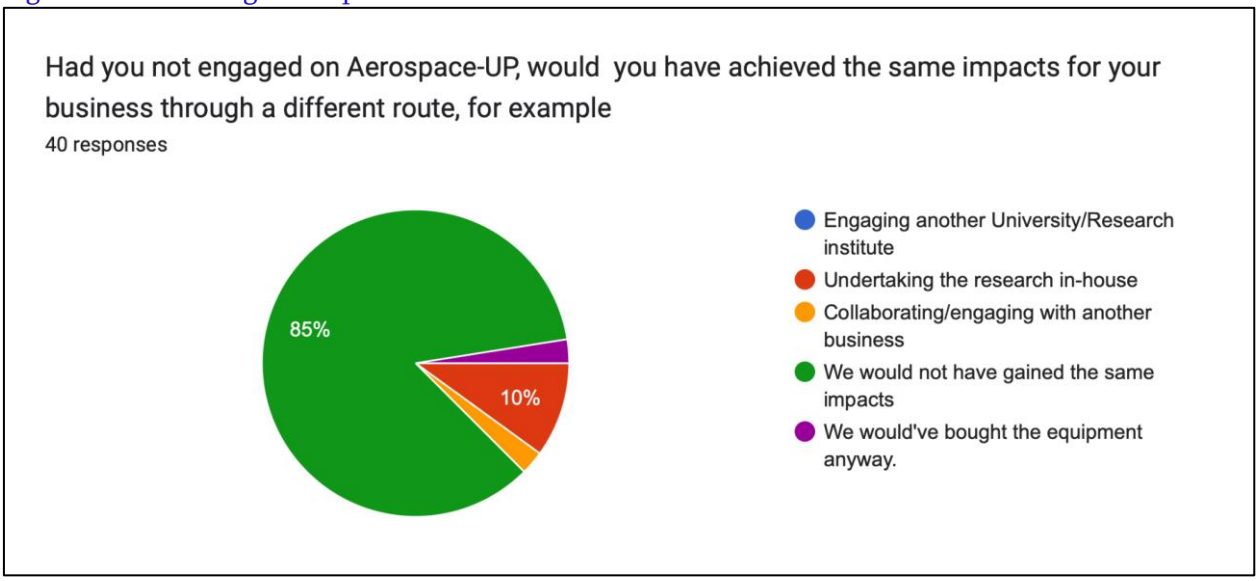


For the assessment of activity deadweight, timing additionality was the most frequently cited (50% of respondents). Most of these responses indicated that the Aerospace UP support advanced activity by two or more years. We accepted companies' projections, but would note that most firms were under significant operational pressure (pull from demanding customers, supply chain quality challenges and component shortages, staff vacancies). We felt that the timescales provided were ambitious given the firms' circumstances, but accepted them on the basis that they were prudent for our assessments of impact (the shorter the timescale, the lower the net impact).

None of the respondents indicated that they would have undertaken a similar activity within the same timeframe.

In addition to half of the projects exhibiting a timing additionality, a further 42.5% were fully additional.

Fig. 3.10 – Deadweight - impact



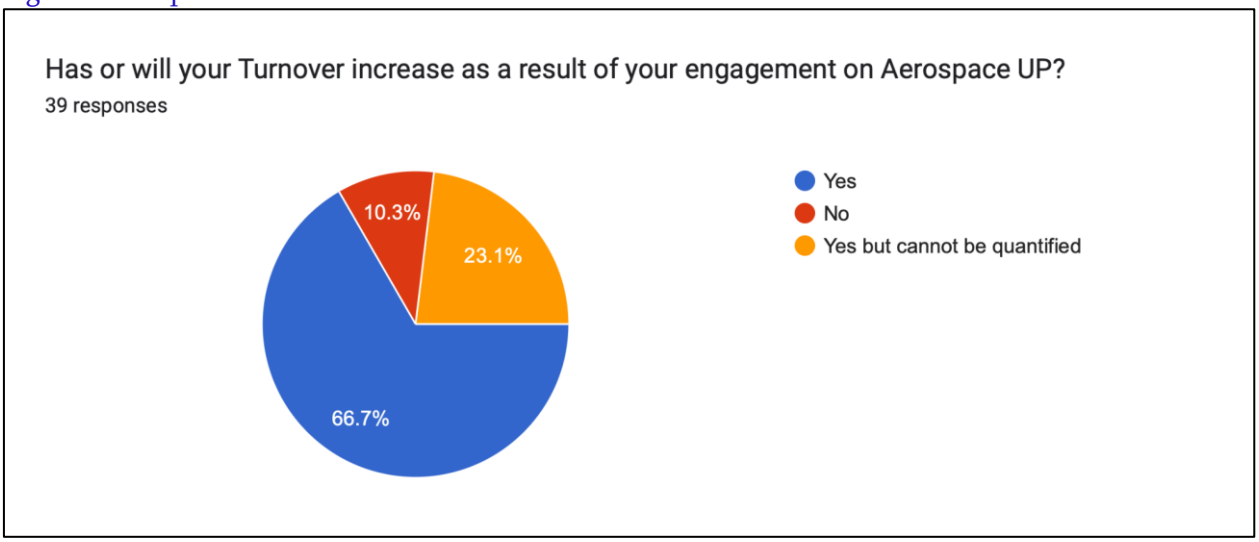
When impact additionality is analysed, over 4/5 of respondents would not have gained a similar benefit for their business through pursuing a different route. For those firms that suggested an alternative, "in-house activity" was the most frequent response (10%). As with activity additionality, we feel that these firms were optimistic in their responses given their states of business and available resources.

3.7. Impact

Detailed data and analysis on the scale of quantitative impacts are presented in the following chapter.

3.7.1. Sales increases

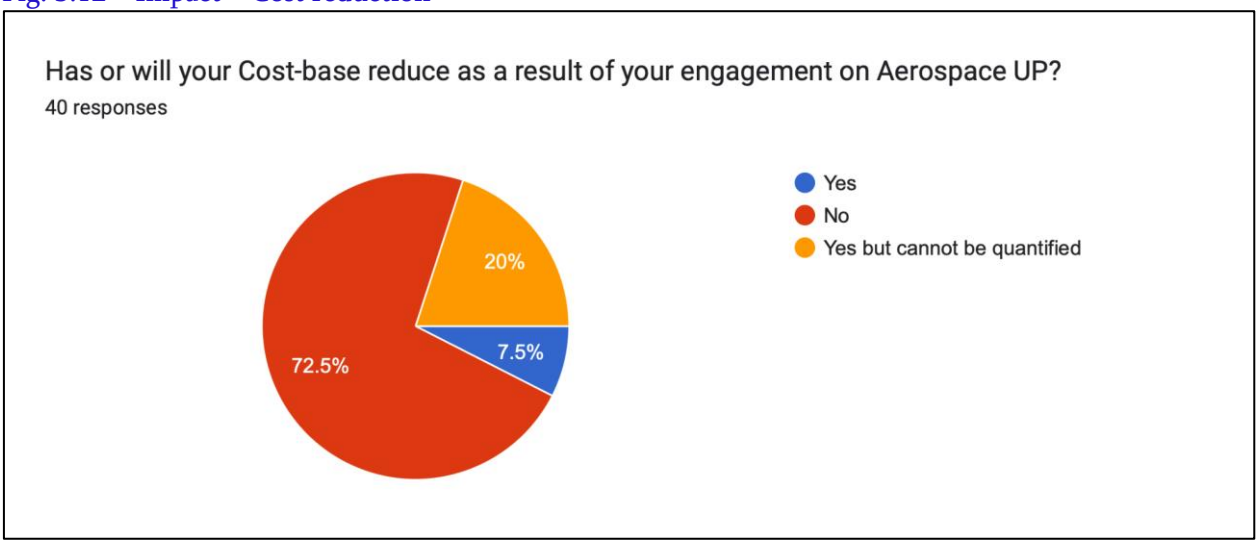
Fig. 3.11 – Impact – Sales increase



Just under 90% of firms indicated that their turnover had, or will increase as a result of their engagement on Aerospace UP. Two thirds could provide a quantum, with most of these data relating to projections of future sales.

3.7.2. Cost Reduction

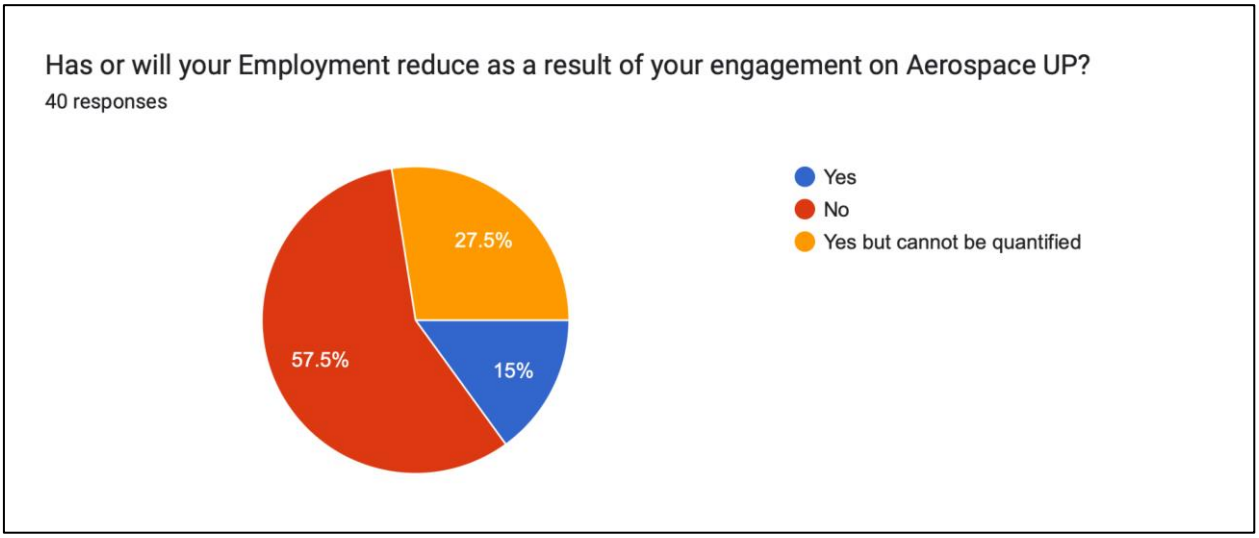
Fig. 3.12 – Impact – Cost reduction



The figure above indicates that over a quarter of respondents identified a cost reduction, but a relatively small proportion could quantify the level. This overall proportion complements the number of projects are related to process improvement.

3.7.3. Employment Creation

Fig. 3.13 – Impact - Employment



Given that a high proportion of respondents citing sales increases, the high percentage of firms indicating a lack of employment growth may appear conflicting. However, it can be explained by Aerospace UP projects supporting process improvement that leads to productivity gains. This was a consistent theme running through the responses.

3.8. Key benefits of Aerospace UP

There were three principal sources of benefit.

3.8.1. Technology Managers

The quality of the MAA Technology Managers was consistently cited as one of the key strengths of the Programme by interviewees.

Generally, firms knew that they had a problem, but many found it difficult to express this in a sufficiently coherent and structured way to make a case for grant support. Firms consistently complimented the Technology Managers for their consulting skills that helped them to identify the real problems they were facing and to focus on those where solutions were likely to be most impactful.

The Technology Managers forced firms to structure their approach and enabled them to identify correctly what they needed to do. Virtually every interviewee noted that the Technology Manager had added significant value in helping them to identify the best approach for implementing the project.

Firms noted that the Aerospace UP requirement to produce a structured and coherent project proposal, that incorporated an implementation plan, was particularly valuable. It introduced rigour and forced them to plan the optimum route for implementation.

In around one fifth of cases, the award had a notable and positive impact on the company's culture. It gave the company confidence that an outside organisation had considered it suitable for investment. This had a knock-on effect on the morale of operative staff, especially where the project involved the acquisition of state of the art equipment.

While firms had a lead Technology Manager for their project, they also had access to the wider team. This leveraged a broad base of market and technology knowledge as well as providing access to relevant market contacts.

Where firms were also members of the MAA, the Technology Managers were proactive in brokering introductions to other members and facilitating opportunities where firms could present their technologies and competencies.

Firms were particularly complimentary when discussing Technology Managers more generally, frequently describing their project management input, encouragement and market introductions as being "invaluable".

Technology Managers invested considerable time with firms in order to agree a robust project specification - they ensured the submissions were of high quality. In many instances, these interactions were relatively efficient with a project specification emerging after a number of weeks. However, we are aware both from firms and feedback from the Managers that some cases required a gestation period of up to a year. Firms valued the Managers' tenacity in these cases.

3.8.2. Flexibility of grant funding

A second key strength of the Programme was the flexibility inherent within the grant conditions and the appropriateness/speed of funding approvals. Firms valued the fact that they could develop a project specification that addressed a core business need and, if approved, quickly access funding that allowed this need to be addressed fully.

Firms observed that it contrasted with many other forms of grant support where the "application overhead" was very high, success rates low and where the grant conditions seemed to be designed to meet the funders' requirements rather than those of the assisted firm.

Linked to funding (funders' reporting requirements), firms valued the ongoing support of the Technology Managers in overseeing the project implementation and reminding them of key milestones and deliverables. Having access to high-quality external support throughout the implementation made projects more successful.

Separately, the Programme support team at the University of Nottingham was also singled out for being helpful. The team was cited on a number of occasions for its constructive feedback and guidance when problems occurred.

3.8.3. Networking, University & Customer visits

Networking, company visits and introductions were the third area firms identified as being specifically valuable. This appears to have been a particular asset during the COVID-19 pandemic as it provided firms with an on-line connection to the wider sector at a time when the industry was in freefall.

Once COVID-19 restrictions were relaxed, firms observed that customer visits (e.g. Ricardo, GKN Aerospace) were particularly valuable. This value did not just relate to the ability to have technical conversations with potential customers, but rather to get a broader insight into the host firms' priorities and commercial cultures. It provided the context within which firms could frame their future "business pitches" to these key industry players.

Separately, firms noted visits to specialist facilities, such as the AMRC in Sheffield and the Precision Manufacturing Centre at University of Nottingham. These visits enabled firms to see first-hand the breadth of technical resources open to them.

3.9. Helping firms engage with the Aerospace sector

A key goal of Aerospace UP was to enable both existing suppliers to the sector to protect their share or expand it and to enable new suppliers to gain access to Aerospace opportunities that might otherwise go to firms outside the UK. The survey captured before and after data which is presented below.

Fig. 3.14 – Share of sales to Aerospace before Aerospace UP support

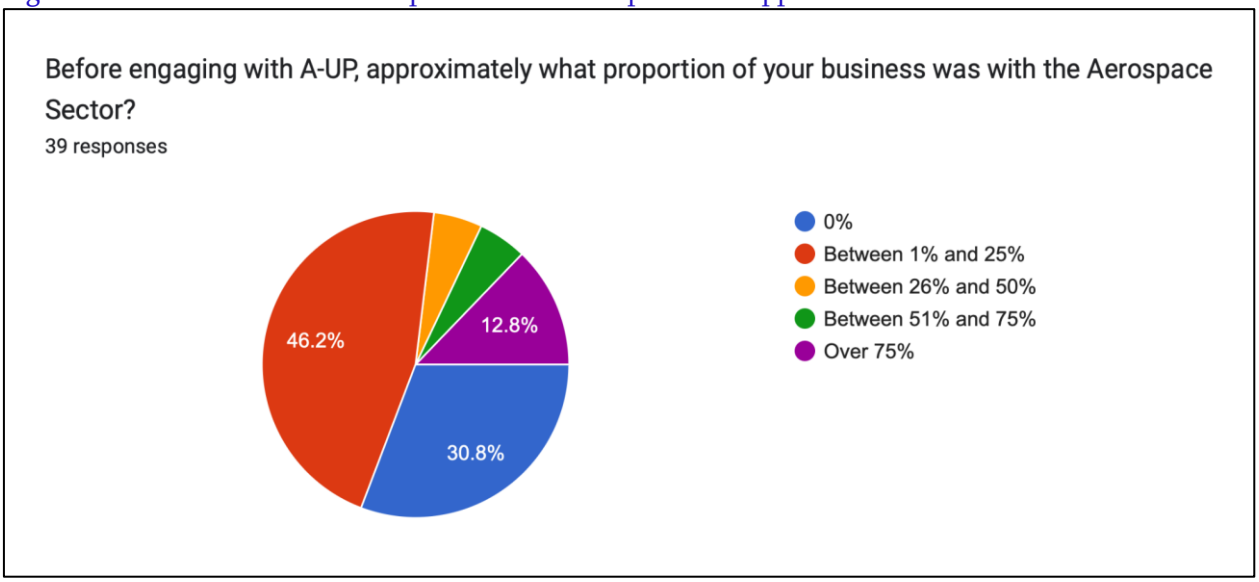
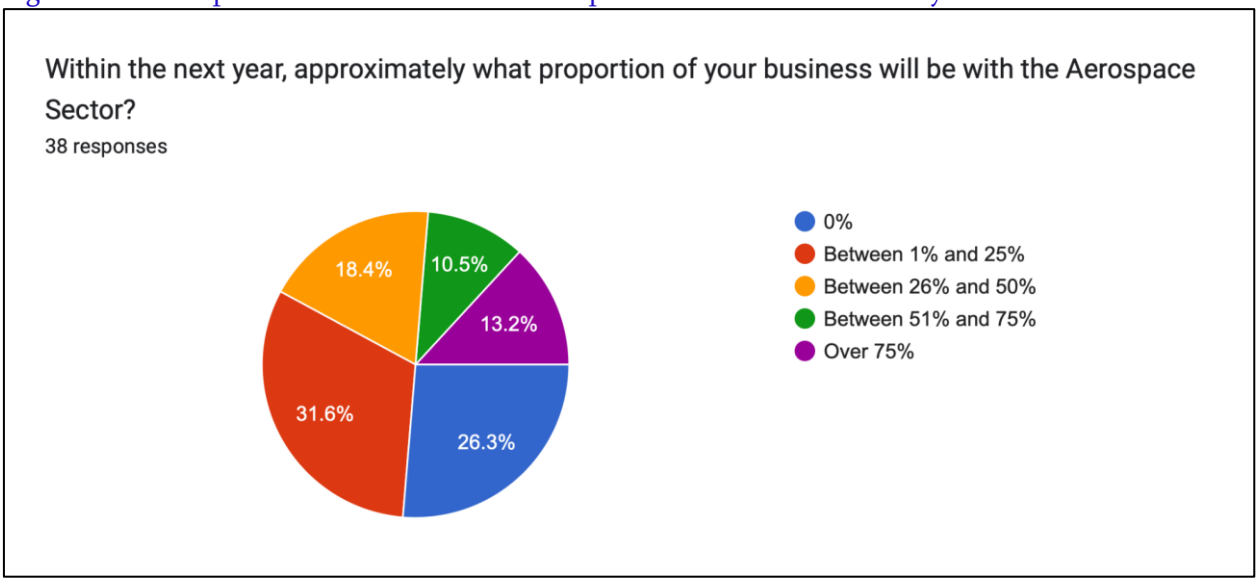


Fig. 3.15 – Anticipate share of sales to the Aerospace sector within the next year



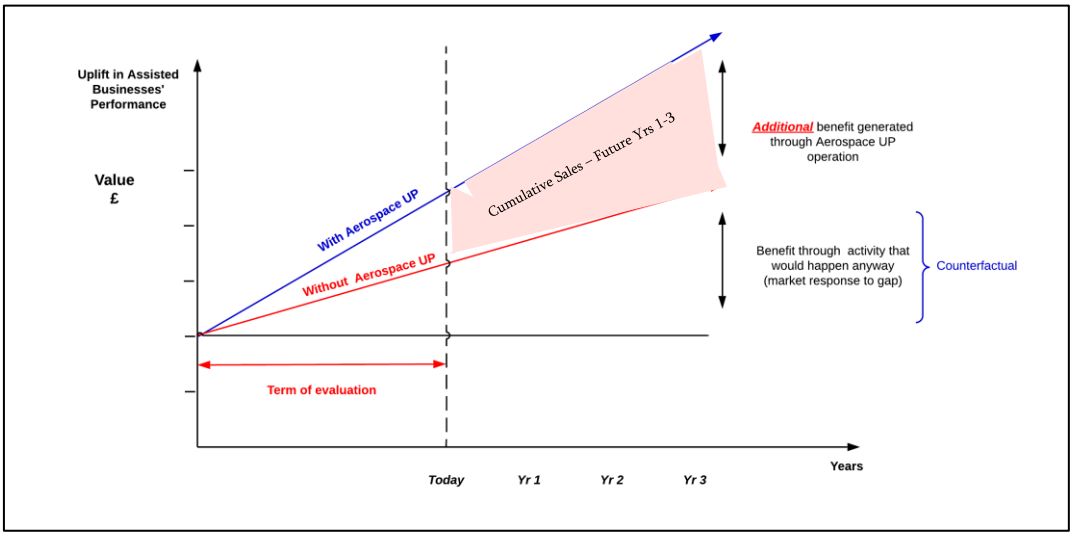
The charts indicate that there has been a notable increase in the proportion of sales from that UK firms anticipate being made in the sector. It can be concluded that the Programme has achieved one of its central goals.

4. Project Outcomes & Impact

4.1. Impact Assessment

The analysis underpinning the assessment of impact is presented in Figure 4.1 below.

Fig. 4.1 – Gross & Net impact



The assessment of impact follows HM Treasury Green Book principles which identifies five additionality factors that inform the conversion of gross impacts to net impacts. These are explained below.

Deadweight (also known as non-additionality) refers to the extent to which outputs/outcomes might be achieved anyway through a different route i.e. if the Aerospace UP project had not been supported. The assessment of deadweight is made on a case by case basis using questions posed to each interviewee and has been shown above to have been comparatively (very) low.

Displacement relates to the number or proportion of project outputs that might be accounted for by reduced outputs elsewhere in the UK i.e. through the firms assisted by Aerospace UP gaining a benefit at the expense of another firm that had invested its own money to develop the same capability. While many of the assisted firms had competitors elsewhere in the UK, it was not always the case that new business, attributable to Aerospace UP assistance, would have been generated at the expense of another UK firm. There were instances that the assisted business was the supplier of a product or service that required to be developed – if not, the contracts would go to a European supplier. In other cases, the capability developed by the firm through Aerospace UP was novel and leading edge so reducing the Displacement effect.

Leakage refers to the number or proportion of project outputs external to the project target area (locally and UK in this instance). Leakage tends to be lower for innovation support measures targeting SMEs. With Aerospace UP, all of the sample were SMEs and none had plants or facilities outside the UK. In addition, all were already implementing (or intending to implement) the innovation within the UK. Leakage was therefore negligible for this sample.

Substitution impacts arise when a beneficiary substitutes one activity for another to take advantage of public sector assistance. In this instance, Substitution effects were negligible as organisations did not have a viable alternative or funding to achieve the same outcome.

Multiplier effects are the wider positive downstream benefits associated with an increase in demand (the ripple effect). These are assessed by applying associated Type II (direct, indirect and induced) multipliers

to projected impacts. Multipliers were sourced from the Scotland Input:Output tables as these are updated frequently and the Midlands' and Scotland economies both have notable Aerospace clusters.

The GVA 'effect' multiplier estimates the indirect or induced GVA change as a result of a direct change of £1m of output generated by the final demand sector. It was applied to the net additional sales value (i.e. after Deadweight, Displacement, Leakage and Substitution effects have been taken into account).

The Type II Multipliers and the GVA Effect used for the analysis are presented in the following Table.

Table 4.1 Multipliers & GVA Effect		
Multiplier SIC Class	Multiplier Value	GVA Effect
20.5 Other Chemicals	1.6	0.6
22 Rubber & Plastic	1.5	0.7
25 Fabricated Metal	1.6	0.8
28 Machinery & Equipment	1.6	0.7
26 Computers, Electronics & Opticals	1.5	0.7
30 Other Transport Equipment	1.6	0.5
32 Other Manufacturing	1.5	0.8

In addition to the five adjustments (excluding GVA Effect), two further effects are discussed below that relate to the estimation of future impacts and are included in the HM Treasury Guidance.

4.1.1. Time Value of Money

HM Treasury proposes that economic projections are presented in constant prices not current prices (the latter where inflation adjustment factors would be applied to future cost and income projections to assess current values).

The HM Treasury Green Book provides detailed guidance on the handling of impacts that will be achieved in the future. In these cases, future impacts are discounted to take account of the "time value of money" and to profile future costs and income at constant prices – the adjustment reflects a desire on the part of users to have the benefit today rather than wait some years to derive it. Currently, the HM Treasury discount rate is 3.5% and we use this for our calculations.

4.1.2. Optimism Bias

There is a demonstrated, systematic, tendency for project appraisers to be overly optimistic when estimating future impacts. This is a phenomenon that affects both the private and public sectors. Green Book Guidance suggests that a figure of 40% should be used where there is a very high degree of uncertainty.

The situation with Aerospace UP is moderately risky, but not as risky as technology start-up or spin out support where future projections are often particularly ambitious. In this instance, firms were mostly well established and had been trading for some time. They were generally relatively cautious about their sales projections. Despite this, we have applied an optimism bias level of 40%, so our estimates should be viewed as relatively prudent.

4.1.3. Impact summary

Table 4.2 – Impact Summary	To date	In 3 years (cumulative***)
Sample (40)		
Gross Sales	£13,795,000	£275,207,050
Net Sales*	£2,307,500	£92,713,287
Multiplier effect	£3,573,750	£134,542,454
GVA	£1,802,750	£62,255,016
Optimism Bias	-	40%
Adjusted Sales	£3,573,750	£80,725,473
GVA	£1,802,750	£37,353,010
Population (109)**		
Gross Sales	£37,591,375	£749,939,211
Net Sales	£6,287,938	£252,643,707
Multiplier effect	£9,738,469	£366,628,188
GVA	£4,912,494	£169,644,920
Optimism Bias	-	40%
Adjusted Sales	£9,738,469	£219,976,913
GVA	£4,912,494	£101,786,952
Programme Cost	£8,349,870	
ROI	**12.78**	

* Future Sales are discounted at 3.5% as per HM Treasury Guidance

** The Population figure may be updated in due course to take account of final Programme deliverables

*** Future Sales are cumulative and assumed to grow linearly up to the Year 3 projections provided by firms at interview

5. Project Value for Money

5.1. Programme ROI

The Programme ROI (Net GVA:Total Programme Cost) to the Public Sector is estimated to be **12.78:1**

This return on investment should be viewed as being very good for an initiative of this kind. Scottish Enterprise has undertaken a range of ex-post evaluations of innovation support measures over the past decade showing a typical ROI of 8.2:1.

6. Conclusions & Lessons Learned

6.1. Programme Aims

Aerospace UP is a Programme of innovation business support activities aimed at connecting and supporting businesses in the Midlands to gain the skills, capabilities and resources to help them grow, improve productivity and prepare for the challenges of the 21st century.

Aerospace UP aimed to provide a cohesive framework, an industry network and a set of targeted support services to enable the development and delivery of new product and process innovations in the lower supply chain tiers of the Aerospace sector.

6.2. Programme achievements

All grant assistance required firms to submit a project proposal that was appraised independently before a grant offer was made. The level of grant support was governed, by the:

- commitment and capacity of the firm to deliver their project
- the quality of the project submission
- the levels of subvention available for their location.

It is clear from firms' feedback that the aims of Aerospace UP have been achieved:

- It has assisted firms currently supplying to the Aerospace sector to expand their footprint
- It enabled firms wishing to enter the Aerospace sector to develop the necessary capacity – these firms were generally specialist high value manufacturers, for example supplying the performance automotive sector, whose expertise would be particularly valuable to UK Aerospace OEMs and higher Tier supply chain firms. This the Programme had an additional benefit of facilitating innovation transfer *to* the Aerospace sector
- It led to new (often IP protected) products and processes being developed
- It improved firms' competitiveness
- It should lead to future productivity increases for those who undertook manufacturing process improvement projects
- It increased firms' management confidence
- In selected cases, it improved the broader culture/confidence in firms by showing staff at all levels that an external organization had faith in their company
- It facilitated the development of breakthrough projects.

6.3. The Programme leveraged private investment

The programme offered CR&D/innovation grants up to £100,000 in value to eligible SMEs. Grant values were well below the maximum figure with:

- the average grant value is £41,000
- the median value is £32,000
- The mode is £10,667 (indicating a skew to lower value awards).

A total of £5.24 million of grant monies were disbursed.

This grant support leveraged contributions from firms, with total project values being higher. The profile of project values was:

- Average project value of £86,023
- Median project value of £64,053.

The total value of projects supported was just over £11million with SME matched funding amounting to £6.12 million (55%).

6.4. Progress against target

Table 6.1 indicates that target achievement is behind profile. These achievement profiles must be viewed within the context of business engagement during the COVID-19 pandemic. Global constraints on social interactions prevented the Programme from being implemented as planned – COVID-19 restrictions led to a range of changes that included:

- Stopping in-person networking events
- Delaying the introduction of student and graduate placements
- Redesigning the grant-funded CR&D/innovation projects – these were originally designed to be collaborative projects involving two or more firms. Following agreement of the Managing Authority, they were re-designed to involve single firms (thereby overcoming the effect of societal lockdowns)
- Delivering a considerable number of networking and technical events on-line.

Table 6.1 – Progress against target

Output Target	Description	Target	Completed/In-Progress at 23.04.23
C1	Enterprises receiving support	365	174
C2	Number of enterprises receiving financial support (grants)	109	126
C4	Enterprises receiving (non-financial) support	328	159
C8	Employment increases in supported enterprises	214	-
C26	Enterprises cooperating with Research Entities	163	32
C28	Enterprise supported to introduce new to the market products	109	55
C29	Introducing New Products, Processes or Services to the firm	109	81

The impact of COVID-19 on the Aerospace sector was fundamental, global and debilitating. Most of the global commercial passenger aircraft fleet was grounded which had a knock-on effect on the entire industry. Thus, the "market" into which the Programme was launched was fundamentally altered from that anticipated when it was put forward for funding.

6.5. Programme impact

Table 6.2 below summarises the economic impact of the Programme.

Programme deadweight (non-additionality) is low:

- None of the respondents indicated that they would have undertaken a similar activity within the same timeframe.
- Half of the projects exhibited a timing additionality – typically, Aerospace UP advanced the activity by two years
- A further 42.5% were fully additional (no Deadweight) and this proportion is comparatively high – typically it might be expected to be in the order of 20-25% for an innovation support initiative of this kind.

Displacement (as with all additionality factors) was calculated case by case and based on firms' responses, was found to be moderate. Firms were generally operating in niche areas with limited displacement or were introducing a new to market product or new to firm process.

Table 6.2 – Impact Summary	To date	In 3 years (cumulative***)
Sample (40)		
Gross Sales	£13,795,000	£275,207,050
Net Sales*	£2,307,500	£92,713,287
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Programme Cost	£8,349,870	
ROI	**12.78**	

* Future Sales are discounted at 3.5% as per HM Treasury Guidance

** The Population figure may be updated in due course to take account of final Programme deliverables

*** Future Sales are cumulative and assumed to grow linearly up to the Year 3 projections provided by firms at interview

Based on the assessment to date, the Return on Investment to the Public Sector (Net GVA:Total Programme Cost) is 12.78:1. This is high.

6.6. Overall

The Aerospace UP Programme has been successful in encouraging firms to invest in their businesses and helped them to develop new products and processes that enhanced their ability to supply to the Aerospace sector.

Firms felt that the Programme design should be retained and not changed. The Programme aimed to improve the competitiveness of the Aerospace supply chain in the Midlands – it achieved this.

The context of the COVID 19 pandemic had a profound impact on the delivery of the Programme. The project partners were proactive and flexible in responding to the constraints introduced by the pandemic and these responses were valued by firms

Air travel stalled globally and OEMs' and Tier 1 firms' businesses radically contracted. Firms in lower Tiers were hit particularly severely and have struggled to rebuild their businesses – few of the 40 firms interviewed were yet back to 2019 turnover levels. In the intervening period, they have depleted their reserves, experienced staff shortages and are now dealing with customers who are much more demanding than they were before the pandemic – these customers are struggling to rebuild their businesses.

The delivery of Aerospace UP should be appraised within this context. The partners retained the core elements of the Programme's design and managed the resources within a particularly challenging delivery environment. They have been proactive in making changes (e.g. a move to on-line networking events and the request (approved) to change innovation grant projects from being collaborative to being single company) to ensure the support reached firms and they maintained independent appraisal process of funding applications to ensure quality.

At 12.78:1, the Programme's ROI is high for an ERDF initiative of this kind. It is at the upper end of the spectrum for UK innovation support projects that do not involve Capital Expenditure for the creation of physical facilities.