



Economic evaluation of the International Partnership Programme (IPP): Economic return to the UK

Prepared for the UK Space Agency

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About London Economics

London Economics (LE) is one of Europe's leading specialist economics and policy consultancies, with a dedicated team of economists specialised in the space sector.

As a firm, our reputation for independent analysis and client-driven problem solving has been built up over 30 years. From our headquarters in London, and associate offices in five other European capitals, we advise an international client base.

As a team, we have been pioneering innovative analytical techniques and advising decision-makers across the space industry, space agencies and international governments since 2008. Drawing on our solid understanding of the economics of space, expertise in economic analysis and industry knowledge, we use our expertise to reduce uncertainty and guide decision-makers.

Our consultants are highly-qualified economists with extensive experience in applying a wide variety of best practice analytical techniques to the space sector, including:

- Market sizing, analysis and demand forecasting;
- Business case support (economic and financial feasibility);
- Value-for-Money (Cost-Benefit Analysis, Cost Effectiveness Analysis);
- Impact assessment and policy evaluation (especially public utility and spillover benefits);
- Sophisticated statistical analysis (econometrics, regression);
- Analysis of industry structure and competitive dynamics;
- Commercial due diligence.

London Economics has been selected to provide the UK Space Agency's International Partnership Programme with specialist economic evaluation support and analysis, in collaboration with Caribou Space.

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About Caribou Space

Caribou Space work with governments, space agencies, development agencies and private sector space companies to bridge the space and development worlds.

Caribou Space is the selected partner for UK Space Agency International Partnership Programme providing ODA compliance, monitoring & evaluation (M&E), knowledge sharing and communications, sustainability and programme strategy support. London Economics has partnered with Caribou Space to provide the economic analysis support for the IPP.



About UK Space Agency

The UK Space Agency leads the UK efforts to explore and benefit from space. It works to ensure that our investments in science and technology bring about real benefits to the UK and to our everyday lives. The agency is responsible for all strategic decisions on the UK civil space programme. As part of the Department for Business, Energy and Industrial Strategy, the UK Space Agency helps realise the government's ambition to grow our industry's share of the global space market to 10% by 2030.

The UK Space Agency:

- Supports the work of the UK space sector, raising the profile of space activities at home and abroad;
- Helps increase understanding of our place in the universe, through science and exploration and its practical benefits;
- Inspires the next generation of UK scientists and engineers;
- Regulates and licences the launch and operation of UK spacecraft, launch operators and spaceports;
- Promotes co-operation and participation in the European Space Agency and with our international partners.

The International Partnership Programme (IPP) is a five-year, £152 million programme run by the UK Space Agency. IPP focuses strongly on using the UK space sector's research and innovation strengths to deliver a sustainable economic or societal benefit to emerging and developing economies around the world.

IPP is part of and is funded from the Department for Business, Energy and Industrial Strategy's Global Challenges Research Fund. This is a £1.5 billion fund announced by the UK government to support cutting-edge research and innovation on global issues affecting developing countries.

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Executive Summary

Objective

The aim of this study is to quantify the expected economic benefits of the UK Space Agency's International Partnership Programme (IPP) on UK grant recipients, their supply chains and the wider UK economy.

Scope and methodology

As a development programme, the IPP's primary aim is to deliver impact in the developing world. This report is focused on the secondary economic benefits that accrue to the UK. Evidence on project inputs and impacts was collected through a survey of UK project participants. A total of 97 individual responses from 67 UK organisations across the portfolio of 33 IPP projects were collected for this study.

Caveats and limitations

The methodology used, and assumptions made, are informed by best practice and described in this report. Nonetheless, the reader should note the following limitations and caveats:

- **Most IPP projects are still ongoing at the time of writing this report.** The expenditure, employment and impact data presented in this report therefore rely on a combination of realised and projected estimates.
- The survey data gathered from UK organisations in receipt of IPP grant funding is taken at face value and assumed to be representative. This may bias the findings.
- Some UK IPP participants have not provided inputs for this study. These omissions are known and represent a small proportion of all relevant organisations engaged in IPP.

Key findings

- The **total present value (PV) of the IPP to the UK economy is estimated at £279m**. This value is generated through two channels:
 - The £119m in expenditure on projects (grant and private) is estimated to generate **£132m** in additional economic activity throughout the economy that would not have occurred without the IPP, and
 - Additional sales of £107m (of which, 90% from exports) that are forecast by IPP programme participants is estimated to generate **£147m** in additional economic activity throughout the economy.
- Considering only public investment, the analysis shows that **each £1 of public investment in IPP generates an additional £2.57 in economic output** of the UK economy.
- Considering both public and private investments, **the IPP's total economic return to the UK is £2.35 per £1 of public investment.**¹

¹ This ratio is known as 'NPV/DEL' – the division of NPV (Net Present Value, defined as the total discounted benefits less total discounted costs, both public and private) by DEL (Departmental Expenditure Limit, the total discounted domestic public investment).

Note: The IPP is ODA-funded development programme (i.e. with primarily development objectives rather than UK commercialisation and/or utility objectives). As end-users of IPP solutions are based in developing economies outside of the UK, the estimate of UK return to IPP excludes benefits for downstream UK-based end-users. **IPP therefore differs from the more typical UK government space investments** that seek to build UK space industrial capacity and deliver benefits to UK public and private users.

- In addition, the IPP is also projected to support employment of approximately **3,300 FTEs** that would not have existed without the programme. This includes 900 UK-based FTEs directly supported by the grants, and a further approximately 2,400 in the wider supply chain.
- Other grantee benefits have been clearly evidenced and fall into four main areas: **commercial, network, reputation, and knowledge**. Together, these benefits suggest that the benefits of participating in the IPP extend significantly beyond the grant into other areas of the business. For example:
 - More than 80% of respondents agree that the IPP has already had a positive impact on their **product/service offer**;
 - The IPP was cited as an “excellent vehicle” for showcasing UK expertise worldwide and promoting the UK sector more generally. This suggests that IPP fits within the UK Space Agency’s broader remit of promoting and developing the UK Space sector.
 - 62% of all respondents agree that the IPP already benefits **sales in other areas of their business**;
 - More than 80% of respondents agree that the IPP has already had a positive impact on their **brand reputation**;
 - Over 80% of all respondents agree that the IPP has already had a positive impact on their **relationship with customers**;
 - More than three quarters of respondents agree that the IPP has already had a positive impact on the levels of technical (95%), commercial (76%), developing country (86%) and measurement evaluation (81%) **knowledge or expertise**, and
 - Over 80% of all respondents believe the IPP has a positive impact on their organisation’s **overall competitiveness**.
- In addition, almost 90% of respondents have already shared knowledge (e.g. project outputs and project lessons) with other organisations or plan to do so. This suggests that benefits from the IPP could extend beyond programme participants to third parties not directly involved in the projects. In the long run, these **spillover** effects can generate tangible benefits for other organisations.

1 Introduction

The International Partnership Programme (IPP) is a five-year, £152 million programme run by the UK Space Agency (UKSA). It is funded by the Department for Business, Energy and Industrial Strategy's (BEIS) Global Challenges Research Fund (GCRF) and forms part of the UK's Official Development Assistance (ODA) commitment.

The IPP uses the **UK space sector's research and innovation strengths to deliver space-enabled solutions in developing countries through partnerships with local organisations**. These solutions are intended to enhance the capacity of these countries to respond to a variety of development challenges, including deforestation, disaster response, agricultural production, maritime communications and renewable energy. A total of 33 projects have been commissioned as of March 2019, involving UK organisations across industry, academia and the non-profit sector.

The impact of the IPP on the developing world is the primary focus of this five-year ODA programme. A rigorous Monitoring & Evaluation (M&E) function has therefore been implemented by Caribou Space to measure and communicate the benefit and impact of IPP on developing countries. All IPP grantees are required to evaluate their project-level impact to support this work. Further information on the projects, and various reports on the potential areas that space can help in developing countries, can be found at www.spacefordevelopment.org.

In addition to this report, Caribou Space and London Economics have conducted Cost Effectiveness Analysis (a type of Value-for-Money) of the different space enabled solutions based on inputs from all projects².

This report quantifies a secondary objective of the IPP: the expected **economic benefits of the IPP on UK grant recipients, their supply chains and the UK economy** based on a survey of UK programme participants. Since most of these projects are **still ongoing** at the time of writing, all forward looking estimates in this study are based on grantee **forecasts**. This report is arranged as follows:

- **Chapter 2** details the methodology (approach, scope and limitations) of the study;
- **Chapter 3** presents summary data on IPP expenditure and employees directly supported by the programme;
- **Chapter 4** reports the impact of the programme on grantee recipient organisations – based on survey responses;
- **Chapter 5** concludes with an assessment of the economic and social return of the programme to the UK – including the UK space sector, wider supply chain and UK economy and society more broadly.

² London Economics (2019). Economic evaluation of the International Partnership Programme (IPP): Cost-Effectiveness Analysis

2 Methodology

2.1 Approach

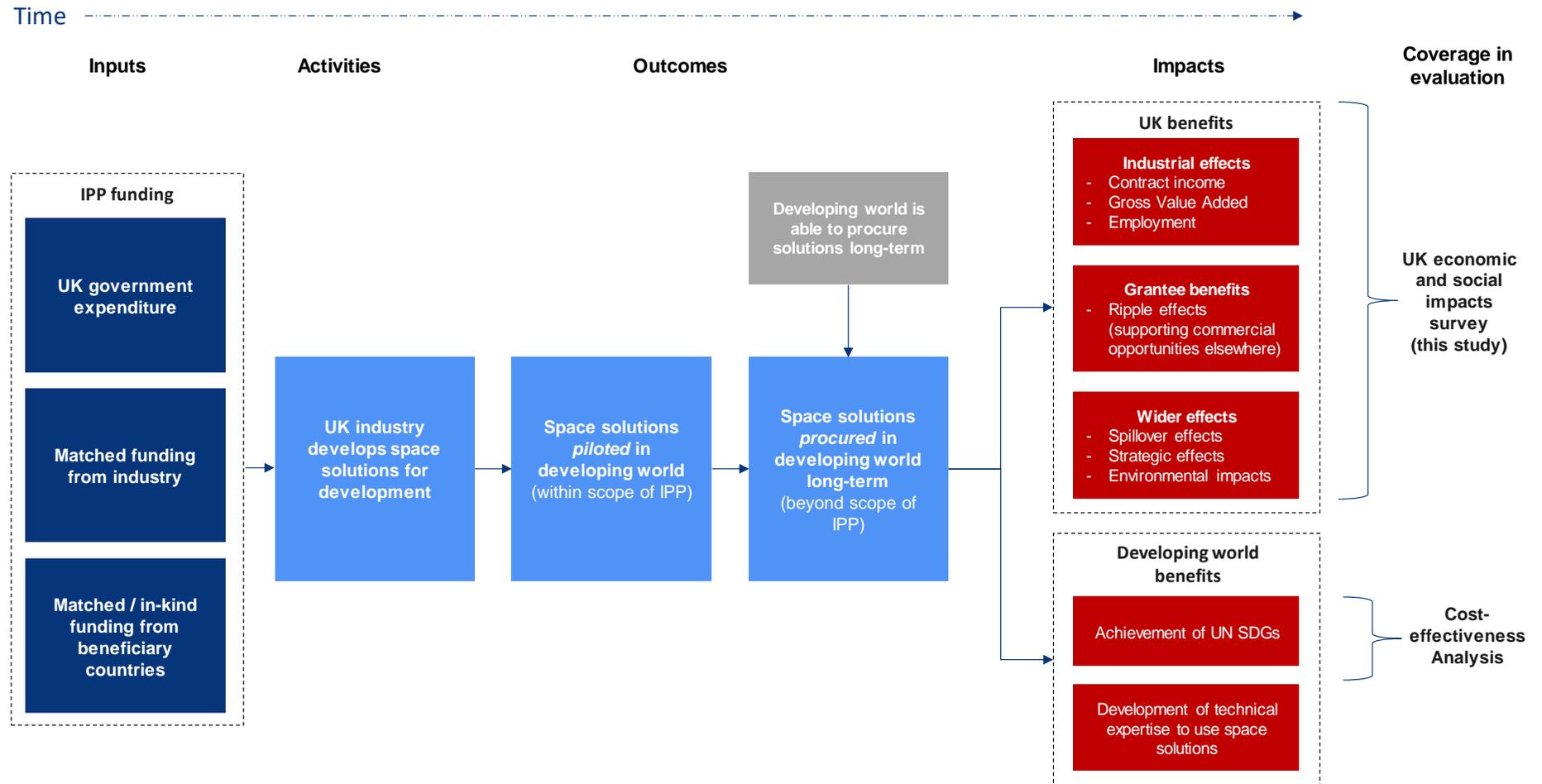
A bespoke survey was used to collect IPP participant-level data on multiple indicators related to their project's inputs and impacts. Data was collected on: IPP-related expenditure; leveraged expenditure; IPP-attributable income (related sales); employment supported; contribution to UK GDP; knowledge gained; exports, and future prospects. A total of **97** individual responses from 67 UK organisations across the portfolio of 33 IPP projects were collected for this study.

These inputs, activities, outcomes and impacts are outlined in the programme's logic model (Figure 1 below). As well as outlining the relationships and dependencies of these variables, the logic model identifies the variables that needed to be estimated for the economic analysis.

To ensure a robust assessment of programme impacts, IPP grantees were also asked to assess how their solution would have changed in the absence of IPP funding. This hypothetical scenario is known as the '**counterfactual**'. The impacts associated with this scenario are netted off the gross impacts identified for the IPP so that only the 'additional' impacts of the programme are considered. Expenditure and impact data are then combined in a Return on Investment model, consistent with HM Treasury best practice³, to estimate the UK's total return from the investment in the IPP.

³ The methodology for this report is consistent with: HM Treasury (2018). The Green Book. Central Government Guidance on Appraisal and Evaluation. Available here: <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

Figure 1 Logic model of the economic impact of the International Partnership Programme (IPP)



Source: London Economics

Box 1 Logic model of the economic impact of IPP

A combination of **funding from government** leverages additional **private sector funding** from UK industry and in-kind contribution from beneficiary developing countries to design, deliver and implement space solutions in the developing world. By improving the adoption of satellite solutions, the primary objective of the IPP is to contribute to the **UN SDGs** e.g. by improving the efficiency and effectiveness of forest management authorities, improving agricultural yield, or the disaster preparedness and responsiveness of disaster management authorities.

This funding also has immediate benefits for the UK economy by stimulating economic activity in the industrial supply chain. These benefits are measured in terms of Gross Value Added⁴ (i.e. contribution to UK economic activity / GDP) and employment supported.

Since IPP grantees deliver complex solutions in new environments, involvement in the IPP may provide UK suppliers with technology, commercial knowledge and intellectual property (IP) that they can leverage to support commercial activity in other areas. These **leveraged sales** are in addition to any **follow-on sales opportunities** that come from long-term procurement of their IPP solution from beneficiary countries.

These benefits may flow beyond IPP grantees to other organisations as the new knowledge gained from the projects are exchanged with others during knowledge-sharing events, conferences and technology demonstrations. This can include knowledge of how to deliver complex solutions, working in a new environment, the nature of the new market, technical innovations or of the technology itself. These wider benefits are termed '**spillovers**' and suggest that the value of IPP-like programmes is significantly bigger than what is captured by the immediate programme grantees or the beneficiary countries. The existence of spillovers justifies government support for programmes like the IPP¹¹.

2.2 Caveats and limitations

This evaluation has been conducted by professional economists with specialist knowledge of space applications. Best practice and judgement have been used to develop the survey that underpins this study, and to inform the aggregate analysis of it. The methodology used, and assumptions made, are described in this report. Nonetheless, the reader should note the following limitations and caveats:

- **Estimates based on projections:** IPP is approximately halfway through a five-year programme and most of the IPP projects are still ongoing at the time of writing this report, with many still at the early stages of implementation or operation. The expenditure, employment and impact data presented in this report therefore rely on a combination of realised and projected estimates. For expenditure and employment figures, projections are grounded in the fixed price budget proposals that were submitted during the bidding process. The inherent uncertainty of projected impacts (not yet realised) should also be

⁴ Gross Value Added (GVA) is the measure of the value of goods and services produced in an area, industry or sector of an economy. It is calculated as the value of sales minus the cost of sales (such as intermediate consumption). Both GVA and Gross Domestic Product (GDP) are measures of output. GDP measures outputs at an economy-wide level by summing the GVA of specific sectors and adding taxes on products and deducting subsidies on products (both of which can only be estimated at the whole economy level).

acknowledged in this report. The results of this report are therefore indicative and will be updated in later editions of this report as actual costs and impacts become known.

- **Survey inputs taken as given:** The survey data gathered from UK organisations in receipt of IPP grant funding is taken at face value and assumed to be representative. This may add a bias to the findings. In some cases, the stakeholder may have a pessimistic view of the future impact of the IPP on their organisation, whereas others may have unrealistically optimistic views.
- **Known omissions:** Despite best efforts to encourage participation, some UK organisations in receipt of IPP grant funding have not yet provided inputs for this study. These omissions are known and represent a small proportion of all relevant organisations engaged in IPP. These omissions are likely to have a small effect on aggregate estimates and suggest that the economic impacts identified in this study are likely to be an underestimate. Furthermore, some respondents overlooked certain questions within their response, which gives rise to some minor inconsistencies in the total values (e.g. expenditures vs. source of funding).

3 Overview of IPP

The following chapter presents analysis of IPP expenditure and employment data to indicate the scale and diversity of the IPP portfolio.

These estimates are based on **97** individual responses from 67 UK organisations across more than 30 different IPP projects that engaged with this study. Organisations with multiple projects were required to provide a response for each of the projects they were engaged in.

Most respondents (58%) identify as commercial enterprises – comprising SMEs (38%) and enterprises with more than 250 employees (20%). The remainder (42%) identify as either NGOs, universities / research institutions or other publicly-funded institutions.

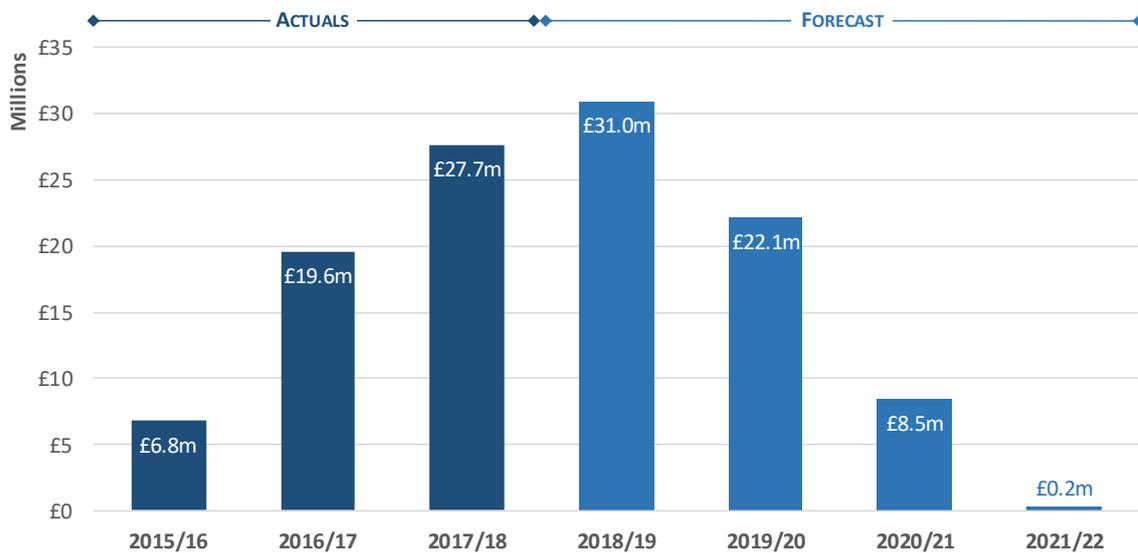
Note: The first half of this section presents data on the financial breakdown of IPP expenditure to indicate the scale and diversity of the IPP portfolio. All monetary values in this section are therefore expressed in **nominal terms** (i.e. current prices – values have not been adjusted for inflation or discounted to Present Value terms).

3.1 IPP expenditure

3.1.1 IPP expenditure by year

Total (public and private) expenditure currently committed on UK IPP projects is forecasted to reach over £116m over the lifetime of the IPP (2015/16 – 2021/22).

Figure 2 IPP expenditure by year

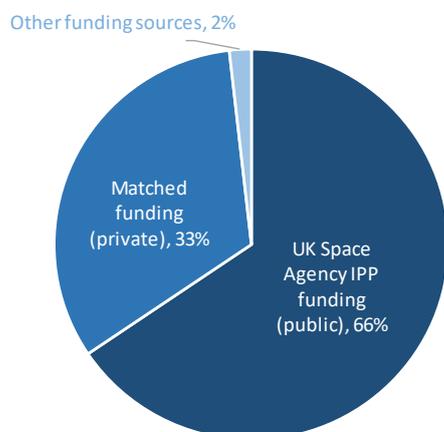


Note: n=91 respondents

Source: LE analysis of survey responses

3.1.2 IPP expenditure by source of funding

Figure 3 IPP expenditure by source of funding



Note: n=92 respondents

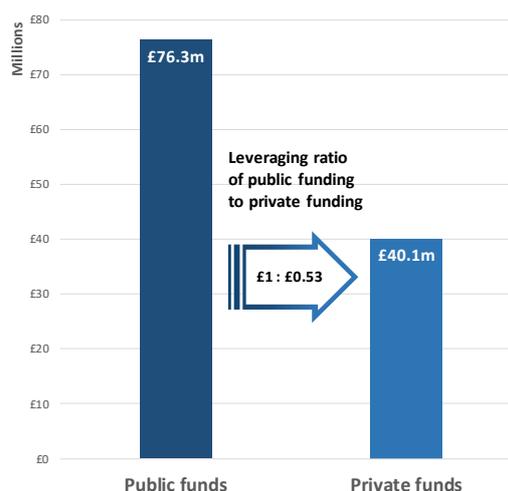
Source: LE analysis of survey responses

The £76.3m in UK Space Agency funding represents approximately half of the programme's entire budget envelope of £150m, with the difference accounted for by unallocated funding (IPP is a multi-year programme with a budget stretching to 2021), expenditure on international partners, non-respondents to the survey, non-UK based companies, grant management and other programme-wide operational costs.

Most of this expenditure (£76.3m or 66%) is projected to come from the UK Space Agency's programme budget. The remainder is expected to come from the UK participants themselves – in the form of matched funding (33%)⁵, and other funding sources (2%).

In other words, £76.3m of public expenditure is expected to leverage a total of £40m in private funding by the end of the programme. This means that **every £1 in public expenditure is expected to leverage a further £0.53 in private investment.**

Figure 4 Public-private leverage ratio



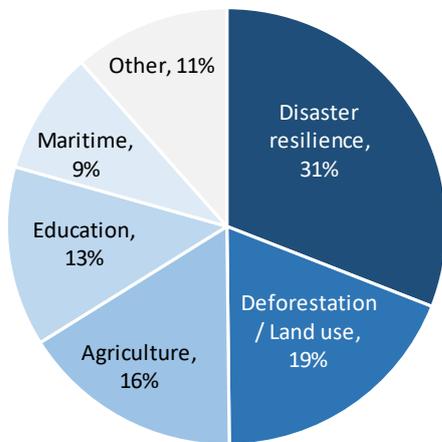
Note: n=91 respondents

Source: LE analysis of survey responses

⁵ Matched funding requirements were as follows, depending on organisation type: large companies (50%), medium companies (40%), small companies (30%), UK universities, research organisations, NGOs (20%), Overseas universities, research organisations, NGOs (0%).

3.1.3 IPP expenditure by development sector

Figure 5 IPP expenditure by development sector



Analysing IPP expenditure on UK organisations by development sector reveals a significant concentration of funding.

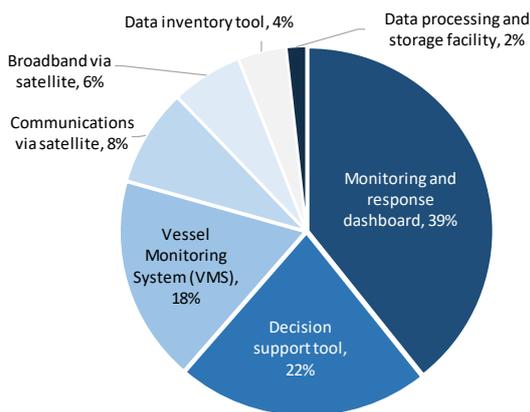
Together, projects that focus on just three development sectors – disaster resilience (31%), deforestation / land use (19%) and agriculture (16%) – account for two third of all IPP expenditure (66%).

Other development sectors covered by the remaining programme budget (34%) include: maritime, education, renewable energy and health.

Note: n=91 respondents.

Source: LE analysis of survey responses

Figure 6 IPP expenditure by solution type



All IPP projects represent developing world applications of space data (i.e. from satellites). Even so, the types of solutions supported by the programme cover several diverse categories⁶.

When measured by total expenditure, most projects rely on satellite-derived Earth Observation (EO) data to: monitor large areas of the Earth and detect changes over the areas being monitored (39%), to advise on or initiate a response from the end users of the solution (22%) and develop data inventories (4%).

Note: n=91 respondents. Based on LE analysis of projects.

Source: LE analysis of survey responses

Solutions that provide telecommunications and broadband via satellite account for a further 8% and 6% of the IPP’s total projected expenditure, respectively.

GNSS data is integrated with both EO and satcom data to support multiple solutions. For example, both Satcoms and GNSS are used to support Vessel Monitoring Systems (VMS) – a solution that accounts for 18% of total IPP expenditure.

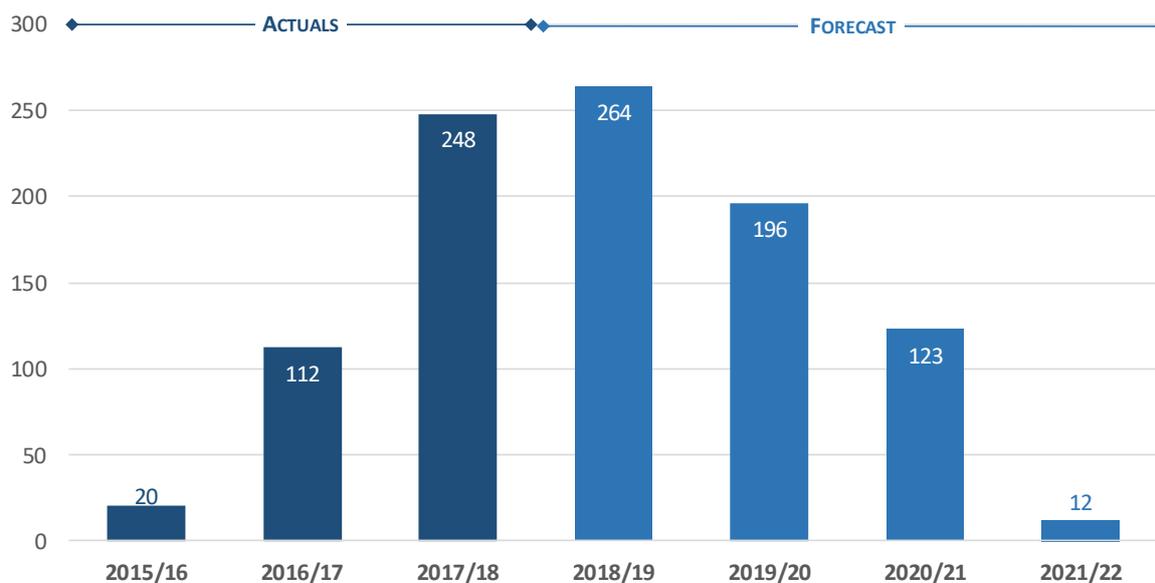
⁶ Note that IPP projects are assigned to one solution type exclusively.

3.2 IPP employment

3.2.1 IPP employment by year

The total number of UK-based employees that will be directly supported by the programme is estimated at **974 full time equivalent headcount (FTEs)** based on survey responses⁷. Of this, 380 FTEs have already been supported by the IPP since the programme launched in 2015/16. A further 594 FTEs are projected to support IPP projects over the remaining lifetime of the programme.

Figure 7 IPP employment by year



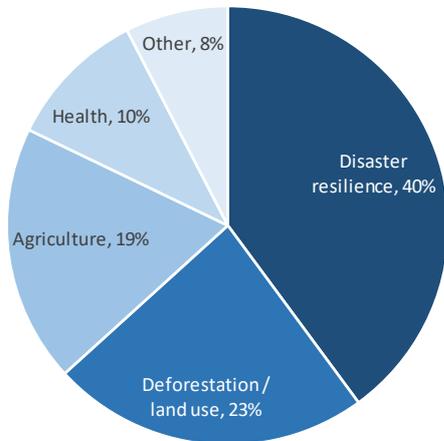
Note: n=89 respondents

Source: LE analysis of survey responses

⁷ This Full Time Equivalent (FTE) estimate is the sum of each respondent's estimate of the total number of FTE UK-based employees (including both salaried employees and external contractors) that have been or are expected to be supported by the IPP project.

3.2.2 IPP employment by development sector

Figure 8 IPP employment by development sector



Note: n=89 respondents

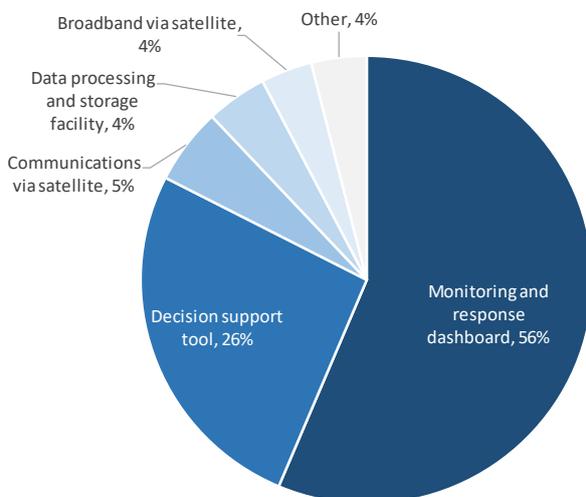
Source: LE analysis of survey responses

The distribution of IPP employment by development sector closely resembles the distribution of IPP expenditure by development sector.

The share of employment accounted for by the three largest development sectors – disaster resilience (40%), deforestation / land use (23%) and agriculture (19%) – is 82%. This is more concentrated than the expenditure share of these areas (66%).

3.2.3 IPP employment by solution type

Figure 9 IPP employment by solution type



Note: n=89 respondents. Based on LE analysis of projects

Source: LE analysis of survey responses

As with expenditure, EO-based solutions dominate the share of employment supported by the IPP.

Monitoring and response dashboard solutions alone account for more than half of all IPP employment (56%), followed by decision support tools (26%) and communication via satellite solutions (5%).

4 Benefits of IPP to grant recipients

This chapter presents a holistic assessment of the programme's benefits on IPP grantees. Assessed benefits include: market opportunities that are likely to be accessible to grantees as result of participation; current and expected sales that have been leveraged on the back of IPP, and other qualitative impacts of the IPP on grantees and the internal capabilities of staff. To identify the specific difference that the IPP has made, the impacts are compared with the 'no-IPP' counterfactual.

Note: All monetary values in this section are expressed in **nominal terms** (i.e. current prices – values have not been adjusted for inflation, or discounted to Present Value terms).

4.1 Assessment of additionality (counterfactual)

To ensure a robust assessment of programme impacts, it is important to consider if and how IPP-funded solutions would have progressed **in the absence of IPP funding** – known as the 'counterfactual'. The impacts associated with this counterfactual scenario are then netted-off the impacts identified for the IPP such that only the 'additional' impacts of the programme are considered. The additional expenditure and impact data that is assessed can then be combined in a Return on Investment model, consistent with HM Treasury best practice, to estimate the UK's total return from the investment in the IPP.

To assess the counterfactual for this study, grantees were asked to indicate whether their project would have proceeded through other means without IPP funding, and if yes, how the project might have changed – in terms of project scale, start time, duration, and level of UK involvement.

From a total of 97 respondents, **76 (80%) indicated that their project would not have proceeded at all**. The remaining 19 respondents (20%) indicated that their project would still have proceeded in some form, albeit not at the same scale and in different form (see Figure 10):

- **Scale:** 16 of these respondents (17% of total) suggest that, without IPP funding, their project would likely have occurred at a reduced scale (if the same scale was indicated, then other parameters would be different e.g. start time, level of UK involvement, duration).
- **Start (delay):** 12 of these respondents (13%) suggest that, without IPP funding, their project would likely have had a later start time.
- **UK involvement:** 9 of these respondents (9%) suggest that, without IPP funding, their project would likely have involved a lower level of UK involvement.
- **Duration:** 5 of these respondents (5%) suggest that, without IPP funding, their project would likely have occurred over a longer timescale.

Figure 10 Counterfactual analysis



Note: Number of respondents (and number of “Not at all” answers), by label order: n = 95 [19 (76)]

Source: LE analysis of survey responses

4.2 Benefits of IPP to grantees

Benefits experienced by grantees include: i) commercial benefits that directly result from the IPP projects, such as related sales in other parts of the business, and ii) other indirect or longer-term benefits of the IPP projects on delivery organisations. These effects include: the knowledge gained from the project, enhanced internal capabilities, relationships with supplies and customers and scalable IP which can ultimately increase sales in the long run. Together, these benefits represent grantee organisations’ private return from involvement in the IPP.

Quotes from IPP grantees

“Various [products] and services are being developed through the IPP that are transferable and scalable”.

“Expertise and credibility gained through this project allows us to demonstrate and export these UK space capabilities”.

“The main opportunities relate to the growth in organisational capability, expertise, networks”.

Source: London Economics analysis of IPP grantee survey responses

4.2.1 Market opportunities

IPP grantees from industry were asked to identify the market opportunities that they foresee as a result of their involvement in the IPP. These benefits are elaborated in more detail below.

- **Leveraging project intellectual property (IP) in other markets:** multiple organisations emphasise how the programme enabled them to develop IP that could be scaled and transferred to other markets. This market opportunity is most applicable to organisations that are developing software or algorithms that can be easily scaled.
- **Leveraging other capabilities developed in the project:** several organisations said that the IPP has allowed them to develop new organisational competences that will be used to support future business development in areas that were previously out of reach. These organisations stated that these competencies would not have been possible without the scale, up-front funding and emphasis on developing country partnerships of the IPP. Notable competencies include technical expertise (e.g. in software development, machine learning and remote sensing), organisational capacity (to deliver large-scale commercial products in-country), and domain-specific expertise (i.e. developing existing applications for new contexts e.g. forestry, agriculture, flooding).
- **Expanding foothold in a new market:** many organisations have developed credibility, strong government relationships, a physical presence and an understanding of how to operate in their IPP market. These markets are typically high-risk countries to operate in. These projects cite confidence in being able to leverage these benefits to secure further sales in these markets.
- **Demonstrating value of capabilities:** by supporting the development of an operational solution, the IPP has been used as a case study by several organisations to demonstrate the value proposition of their solution and therefore support sale leads in new markets.

Quotes from IPP grantees

“We are confident that in-country presence and close working partnerships will help secure future market opportunities”.

“We will use the technology we have developed in the projects for other services we sell around the world”.

“[Company] will benefit from the publicity that UKSA lends the IPP”.

Source: London Economics analysis of IPP grantee survey responses

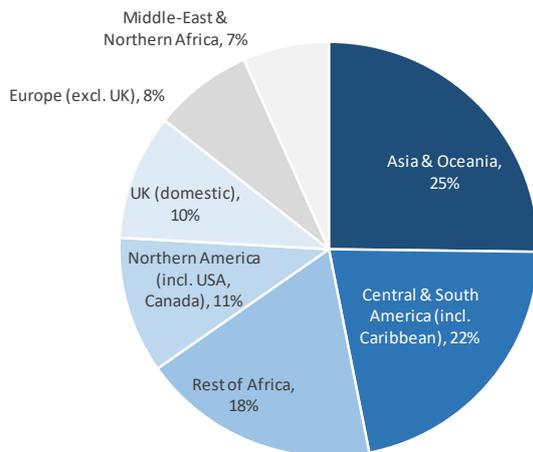
4.2.2 Leveraged sales

Leveraged sales refer to the follow-on benefits of the IPP to grantees. These include any knowledge or capability that has been gained through the IPP and leveraged to support sales in other parts of the organisation. Since these benefits accrue to grantees, they are part of the private return to the programme.

To date, respondents suggest that a total of £3.0m in additional income has been earned as a result of their participation in the IPP. Over the next five years (2019 – 2024), grantees forecast these leveraged sales to grow by a further £144.6m. Together, this suggests a total of £147.7m in ‘IPP-attributable’ sales⁸.

⁸ Discrepancy in total due to rounding.

Figure 11 Leveraged sales by customer location



Note: n=76 respondents.

Source: LE analysis of survey responses

The projected destination of these follow-on sales reflects the geographic distribution of IPP projects. Asia & Oceania represents the most promising market for IPP organisations with 25% of all sales, followed by Central & South America (22%) and the Rest of Africa (18%).

Notably, IPP organisations forecast to earn 28% of sales in developed-world markets. These markets were not recipients of IPP project funding and comprise Northern America (11%), UK (10%) and Europe (8%)⁹.

Overall, this suggests total exports of £132.7m, or 90% of all ‘IPP attributable’ sales that are expected between 2015/16 and 2023/24. The remaining 10% of sales are domestic (UK).

4.2.3 Impact of IPP on grantee organisations

As part of this study, IPP grantees were asked to identify the benefits that they have already gained or expect to gain from their involvement in IPP. These views have been synthesised into the following benefit areas: i) commercial; ii) reputation; iii) business relationships, iv) expertise and internal capabilities. These benefits are elaborated below.

■ **Commercial impacts:**

- More than 80% of respondents agree that the IPP has already had a positive impact on their product/service offer, and almost 90% expect to observe further positive impacts to product/service offer in the future (Figure 12 below).
- 62% of all respondents agree that the IPP already benefits sales in other areas of their business, with over a third expecting to see further positive impacts to sales in the future. For example, as detailed in 4.2.2, IPP grantees expect to earn a total of £147.7m in ‘IPP-attributable’ sales as a result of their involvement in the project. Based on additional private investments of £17.7m into the programme and the £78.1m in IPP grant income, this suggests

Quotes from IPP grantees

“Project was a game changer...it helped to develop technologies and to reach markets”.

“Gives gravitas / helps push solution sales”.

“Excellent PR, both internally and externally which helps with recruitment and outreach”.

“It is extremely motivating for the staff...it helps make the company more attractive for recruiting”.

“Provides insights into pathway for commercialisation of our IP”.

“IPP has taken our data analytic capabilities to a new level and that benefits the firm a whole”.

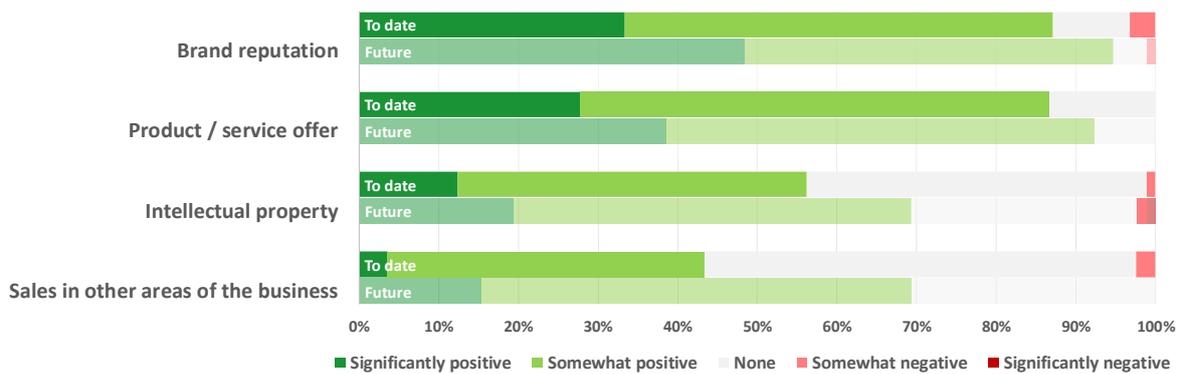
Source: London Economics analysis of IPP grantee survey responses

⁹ Discrepancy in total due to rounding.

a noteworthy **private Return on Investment (RoI) of £9.5 for every £1 invested in present value terms** (see 6.2).

- Many projects also expect to earn further revenues on the back of their IPP relationships with consortium partners and international partners. For example, one organisation is currently investigating the opening of a commercial office in their IPP customer’s country which they said would not have been possible without the project.
 - One organisation emphasised the value of IPP’s support for M&E, sustainability and cost-effectiveness analysis (CEA) in helping to build the business case for this and future projects. This support was provided by Caribou Space and London Economics.
 - Several organisations reported delays in commencing the implementation of the projects after award, with some temporarily suspended by the UKSA for different reasons. These delays caused some business risk and had some negative impacts, such as reputation with the potential partners, cashflow and retention of staff.
- **Reputational impacts:**
- More than 80% of respondents agree that the IPP has already had a positive impact on their brand reputation, and over 90% expect to observe further positive impacts to brand in the future (Figure 12 below).
 - The IPP was cited as an “excellent vehicle” for showcasing UK expertise worldwide and therefore promoting the UK sector more generally. This suggests that IPP fits within the UK Space Agency’s broader remit of promoting and developing the UK Space sector.
 - Several organisations have emphasised the benefits that involvement in the sustainable-development focused IPP programme have had for their brand and therefore for motivating and recruiting high-calibre staff.
 - Collaboration between UK suppliers and end users have allowed many UK suppliers to demonstrate their capability and develop reputations for competency and innovative solutions.

Figure 12 Current and expected commercial and reputational impact of IPP



Note: Number of respondents (and number of “Not relevant” answers), by label order: n = [93 (3); 90 (5); 88 (4); 83 (12)]

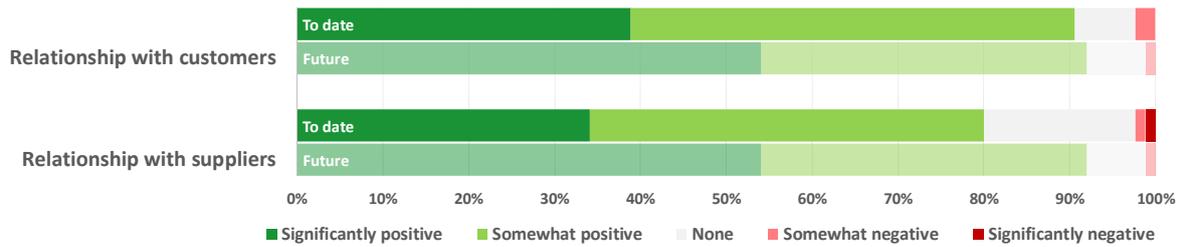
Source: LE analysis of survey responses

- **Business relationship impacts:**
- IPP facilitated collaborative solution development between UK suppliers, allowing them to demonstrate their capabilities and build trust. For example, more than 80% of all respondents agree that the IPP has already had a positive impact on their relationship with customers and the same number expect further positive impacts in this respect in the future. In many cases, the relationships between consortium

partners have been maintained beyond the project and supported further commercial opportunities in other areas in the UK and overseas (Figure 13 below).

- IPP also facilitated engagement between UK organisations and end users in developing countries – an experience new to many of the UK suppliers. For example, 72% of all respondents agree that the IPP has already had a positive impact on their relationship with suppliers and a large number expect further positive impacts in the future. These relationships have established the credibility of UK organisations in-country and acted as a springboard for further exports in many cases.

Figure 13 Current and expected impact of IPP on business relationships



Note: Number of respondents (and number of “Not relevant” answers), by label order: n = [85 (8); 85 (10)]

Source: LE analysis of survey responses

■ **Expertise and internal capability impacts:**

- More than three quarters of respondents agree that the IPP has already had a positive impact on the levels of technical (95%), commercial (76%), developing country (86%) and M&E (81%) knowledge or expertise. In all cases, respondents expect to observe further positive impacts in the future (Figure 14 below).
- For example, most respondents could identify expertise that they had developed from their IPP project that has or could potentially be leveraged to support work in other areas. This includes the development of: i) technical expertise – such as in their capabilities to use remote sensing, EO data and machine learning and modelling in other areas; ii) customer expertise – e.g. developing a better understanding of international markets, the needs and challenges of government customers and the complexities of the operating environment; iii) experience of working to deliver large projects in-country, especially ‘high-risk’ developing countries where most grant recipients had little or no experience; iv) experience of delivering commercial solutions within the

Quotes from IPP grantees

“Helped showcase existing expertise, build new skills and knowledge, explore new technologies and also significantly build upon it”.

“IPP has significantly enhanced our engagement with international government, academia, NGOs and industry partners”.

“IPP has allowed us to adapt our management systems for large projects”.

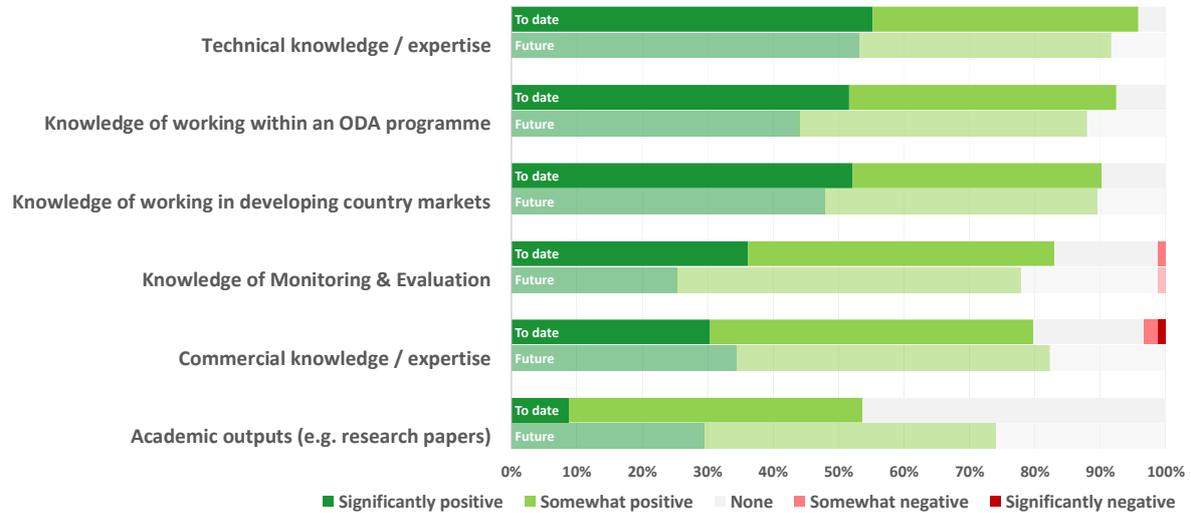
“Impact will be realised through high profile publications and knowledge sharing in our teaching”.

“The project has enabled us to enter a new domain with new knowledge, experience and contacts”.

Source: London Economics analysis of IPP grantee survey responses

context of a grant programme; v) outputs that can support further academic research, and vi) M&E and cost-effectiveness analysis expertise which can be used to support future business case development and therefore sales in the long-term.

Figure 14 Current and expected impact of IPP on expertise and internal capabilities



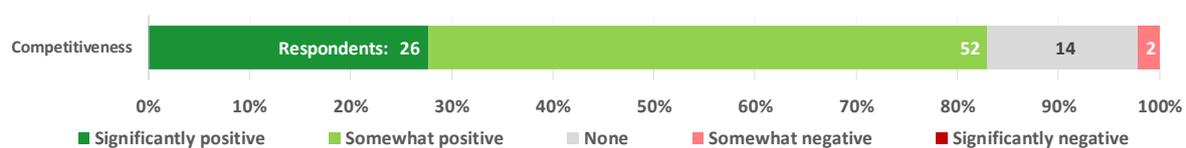
Note: Number of respondents (and number of “Not relevant” answers), by label order: n = [96 (1); 91 (2); 92 (4); 94 (2); 89 (6); 80 (13)]

Source: LE analysis of survey responses

Impact of IPP on competitiveness

As indicated in the figure below, over 80% of all respondents believe the IPP has had a positive impact on their organisation’s overall competitiveness. Most of the reasons for this relate to the impacts detailed previously, although the impact of the programme on the development of new services and company reputation are cited specifically.

Figure 15 Impact of IPP on organisational competitiveness



Note: Number of respondents (and number of “Not relevant” answers), by label order: n = [94 (0)]

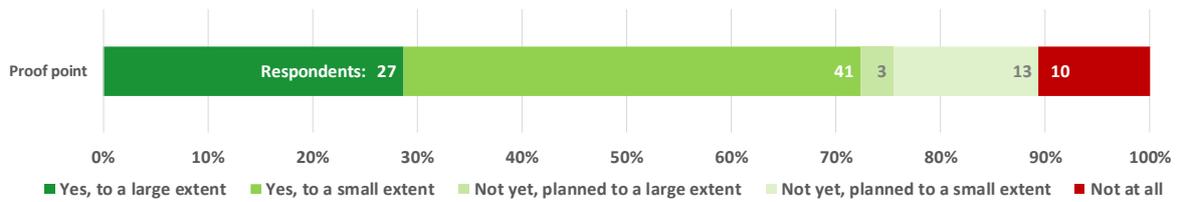
Source: LE analysis of survey responses

4.2.4 Proof point to support business activities

To date, nearly three quarter of all respondents have used their project as a proof point to support their business activities; and 17% expect to do so in the future.

Specific areas where IPP projects have been identified as proof points include: external marketing and communications, grant funding proposals, testing technologies (e.g. Data Cube), demonstrating country/technical knowledge to prospective clients, and testing products/services for other settings.

Figure 16 Impact of IPP on organisational competitiveness



Note: Number of respondents: n = [94]

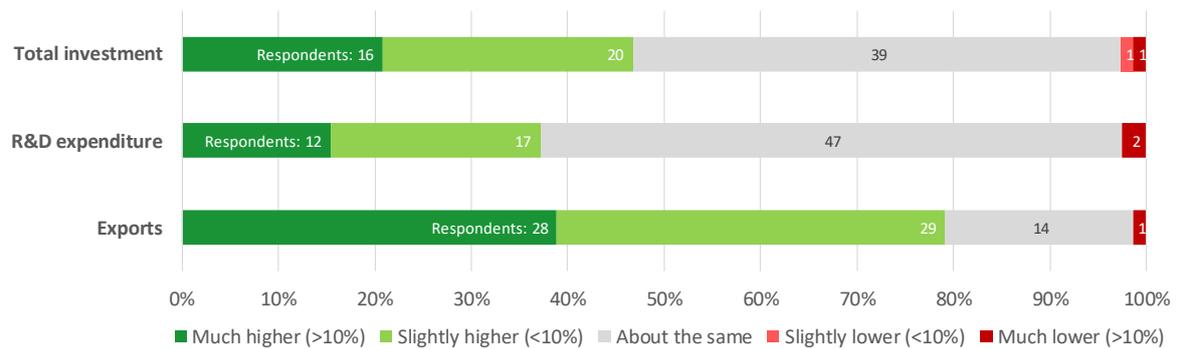
Source: LE analysis of survey responses

4.2.5 Expected performance in next five years

Grantees have earned and expect to continue earning revenues on the back of IPP. As Figure 11 indicates, most sales are expected to be overseas. This is reflected in grantees’ positive expectations of export growth over the next five years, with almost 80% of all respondents expecting export growth.

Grantees also expect to gain new market opportunities, IP and knowledge. It is therefore unsurprising that a significant number of respondents also expect higher levels of investment and R&D expenditure across their organisation to capitalise on these outcomes, even if the precise impact is difficult to foresee at this stage.

Figure 17 Expected performance of IPP grantees in the next five years



Note: Number of respondents (and number of “Not relevant” answers), by label order: n = [94 (2); 94 (0); 94 (0)]

Source: LE analysis of survey responses

5 Benefits of IPP to UK economy and society

This chapter presents a summary of the wider economic impacts of the programme on the UK economy. The specific impacts that are considered include: the impact of IPP project expenditure on UK economic output and employment (**IPP project expenditure effects**); the sales and capabilities of participating companies that are leveraged on the back of the programme (**leveraged sales**), and the wider benefits that flow beyond IPP grantees to the wider economy (**spillover effects**).

Note: All monetary values in this section are expressed in **Present Value (PV)** terms (i.e. constant prices – values have been adjusted for inflation and discounted to Present Value terms), unless specified otherwise.

5.1 IPP project expenditure effects

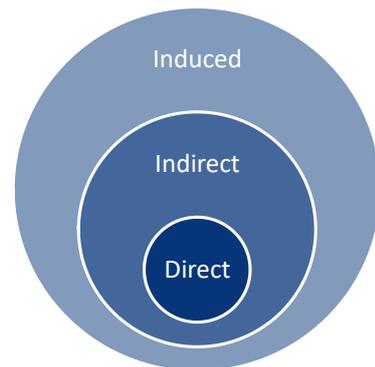
The expenditures of organisations involved in the delivery of IPP projects contribute to economic activity in different ways. For example:

- **Direct effect** on organisations includes the value added by the project's employees;
- **Indirect effects** capture the value added by UK-based suppliers to IPP organisations, and
- **Induced effects** capture the economic activity supported by the expenditure of employees.

These effects from the expenditure of IPP grantee recipients are represented in Figure 18.

This economic activity can be measured in terms of **Gross Value-Added (GVA, £)** and **jobs supported (FTE)**. GVA measures the contribution of the IPP to the UK's economic activity and is defined as turnover minus the cost of intermediate goods and services sourced from other suppliers.

Figure 18 Multiplier effects from IPP



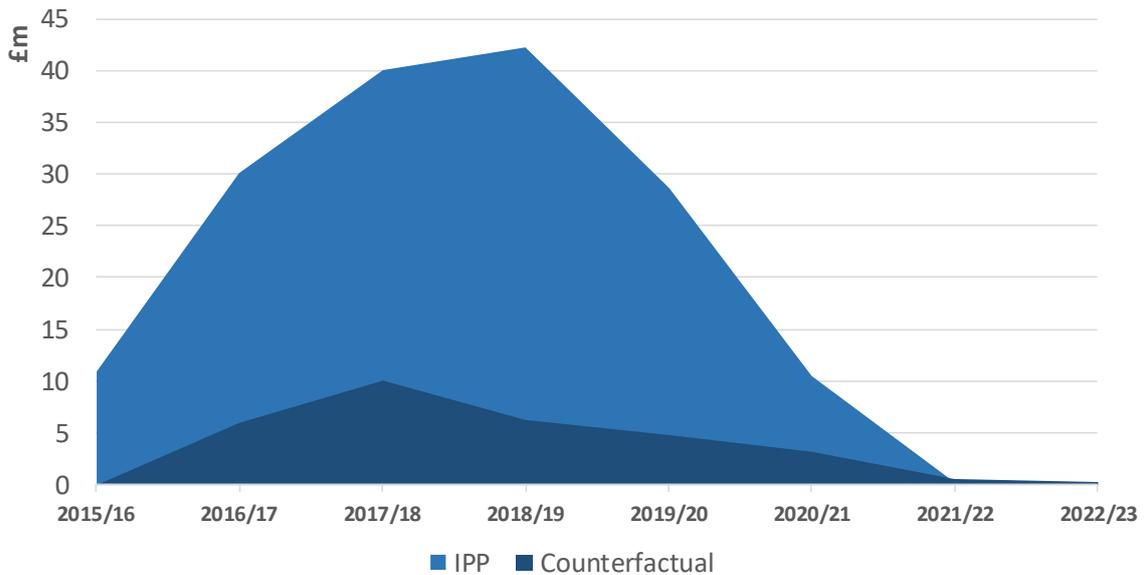
Source: London Economics

5.1.1 IPP project expenditure: Gross Value Added (GVA)

Given projected nominal expenditure on IPP projects of **£116.0m** (or £119.2m in PV terms) between 2015/16 and 2021/22, the PV of all industrial effects (direct, indirect and induced) is estimated at **£162.7m** over the lifetime of the project. Of this, **£132.0m** is additional industrial activity that would not have occurred without the IPP. This implies that each **£1** of IPP grant expenditure is associated with an additional **£0.69** in economic activity in the rest of the economy.

The distribution of these industrial effects by year is presented in the chart below.

Figure 19 IPP project expenditure GVA over time



Note: n=96 respondents

Source: LE analysis of survey responses

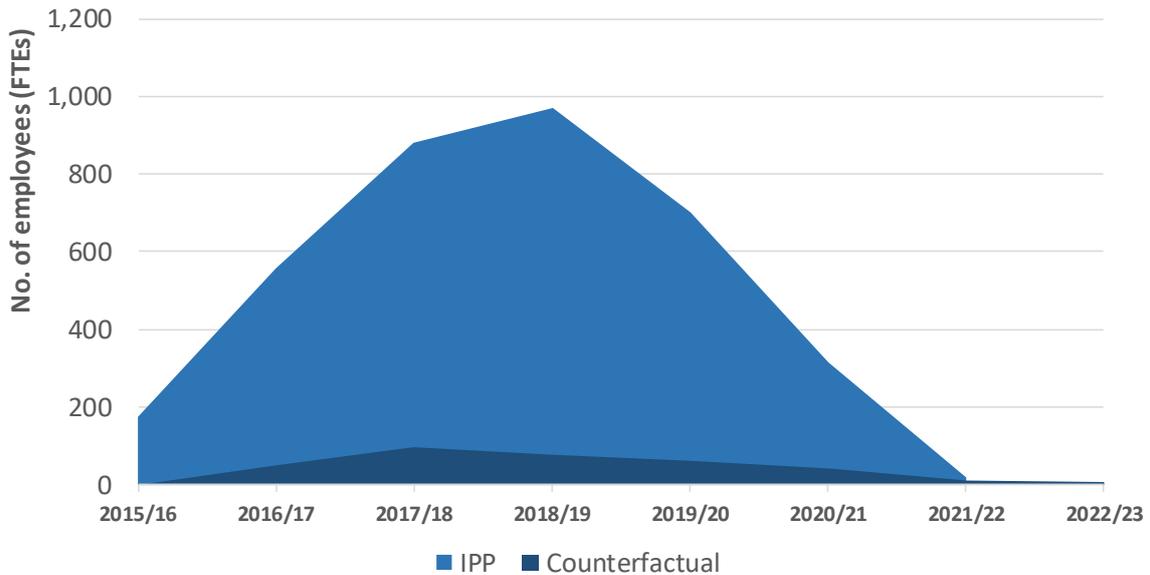
5.1.2 IPP project expenditure: employment supported (Full Time Equivalent-years)

The impact of the IPP on employment throughout the supply chain is also a key indicator of the IPP’s economic value. Employment in this study is measured in terms of FTE headcount and follows a similar logic to that used for GVA.

Survey returns from respondents indicate that the IPP will support a total of **3,616 FTEs** throughout the UK economy over the programme’s lifetime. Of this, **974 FTEs** (2.3% of space industry employment based on the *Size and Health 2018* statistics) are estimated as being directly supported by IPP grants (sourced directly from surveys), and **2,642 FTEs** through the wider supply chain (based on *Size and Health 2018* employment multiplier ratios).¹⁰

Since the assessment of the counterfactual indicates that some projects may have progressed in some form even without IPP funding, the programme’s additional effect on employment is somewhat smaller at **3,300 FTEs**. This comprises **900 FTEs** that are directly supported by the grant expenditures, and a further **2,400 FTEs** through the wider supply chain.

¹⁰ London Economics (2019). Size and Health of the UK Space Industry 2018. Available here: <https://www.gov.uk/government/publications/uk-space-industry-size-and-health-report-2018>

Figure 20 Employment supported by IPP over time

Note: n=94 respondents

Source: LE analysis of survey responses

5.2 Leveraged commercial sales

The wider benefits of the programme to participating companies (grantees), e.g. in terms of internal capabilities and additional leveraged commercial sales.

Respondents indicate that a total PV of £123.7m sales will be leveraged on the back of the IPP between 2015/16 and 2021/22 in present value terms. Analysis of the counterfactual suggests that £107.3m of these sales (87%) are additional – i.e. they would not have occurred without the IPP (Table 1).

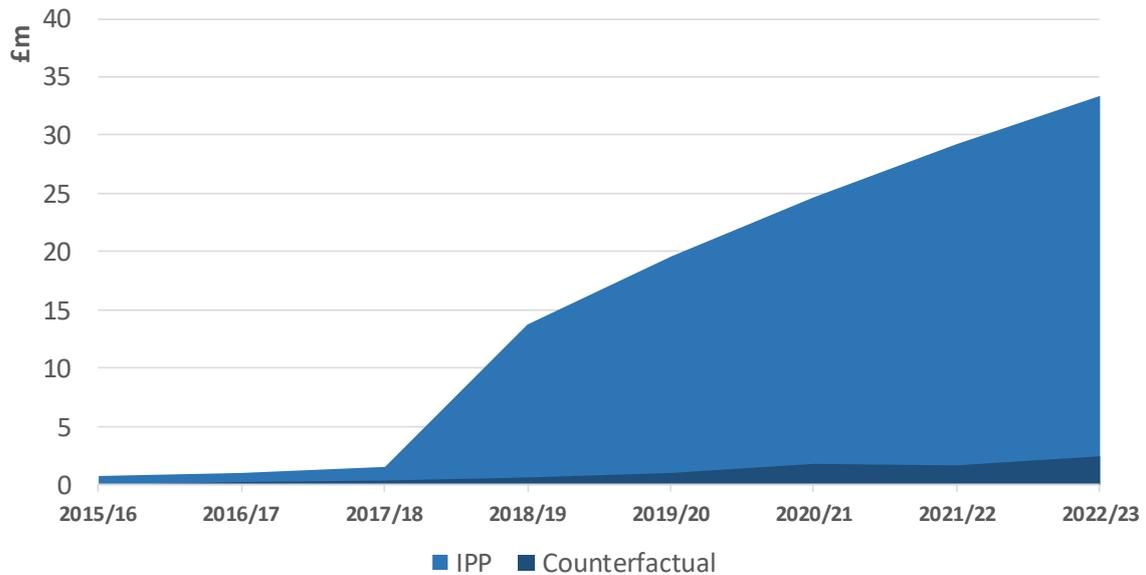
Table 1 Leveraged commercial sales

Effect	IPP	Counterfactual	Additionality (IPP – Counterfactual)
Present Value of revenue from leveraged sales (£m)	123.7	16.4	107.3

Source: London Economics analysis of survey responses

In present value terms, this suggests that every **£1** of public investment in the IPP is associated with a further **£0.37** in additional sales in recipient organisations.

Since these sales represent economic activity, the industrial impact (direct, indirect, induced) of these sales represents a further £168.8m in GVA, of which **£147.3m (87%) is estimated as 'additional' GVA** that would not occur without the IPP. In present value terms, this suggests that every **£1** of public investment in the IPP is associated with a further **£0.89** in additional economic activity throughout the supply chain because of leveraged sales.

Figure 21 Sales leveraged from IPP over time

Note: n=66 respondents

Source: LE analysis of survey responses

5.3 Spillover effects

Alongside the impacts quantified above, a substantial proportion of the benefits will arise from spillovers. These describe benefits from the IPP that extend beyond programme participants to third parties not directly involved in the projects. These spillovers include¹¹:

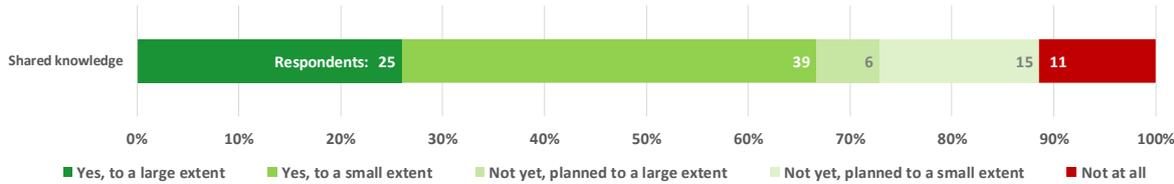
- **Knowledge spillovers:** this describes new knowledge generated by the grantees whose value is not fully compensated by grantees (i.e. it flows to others). This knowledge can take the form of project outputs, such as open data and IP, or project lessons, such as those gleaned from the experience of operating in-country, delivering large projects with partners, and establishing client relationships with foreign institutions.
- **Network spillovers:** occur when the 'clustering' of firms, individuals, or products generates some sort of effect on other firms, individuals, or products. For example, the combination of individual UK suppliers to deliver IPP projects within a project consortium enables each individual organisation to pursue an opportunity and generate an output that they could not otherwise do.
- **Market spillovers:** refers to the spillovers that occur once an innovation has been commercialised. For example, some innovations result in benefits for end users that are not fully captured by the innovator (i.e. in the price of the innovation). Within the context of the IPP, these benefits are captured by end users in the IPP customer countries and therefore do not flow to the UK.

¹¹ London Economics (2018). *Spillovers in the space sector*. A research report for the UK Space Agency. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/788725/LE-UKSA-Spillovers_in_the_space_sector-FINAL_FOR_PUBLICATION_050319.pdf

While network spillovers have already been realised, the extent of knowledge spillovers and therefore wider benefits to the UK depends on the degree to which project partners have shared project outputs and lessons.

The results from this study are therefore promising: almost 90% of respondents have already shared knowledge or plan to do so. Notable knowledge-sharing channels that have been highlighted by grantees include: ongoing engagement with project partners, programme and project-level knowledge-sharing events, academic publications, marketing material, demonstration products, conference presentations and industry forums.

Figure 22 IPP grantees that have or plan to share knowledge beyond their organisation



Note: Number of respondents: n = [89]

Source: LE analysis of survey responses

In the long run, these spillover effects can generate tangible benefits for other organisations throughout the UK economy. For example, research by London Economics on spillovers in the space sectors suggests that spillover returns are typically 2 to 3 times larger than the private return of an investment¹² and are additional to the benefits already outlined. The existence of spillovers justifies government support for programmes like the IPP.

¹² London Economics (2015). *Return from Public Space Investments: An initial analysis of evidence on the returns from public space investments*. Available at: <https://londoneconomics.co.uk/wp-content/uploads/2015/11/LE-UKSA-Return-from-Public-Space-Investments-FINAL-PUBLIC.pdf>

6 Aggregate impact of IPP on UK economy and society

This chapter presents the results of a Return on Investment (RoI) analysis that is consistent with HM Treasury's *Green Book* guidance. More specifically, this analysis combines the (realised and projected) impacts from the preceding chapters into an overall indicator of the programme's economic impact on the UK up to five years after this study (i.e. until 2023/24)¹³.

Note: All monetary values in this section are expressed in **Present Value (PV)** terms (i.e. constant prices – values have been adjusted for inflation and discounted to Present Value terms), unless specified otherwise.

6.1 Leveraged investment

While **£78.1m** in public funds is expected to leverage a total of £41.1m in private funding by the end of the programme (a leverage ratio of £1 : £0.53, as presented in 0), survey responses indicate that some of this investment would have occurred even without the IPP.

The remainder, **£17.7m**, represents the (additional) private investment from IPP grantees that would not have been made without the IPP. This means that each £1 in public investment leverages a further £0.23 in additional private investment.

6.2 Private return on IPP public investment

From an IPP participant perspective, the £17.7m in 'additional' private investments leverages a total of £185.4m in additional income. This comprises £78.1m in IPP grant income and £107.3m in additional IPP-related sales. This suggests a **private return of £9.48 per £1 of private investment**.

6.3 Public return on IPP public investment

This analysis of industry and economy-wider impacts is based on 97 survey inputs from 67 organisations across the portfolio of 33 IPP projects. These survey inputs have also made it possible to model a counterfactual scenario and to therefore consider only 'additional' impacts. Of these, it has been possible to quantify two categories of impact:

- **IPP project expenditure effects:** the overall impact of IPP grantee expenditure on the supply chain and wider economy, as measured in terms of GVA and employment supported, and
- **Leveraged sales:** The additional value associated with sales leveraged by IPP grant recipients on the back of the programme, as measured in terms of GVA.

On this basis, the total present value (PV) of the IPP to the UK economy is estimated at **£279.3m** (Table 2), comprising £132.0m in GVA from IPP project expenditure, and £147.3m in GVA from leveraged sales.

¹³ HM Treasury (2018). *The Green Book: Central Government Guidance on Appraisal and Evaluation*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

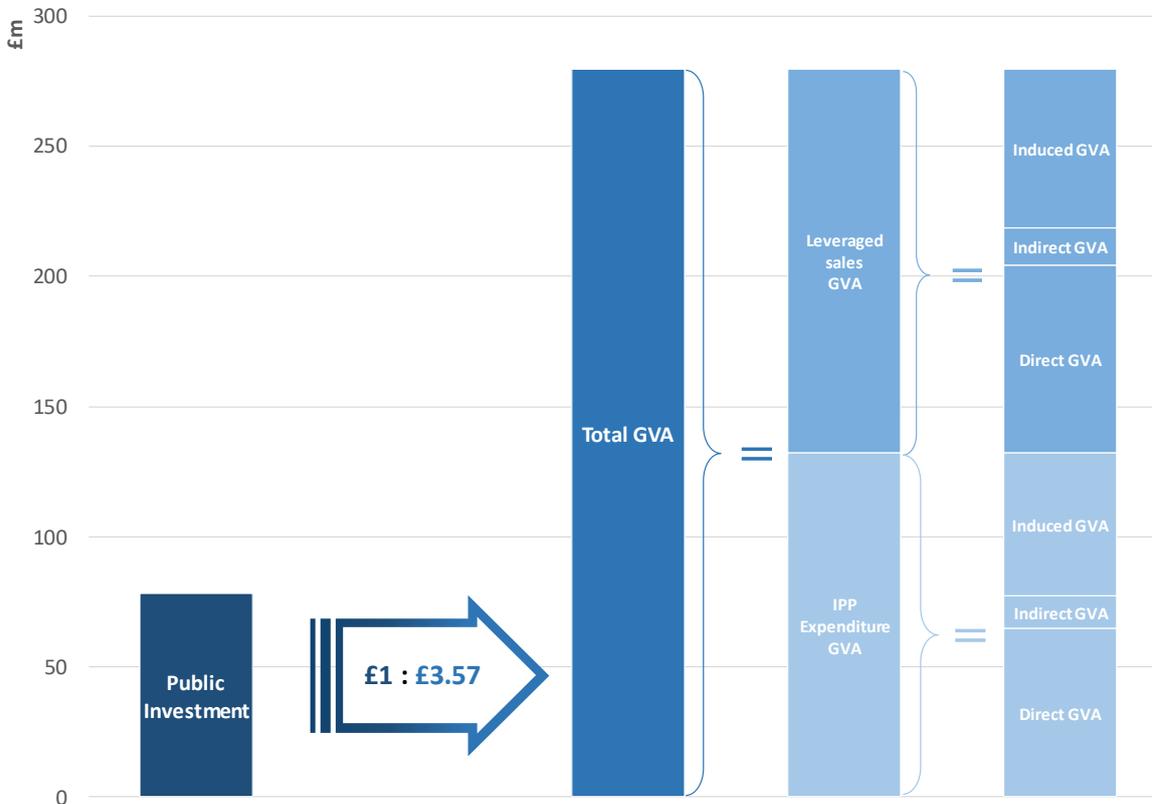
Table 2 IPP quantified economic impact, by effect

Economic impact	IPP	Counterfactual	Additionality (IPP – Counterfactual)
IPP project expenditure effects, GVA (£m)	162.7	30.7	132.0
Leveraged sales, GVA (£m)	168.8	21.5	147.3
Total GVA (£m)	331.6	52.2	279.3

Source: London Economics analysis of survey responses

Given total public expenditure of £78.1m over the programme’s lifetime, this implies that each £1 of IPP grant expenditure is associated with an additional £2.57 in economic benefit in the rest of the UK economy. **This means that each £1 of IPP public investment increases UK output (as measured by GDP¹⁴) by £3.57** (Figure 23).

Figure 23 Decomposition of GVA impact of IPP



Note: n=91 respondents

Source: LE analysis of survey responses

By considering public and private costs (including those borne by grantees), we can estimate the **total net return of the IPP to the UK more broadly** (commonly referred to by government economists as **NPV/DEL**). This allows us to benchmark the IPP against other programmes in government. The result is a lower multiplier of **£2.35 per £1 of public investment**. Details of this calculation are provided in Annex 1.

¹⁴ Gross Domestic Product (GDP) is a monetary measure of the market value of all final goods and services produced in a period of time.

Note: The IPP is ODA-funded development programme (i.e. with primarily development objectives rather than UK commercialisation and/or utility objectives). As end-users of IPP solutions are based in developing economies outside of the UK, the estimate of UK return to IPP excludes benefits for downstream UK-based end-users. **IPP therefore differs from the more typical UK government space investments** that seek to build UK space industrial capacity and deliver benefits to UK public and private users.

IPP is also projected to support **employment of 3,270 FTEs** that would not have existed without the programme. This includes 828 FTEs directly supported by the grants, and a further 2,388 in the wider supply chain.

In addition, **other grantee benefits have been clearly evidenced** and fall into four main areas: commercial, network, reputation, and knowledge. Together, these benefits suggest that the benefits of participating in the IPP extend significantly beyond the grant into other areas of the business.

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ANNEX

Annex 1 Rate of return calculation

A1.1 Terminology and definitions

Borrowing from our previous *Return from Public Space Investments* study¹⁵ for the UK Space Agency, we adopt the following terminology and definitions.

A1.1.1 Investment

- **Public investment:** A direct investment of public capital and/or resources to a space-related programme, project, infrastructure, facility or organisation (e.g. R&D) – i.e. IPP grants awarded to recipient consortia.
- **Private (leveraged) investment:** The *increase* in private, third sector and foreign public investment in the project as a proportion of the domestic public investment – i.e. matched funding by IPP grant recipients.

A1.1.2 Impact

The impact of the IPP public space investment can be measured (or modelled) with reference to a range of factors, or ‘impact parameters’, as defined below:

- **Public (Social) Rate of Return:** The social net benefit/cost from the investment of public funds, measured as the impact on aggregate domestic economic output (GVA, producer surplus) and wider benefits (knowledge spillovers, consumer surplus, environment, health, safety, etc.) net of deadweight and displacement effects relative to the quantum of public investment.
- **Lag:** Time in years before the impact starts.
- **Benefit duration:** Time in years (from the end of the lag) that the impact endures.
- **Deadweight:** The returns that would have occurred without the public investment, as measured by the Counterfactual scenario.
- **Displacement or ‘Crowding out’:** The *decrease* in private, third sector and foreign public investment in the project as a proportion of the domestic public investment.
- **Leakage:** Benefits arising outside of the domestic economy.
- **Other quantitative outputs:** Quantitative measures of impact on key outputs and outcomes adjusted for deadweight and displacement effects (e.g. employment, spin-offs, prototypes, commercialised products, academic papers).
- **Wider benefits:** The wider societal impacts and unintended consequences associated with the public space investment, linking to spillover benefits (e.g., employment, economic multiplier, consumer surplus, producer surplus, environmental impacts, and social impacts).

¹⁵ London Economics (2015). *Return from Public Space Investments: An initial analysis of evidence on the returns from public space investments*. Available at: <https://london-economics.co.uk/wp-content/uploads/2015/11/LE-UKSA-Return-from-Public-Space-Investments-FINAL-PUBLIC.pdf>

A1.2 Calculation of rate of return

In line with HM Treasury best practice, we adopt an NPV/DEL multiplier calculation as the headline return measurement, which translates into a **return per £1 of public investment**.

The division of NPV (Net Present Value, defined as the total discounted benefits less total discounted costs – both public and private) by DEL (Departmental Expenditure Limit, the name given to the total discounted domestic public investment) results in a multiplier which can be interpreted as the average *additional* economic benefit to the economy after an initial public investment of £1, or the return per pound of public investment.

All impacts are discounted totals to Present Value terms, and benefits are adjusted for deadweight and displacement effects (i.e. additional).

The NPV/DEL multiplier is calculated as:

$$\frac{NPV}{DEL} = \frac{(IndustrialGVA + RippleGVA) - (PublicInvestment + PrivateInvestment)}{PublicInvestment}$$

At this point, it is worth highlighting the difference between this multiplier and the Benefit-Cost Ratio (BCR), the latter being defined as a simple ratio of the Present Values of Total Benefits to Total Costs.

Applied to the IPP, the result is a lower **NPV/DEL calculation yields a lower multiplier ratio of 2.35**, as per calculations below.

Table 3 Calculation of public (social) rate of return of IPP to UK economy and society

Public (Social) Rate of Return	=	$\frac{NPV}{DEL}$
	=	$\frac{(Industrial\ GVA + Ripple\ GVA) - (Public\ Investment + Private\ Investment)}{Public\ Investment}$
	=	$\frac{(\pounds 132m + \pounds 147.3m) - (\pounds 78.1m + \pounds 17.7m)}{\pounds 78.1m}$
	=	$\frac{\pounds 183.5m}{\pounds 78.1m}$
Public (Social) Rate of Return	=	£2.35 of NET ADDITIONAL economic benefit per £1 of public funding

Source: LE analysis



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