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Knowledge Transfer Partnerships Evaluation

Final Report

SQW

Contents

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Executive Summary

1. The KTP scheme was established over 45 years ago and **aims to '*help businesses in the UK to innovate and grow*'.** The scheme creates and supports three-way partnerships between a business, a Knowledge Base partner (KB, e.g. a university or college) and an individual associate (e.g. post-graduate) who is embedded within the business. KTPs are specific and strategic innovation projects with a commercial focus, drawing on new skills and the latest academic thinking. Projects are typically 12 to 36 months in length. The scheme employs Knowledge Transfer Advisors (KTAs), who work in partnership with KBs across the UK to help to form partnerships and provide support during project delivery. SQW, in partnership with Qa Research, was commissioned by Innovate UK and UKRI to evaluate the KTP scheme between 2010 and 2020.

Key statistics for KTPs 2010-2020

- Innovate UK invested **£223m** in KTP projects, with KTP grants typically averaging **£80-100k per project**. Just over **2,100** projects were completed over this period.
- KTP projects engaged with nearly **1,900 businesses** (of which 15% were micro, 36% were small, 24% were medium and 25% large in size), **136 KB institutions** and over **3,000 associates**.
- KTP projects were **well distributed across the UK**, with 75% of beneficiary businesses and 68% of the KB partners being outside of London and the Greater South East.

Key findings

Overall performance

2. Overall, the KTP scheme has achieved its core objective of helping businesses in the UK to innovate and grow, and has made a substantial contribution to the UK economy.

Economic impact

- KTPs between 2010 and 2020 have generated **an estimated £1.7 to £2.3 billion in net GVA for the UK economy**. These impacts are based on the estimated effects on business growth and on the earnings of associates.
- The scheme has delivered strong value for money over this period: **for every pound of public and private investment, the scheme has generated a return of £4.20 to £5.50 in net economic benefits.**

Design and implementation

3. **The scheme aligns well with Government priorities for innovation** and with strategic priorities of KB institutions, which have become more closely aligned with KTPs over the evaluation period with an increasing requirement to demonstrate impact, including through

knowledge exchange. KTPs are viewed as important in the innovation ecosystem and **do not duplicate other forms of support**. The scheme could be better aligned and integrated with the wider innovation support landscape in practice, and this could help to maximise the benefits of KTPs further and attract new types of applicant that may not have collaborated with the KB previously – see recommendations below. **Overall levels of satisfaction with KTP processes and project implementation were high**, although feedback on the associate recruitment processes and marketing/promotion of the scheme were mixed.

Business benefits

4. The KTP scheme has helped businesses to mitigate the risk of investing in innovation, addressing resource constraints and, to some extent, information failures for both businesses and academics that hindered collaboration. KTP resources have been focused on projects that were strategically important to most of the businesses participating.

5. KTPs have helped businesses to undertake **both product and process innovation**. This has led to business performance improvements. According to the econometric analysis, **impacts on the growth rate of employment and turnover were statistically significant**, and were sustained throughout the KTP and for three years following completion. Wider feedback suggested that KTPs have led to high quality jobs and helped businesses to generate additional turnover from exports. Whilst some businesses reported benefits to productivity, the econometric analysis found that impacts on productivity were not statistically significant. That said, KTPs have **helped to strengthen the underpinning drivers of productivity**, such as skills, R&D investment and process innovation. Outcomes were still being attributed to the KTP, even where the project finished a number of years ago, demonstrating the **sustainability of outcomes**. KTPs have influenced businesses' perceptions of, and capability to undertake, R&D, thereby making future innovation activities more likely. The evidence indicated that many of the relationships between businesses and KB partners were pre-existing, and these have often been strengthened and have continued since the project ended.

Business benefits

Of the 86 KTP beneficiary businesses surveyed ….

- **65%** had introduced new processes/practices
- **70%** had improved existing products or services
- **57%** had progressed new products/services to market
- **83%** had already experienced or expected an increase in at least one of the following: productivity, profitability, employment and/or turnover
- **87%** had improved their technical knowledge and skills
- **66%** had improved their capability to introduce other performance enhancing practices
- **79%** placed greater value on academic expertise and were now better able to engage with KBs

… as a result of KTPs

Academic benefits

6. KTPs have enabled academic partners to strengthen their knowledge of industry challenges, leading to **more industry-relevant research and teaching materials,** academic publications, and helping them to **lever further funding**. KTPs have helped to strengthen the ability of academics to engage with businesses and transfer knowledge. KTPs have also helped to progress academic careers, and a small number have generated IP and/or spinout businesses. **KTPs have had a legacy effect for academics**: almost all academics surveyed said the benefits gained from the KTP were sustained after it was completed and the majority of those academics continued to reap the benefits.

7. KTPs have generated **wider benefits for the KB institution**, including improved profile and credibility, providing material on impact for REF/KEF case studies, and widening and strengthening business networks. There was evidence that demonstrated how KTPs have influenced attitudes towards business engagement and innovation at an institutional level. The cross-disciplinary nature of some KTP projects has also helped to strengthen relationships within institutions.

Academic benefits

Of the 93 KTP academic partners surveyed ….

- **92%** reported an improved in their knowledge of industry challenges
- **81%** had developed more industry-relevant research
- **75%** had developed more industry-relevant teaching
- **62%** had generated publications
- **51%** had levered further commercial funding
- **48%** had progressed their career

… as a result of KTPs

Associate benefits

8. There was strong evidence to show that associates have increased **their knowledge, skills and capabilities** from KTPs, which included technical, commercialisation and business related skills. For the majority, the KTP has **raised career ambitions and accelerated career progression** (particularly for those within industry). KTPs have positively impacted upon associates' **employment opportunities and their earnings** over the course of their career. Many associates secured a job at the KTP business partner after the project ended, and almost all associates surveyed are now in employment in industry or academia. Knowledge gained through KTPs has been disseminated more widely, with examples from both industry and academia, although the subsequent effects on third parties could not be confirmed in this study.

ssociate benefits

Of the 400 KTP associates surveyed ….

- **93%** improved their applied research and technical skills
- **82%** improved their business skills (e.g. project and business management, professional and interpersonal skills)
- **77%** improved their skills/capabilities in business innovation and commercialisation processes
- **78%** raised their career ambitions and **65%** accelerated career progression within industry
- **19%** had created or were involved in the creation of new business start-ups (136 new businesses in total)

… as a result of KTPs

Additionality and contribution of KTPs

9. **The majority of outcomes described above were partially or (to a lesser extent) fully additional,** and there was strong evidence to suggest that KTPs have made a key difference in bringing about outcomes, often alongside other factors. For all partners surveyed, full deadweight was very low, indicating that very few would have achieved all the outcomes anyway without that support. Evidence on the relative contribution of KTPs suggested that **the scheme did play an important – and in some cases critical – role in generating the outcomes observed**. It is important to recognise that these outcomes have often been achieved in combination with other factors. KTPs often formed part of wider business development plans and the businesses often had prior experience of innovation and working with academia. The academics involved often had a track record of working with and/or in industry.

Success factors

10. The evidence demonstrates how the KTP model is effective in facilitating knowledge transfer between partners. The **three-way, industry-led partnership** and **dedicated resource for an associate that is embedded in the business** have been key to this. Other key factors that influenced the success of KTPs included: having a strong and realistic plan at the outset, with alignment of goals and buy-in from all partners; close alignment between expertise and need; and having a well-structured project. Within the business, strategic fit and prioritisation of the KTP by the leadership team was important, alongside buy-in across other relevant teams. The fit, motivation, capability and calibre of the associate was "instrumental" to the success. Proximity between partners can be helpful, but was not always necessary. The location, sector of the business, and the size of the KTP grant were not significant determinants of the effects on business growth as a result of the KTP. This highlights their potential role across different types of business, and all places and sectors.

Wider benefits

11. Above and beyond the direct benefits for those involved in the KTP scheme, there was some evidence for potential spillovers. This included academics sharing the knowledge gained through KTPs with other academics and businesses, and associates taking the skills and knowledge gained with them as they progressed their careers in other organisations.

Recommendations and key lessons

12. Overall, as set out above, the KTP scheme achieved significant impact over the 2010-2020 period, with strong evidence of outcomes for the three partners involved in line with the underlying programme logic. The recommendations and lessons to consider are made in this context.

Demand and reach of the scheme

13. The evidence in the report has demonstrated that the demand for, and reach of, the scheme is broad. A few areas have been identified where this could be developed further to increase access to the scheme by businesses who are less active in relation to innovation and/or engagement with the knowledge base, and for projects that may be less commercially-focused. This may require additional resources for the scheme.

- The application process/forms and criteria were thought to be potential barriers to projects that have a focus on social/environmental rather than commercial aims. These should be revisited to ensure that they are aligned with potential projects in these fields.
- The majority of businesses were innovation-active and/or had prior experience working with the knowledge base before their KTP. The evidence also indicated that KTPs have often been used as part of a business's wider package of development activities to support growth. Two options for expanding reach to businesses that are newer to innovation and/or collaboration with the knowledge base could be to: tap into the wider business support landscape to attract new applicants, including those within UKRI (e.g. EDGE) and those outside (e.g. linking to export support or schemes such as Help to Grow); and consider shorter KTPs, thereby reducing the investment required for those businesses new to innovation. Actions here may require additional resource for programme delivery.
- Supporting the two previous points, communications on the potential business benefits and on projects with social or environmental objectives may help to broaden access.
- A key lesson from the evaluation was the need for senior buy-in within KB institutions to KTPs and the existence of individuals within relevant technology transfer/enterprise offices with the drive to promote them and make them happen. KB institutions should therefore engage and periodically re-engage with senior leaders, highlighting the benefits that KTPs can bring.

Implementation

14. The evaluation found a number of key facets that were important in supporting the impact of KTP projects, particularly around the partnership and the three parties involved in this. These provide lessons for those that are involved in instigating, developing and supporting projects so that impact can be maximised. Key areas of good practice for dissemination are as follows:

- Associate recruitment is important to ensure a suitable candidate is found. Processes that can support this include speed of action upon project approval and ensuring the post is seen as attractive. The range of benefits to associates found in this evaluation, including for those wishing to pursue careers in industry, academia or at the interface of the two can help to promote these posts.
- A KTP plan that is developed post-award, including with clear goals and shared and well-understood ways of working, was found to be key to success. This could be a useful check for KTAs, and provides an important first milestone for the parties involved.
- Capacity and buy-in within business was a key factor in success. A senior representative of the business with ownership of the KTP project helps to ensure that this is in place.
- The institutional capacity of the knowledge base partner to support the project during delivery was found to be an important factor in success. KB representatives should note this, particularly if academic partners have less previous experience in working with industry, and so may require additional support. The support role provided by KB representatives includes taking on administrative tasks such as meeting minutes and claims processes.

15. Finally on implementation, monitoring data to help facilitate the evaluation could have been better, in particular in relation to close out data and contact information. This may reflect that the period subject to the study went back to 2010. That said, it is critical for monitoring information to be captured and maintained to enable future evaluation. A useful action would be to check, update and add secondary details for key contacts at the end of the KTP.

Wider aspects

16. KTPs were seen as distinctive in the innovation landscape. However, it was not clear how they fit or complemented other support in practice, and there was a perception that some in UKRI had a lack of understanding of the role of KTPs. As well as the potential for tapping into schemes such as EDGE (see above), two other key issues should be considered:

- Communications and profile-raising within UKRI on the role of KTPs in their existing form could help encourage better integration with other existing activities, e.g. with those of Research Councils. This could highlight the various routes to impacts that KTPs can have, and so prompt more consideration on how they could align with other schemes. Key relevant routes include: increasing the application of research into industry and wider contexts; as a means of developing human capital for innovation, including at the

important interface between research and industry; and to support innovation and growth in businesses.

- There was some ad hoc evidence on the role of KTPs in contributing to place-based aspects. Whilst not part of KTP design, a key question is whether there is scope to maximise place-based impacts further in future. This would need to be actively instigated by Innovate UK and/or by local partners, likely on a case-by-case basis.

1. Introduction

Introducing the Knowledge Transfer Partnership (KTP) scheme

1.1 The KTP scheme was established over 45 years ago and aims to deliver UK economic growth through supporting commercialisation. The scheme creates and supports three-way partnerships between a business, a Knowledge Base partner (e.g. a university or college) and an individual (associate) to deliver a specific, strategic innovation project using new skills and the latest academic thinking. Between 2010 and 2020, Innovate UK invested £223m in just over 2,100 completed projects. These completed projects engaged with nearly 1,900 businesses, 136 Knowledge Base institutions and over 3,000 associates across the UK.

Evaluation aims and approach

1.2 Innovate UK on behalf of UKRI commissioned SQW, in partnership with Qa Research, to evaluate the KTP scheme, covering the projects supported between 2010 and 2020. The aims of this study were to assess the effectiveness and impact of KTPs, and the scheme's overall performance against its objectives. This included an assessment of impact of the KTP scheme (including long-term benefits) on businesses, the Knowledge Base ('KB') and associates directly involved in KTP projects, and wider impacts of the scheme, including the impact on the UK economy. More detailed research questions are summarised below.

Table 1-1: Key Research Questions

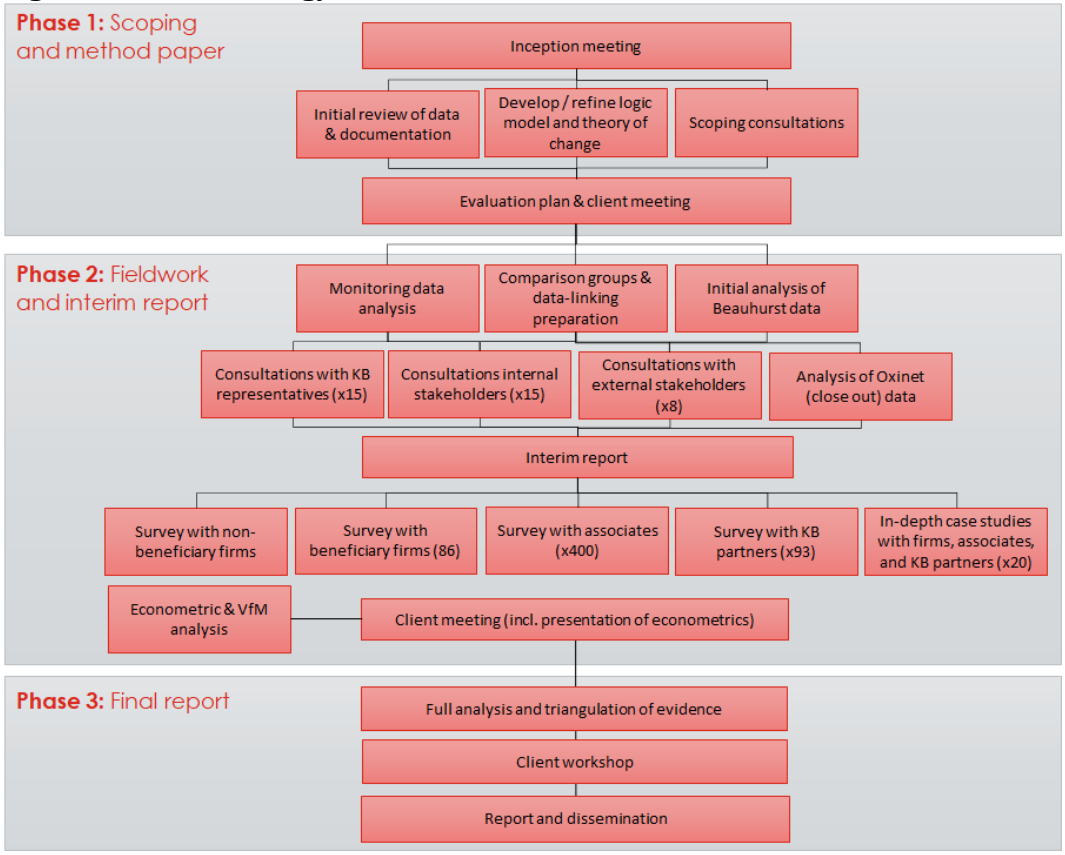
KTP businesses	• To what extent does a KTP (i) generate innovation outcomes, (ii) impact on overall business performance, and (iii) deliver wider outcomes for the business, during and after the project?
Knowledge Base	• To what extent does a KTP deliver outcomes for the Knowledge Base, during and after the project - at a project and institutional level?
Associates	• To what extent does involvement in a KTP benefit the associates involved, during and after the project?
Cross-cutting questions	• Do KTP or partner characteristics influence key outcomes achieved? • What factors have enabled or impeded outcomes? • How effectively is the KTP scheme aligned with the wider innovation landscape? • What motivates partners to engage with KTPs and who initiates KTPs? • Are there mechanisms through which KTPs bring about regional impacts?
Overall performance	• Overall, to what extent has the KTP scheme achieved its objectives? • To what extent does the KTP Scheme contribute to the UK economy? • Is the scheme providing value for money? • How could the KTP scheme be improved to maximise its relevance and impact?

Source: SQW

1.3 The evaluation adopted a theory-based approach, using the logic model and theories of change as a framework to assess whether and how KTPs have brought about intended outcomes and impacts. We have used contribution analysis to assess the scheme's contribution to observed outcomes and impacts, whilst considering other factors which may have contributed to these benefits. This analysis was supported by quasi-experimental analysis (using Difference-in-Difference methodologies) to assess and quantify the scheme's impact on key outcome measures for the businesses involved in KTPs.

1.4 We adopted a mixed method approach, combining quantitative and qualitative research. As illustrated in Figure 1-1, this included analysis of monitoring and close out data[1], econometric analysis, consultations with internal/external stakeholders and Knowledge Base representatives (e.g. KTP managers, business development managers or technology transfer officers at universities), survey work with businesses, associates and academics involved in projects and non-beneficiary businesses who were rejected or withdrew from the scheme[2], and in-depth case studies with 20 projects. Please turn to Annex A for a list of individuals consulted for the evaluation and Annex C for further details on the methodology.

Figure 1-1: Methodology



Source: SQW

[1] Note, the quality of close out data was limited in places, and therefore it has not been possible to use this database as much as intended.
[2] I.e. their KTP application was approved, but they did not start the project. The response rate to the non-beneficiary survey was very low, so it has not been possible to use the results in this report

Report structure

1.5 This report is structured as follows:

- Section 2 provides an overview of KTP scheme.
- Section 3 summarises KTP expenditure and projects supported between 2010 and 2020, and characterises partners involved in the KTP projects.
- Section 4 provides feedback on KTP design and implementation.
- Sections 5 to 7 present evidence on outcomes for businesses, associates and the Knowledge Base respectively. These sections include case studies of KTP projects funded over the period to provide examples of the outcomes reported as well as illustrating the background to projects, their other benefits and success factors.
- Section 8 explores wider impacts associated with KTPs, including place-based impacts.
- Section 9 provides a monetary estimate of the impact of KTPs, based on evidenced impacts on businesses and associates.
- Section 10 discusses factors influencing KTP performance.
- Section 11 provides the overall assessment of the contribution and value for money associated with the KTP scheme.
- Section 12 summarises the conclusions and lessons.

1.6 The report is supported by five annexes: Annex A provides a summary of key findings, as requested by UKRI; Annex B lists the individuals consulted for the evaluation; Annex C presents the detailed theories of change and the assumptions that underpin it; Annex D provides further details on the surveys; and Annex E explains the econometric and value for money analysis and results in further detail.

2. Overview of KTP scheme

2.1 In this Section, we provide an overview of the KTP scheme. This includes the rationale for the scheme, the overarching aims and objectives, and the intended outcomes and impacts against which the evaluation has assessed the scheme's performance.

Rationale

2.2 Transferring skills and knowledge from academia into businesses to drive economic impact is inherently difficult. According to the documentation reviewed for this study, the challenges underpinning the rationale for KTPs include the following[3]:

- For the Knowledge Base, academics may have relevant expertise but lack the resource/capacity to share this knowledge with businesses without additional support. They are also often unaware of the needs of businesses in relation to the expertise that they have to offer.
- From the business perspective, KTPs are designed to support businesses that lack a track record in R&D and/or collaborating with the Knowledge Base. Collaboration is hindered by a lack of awareness of where/how to access expertise and knowledge that could benefit them in terms of the development of new products/services or improvements to their own processes and performance. This can be exacerbated by the lack of information or certainty about the potential benefits that could be brought about by accessing this expertise, resulting in an unwillingness by businesses to cover the full costs of doing so.

2.3 As a result of these **information and coordination failures**, interactions between the Knowledge Base and businesses are sub-optimal, despite academics having relevant knowledge and expertise that businesses might benefit from. In addition, there is a further rationale in that better connecting the two parties can lead to the development and application of knowledge in industry, which is then disseminated or shared through spillover effects, i.e. KTPs have the potential to bring about **positive externalities** for third parties, thereby bringing about benefits to the UK economy more widely.

2.4 The KTP model assumes that businesses recognise there is an opportunity or problem that it could address with access to necessary knowledge, skills and expertise. It is also based on the premise that employing high-calibre graduates to work with a business and the Knowledge Base is an effective way of ensuring relevant information and knowledge is transferred between the two and becomes embedded within the business.

[3] These align with the 2008 Solutions for Business Review (BIS) which identified two justifications for the KTP scheme based on information and co-ordination failures

Aims and objectives

2.5 The overarching objective of the KTP scheme is "**to help businesses in the UK to innovate and grow**"[4]. Specifically:

The KTP scheme aims to deliver UK economic growth through supporting the commercialisation of innovation. The KTP scheme helps UK businesses to innovate and grow, improving their competitiveness and productivity by enabling a business to deliver a specific, strategic innovation project using new skills and the latest academic thinking. It does this by linking a business with an academic or research organisation and a graduate in a funded partnership.
UKRI (2021) KTP Evaluation Brief

2.6 The scheme's underpinning aims and broader strategic goals are outlined below.

Table 2-1: KTP aims and strategic goals

KTP aims	Strategic goals
• To facilitate the transfer of knowledge and the spread of technical and business skills, through innovation projects undertaken by high calibre, recently qualified people under the joint supervision from the business and Knowledge Base. • To provide business-based training for recently qualified people to enhance their business and specialist skills. • To stimulate and enhance business-relevant training and research undertaken by the Knowledge Base. • To increase the extent of interactions of business with the Knowledge Base and their awareness about the contribution that the Knowledge Base can make to business development and growth.	• Innovation: delivering solutions that are market leading and creating new commercial opportunities. • Impact: demonstrating a significant influence on the business's financial position and embedding new capabilities for future innovation. • Challenge: changing business practices, translating academic research into commercial capability and accelerating the career of the graduate. • Cohesiveness: ensuring all the above are individually strong, inter-connected and demonstrating benefits for all of the partners.

Source: Innovate UK

Inputs and Activities

2.7 The scheme is led and run by Innovate UK. Current funders are UKRI, Invest Northern Ireland, Scottish Funding Council, Welsh Government, the Department for Business, Energy and Industrial Strategy (BEIS)/now the Department for Science, Innovation and Technology (DSIT), and Department for Environment, Food and Rural Affairs (Defra). During the period under evaluation, separate funding was provided by individual Research Councils as well as the Department of Health, and ad hoc funding for specific competitions also came from the Nuclear Decommissioning Authority and RSSB (formerly known as the Rail Safety and Standards Board). The annual budget for the KTP scheme between 2010 and 2020 ranged

[4] UKRI KTP Project Authorisation Form

from £15m to £35m, which included grant and non-grant costs but excluded business contributions. Over the 2010-2020 period, Innovate UK typically awarded an average of £80-100k per project. Each one usually lasted for 12 to 36 months. The grant contribution to project costs was paid to the Knowledge Base and predominantly covered associate employment costs and academic time. The grant rate was 67% of the project cost for SMEs and 50% for large businesses. The business partner therefore had to contribute financially to the project cost, in cash and/or in kind.

2.8 Each year, the KTP scheme has and continues to run a series of funding application windows, with grants awarded on a competitive basis. In addition to general 'open' calls for applications, the KTP scheme has delivered a series of thematic calls for applications since 2016/17. These thematic calls have covered emerging and enabling technologies, health and life sciences, infrastructure systems, and manufacturing and materials themes. In addition, further funding has been provided specifically for Management KTPs[5].

2.9 As noted above, a KTP project is a three-way partnership between a Knowledge Base partner (which could be a UK registered university, college, research and technology organisation, or a Catapult), a UK-based business of any size (or a not-for-profit organisation), and an individual associate with relevant graduate-level education. It provides increased capacity for academics to transfer their knowledge and expertise into businesses; it enables businesses to bring in new skills and the latest academic thinking to deliver innovation that will improve performance; and it develops skills, experience and the earning potential of graduates who are the KTP associates. Each project is intended to be innovative and have a commercial focus, supporting businesses where a KTP can really make a strategic difference. Each partner in a KTP project plays a specific role:

- The Knowledge Base partner helps to develop the project, submits the application and recruits the associate. The KTP grant funding goes directly to the Knowledge Base partner, providing capacity for the academics to transfer their expertise to businesses including through the recruitment of the associate. During project delivery, the Knowledge Base partner provides academic inputs and supervises the associate (typically devoting half a day per week to the project), and receives industry and market knowledge in return.
- The associate is a suitably qualified UK or overseas graduate who leads the KTP project within the business. They are expected to be recently qualified graduates/post-graduates in a relevant subject and with 'the potential to be a business leader of tomorrow'. The associate is employed by the Knowledge Base but works at the business for the majority of the project. The scheme also provides two weeks of training for each associate, as well as a dedicated training budget. Projects can employ more than one associate.

[5]Note: all Management KTP projects were still live by the end of 2020 and therefore were not in scope for the evaluation. The Africa Agrifood KTP thematic call was also excluded from scope.

- The business commits match funding to the KTP project, and is usually closely involved in the defining the focus and designing the project to address a specific challenge and/or opportunity within the business. The business hosts and supports the associate.

2.10 The scheme is managed by Innovate UK on a day-to-day basis. The scheme employs Knowledge Transfer Advisors (KTAs), who work in partnership with KBs across the UK. KTAs help to generate demand for KTPs, to form partnerships, and with applications. This includes an initial 'diagnostics' role to ensure that project proposals are appropriate for the scheme before an application is submitted. KTAs visit each project every 3-4 months to discuss progress, and can also provide ongoing business support and coaching/mentoring for the associate. Each project also has a Local Management Committee, which acts as a steering group and meets every four months to assess progress. Monitoring forms are completed every three months by the Knowledge Base partner. At the end of each project, a final report is submitted, which is scored by Innovate UK assessors.

Intended outcomes and impacts

2.11 KTPs are expected to bring about benefits for all three partners involved, both in terms of quantifiable outcomes (such as improved business performance and associates' earnings) and wider outcomes (such as changes in attitudes, cultures and behaviours). For example:

- For businesses, KTPs are expected to support the progression and commercialisation of new products/services, and/or support the adoption of new/innovative processes and practices within the business. In turn, this is expected to lead to improved business performance. KTPs are also expected to generate changes in business culture, such as changed views towards innovation and engaging with academia, and to strengthen the absorptive capacity for other performance-enhancing changes in the future.

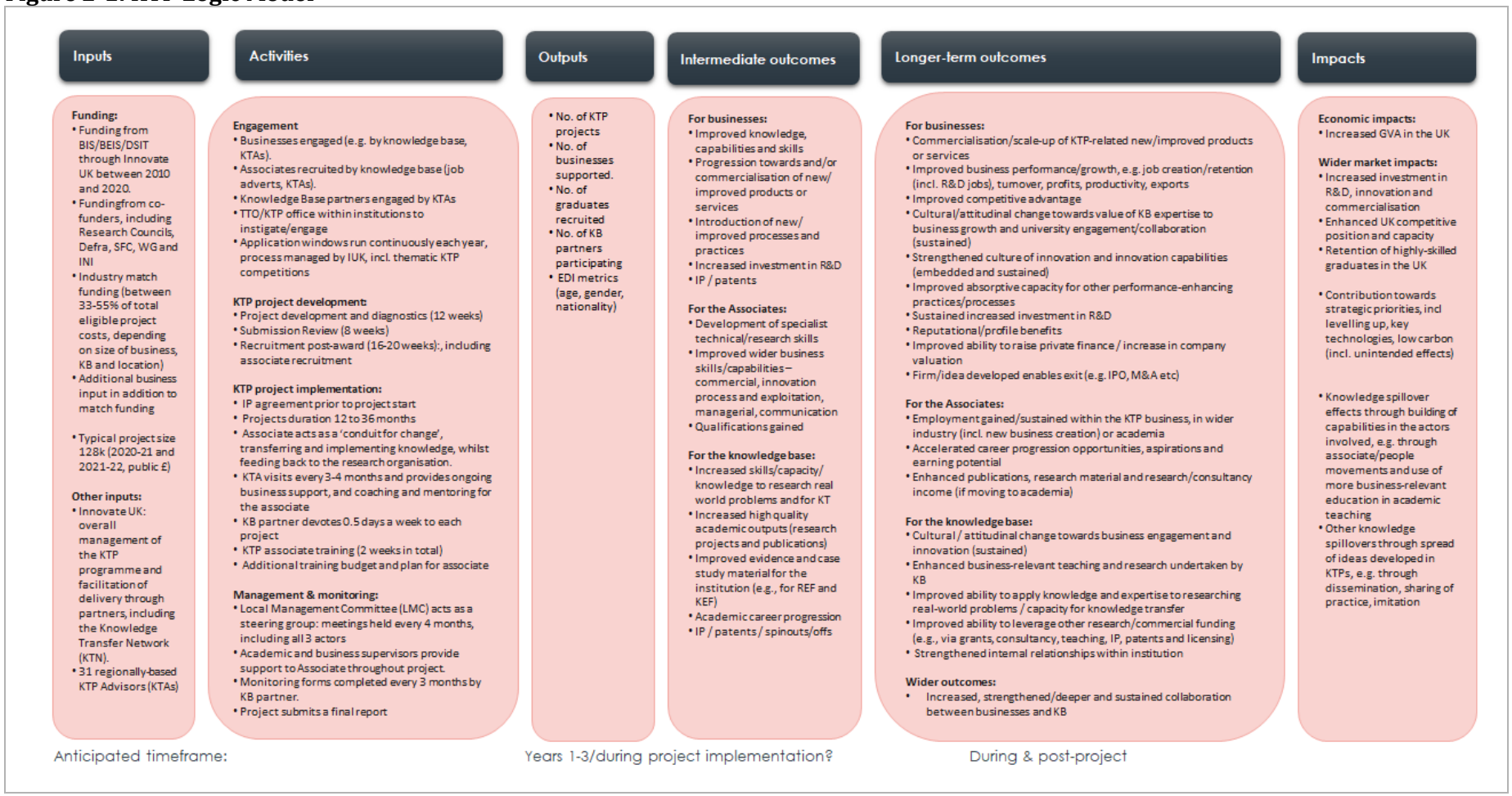
- For associates, KTPs are intended to help graduates gain confidence and industry experience, and then subsequently enable them to secure employment and to accelerate their career progression and earnings potential. KTPs also help them to develop their technical *and* business-related skills and capabilities.

- For the Knowledge Base, KTPs are designed to improve academics' understanding of business-related challenges, thereby enhancing business-related teaching and research. KTPs are also intended to help shift attitudes towards business engagement, strengthen relationships, and help to leverage further research and commercial funding.

2.12 There is also scope for spillover effects, through building capabilities of the partners involved (e.g. by associates applying skills in other businesses, and students at the Knowledge Base partner receiving more business-relevant education) and the spread of knowledge/ideas developed by KTPs more broadly. By generating these direct and indirect outcomes, KTPs are designed to benefit the UK economy and contribute towards strategic priorities linked to R&D investment, innovation and competitiveness.

2.13 Figure 2-1 overleaf presents a logic model for the KTP scheme, which sets out KTP inputs, activities and intended outputs, outcomes and impacts. Annex B presents the underpinning theories of change and detailed assumptions and factors that might enable/help impacts to be realised or hinder progress/cause the theories of change to break down.

Figure 2-1: KTP Logic Model



Source: SQW

3. Overview of KTP projects

3.1 This section provides an overview of the KTP scheme during the evaluation period, which is from the start of 2010 to the end of 2020. It explores inputs at the scheme-level and details activities funded covering the projects and partners involved. Projects in scope include only those that were approved and then closed within the study period, and does not include those that were still active after 2020. This is based on analysis of monitoring data provided by UKRI, our surveys, the Beauhurst database and the ONS Social Research Service.

3.2 There are two categories of KTP projects within the study period:

- First, there were projects that closed after completion (i.e. F1 status and W3) and had submitted a project closure report[6]. We refer to these projects as being 'complete' (i.e. beneficiaries) in the paragraphs that follow.
- Second, there were projects that started but closed with no final report being submitted (i.e. W4) or projects that were approved that were withdrawn entirely/did not start (W2)[7]. These are referred to as 'incomplete' (i.e. non-beneficiaries). Common reasons for this included businesses withdrawing from the KTP because the project was no longer a priority (noting that developing a project idea pre-award can take a number of months, and then associate recruitment post-award can take up to nine months, over which time business priorities and external contexts can change) and the failure to find an appropriate associate at the outset or to replace associates that left during project delivery. This attrition is a recognised feature of the KTP scheme, and so the management team account for it in award decisions. It is also worth noting that some applicants with withdrawn KTPs have submitted subsequent re-shaped proposals which were successfully taken forward.

Scheme-level inputs

Funding

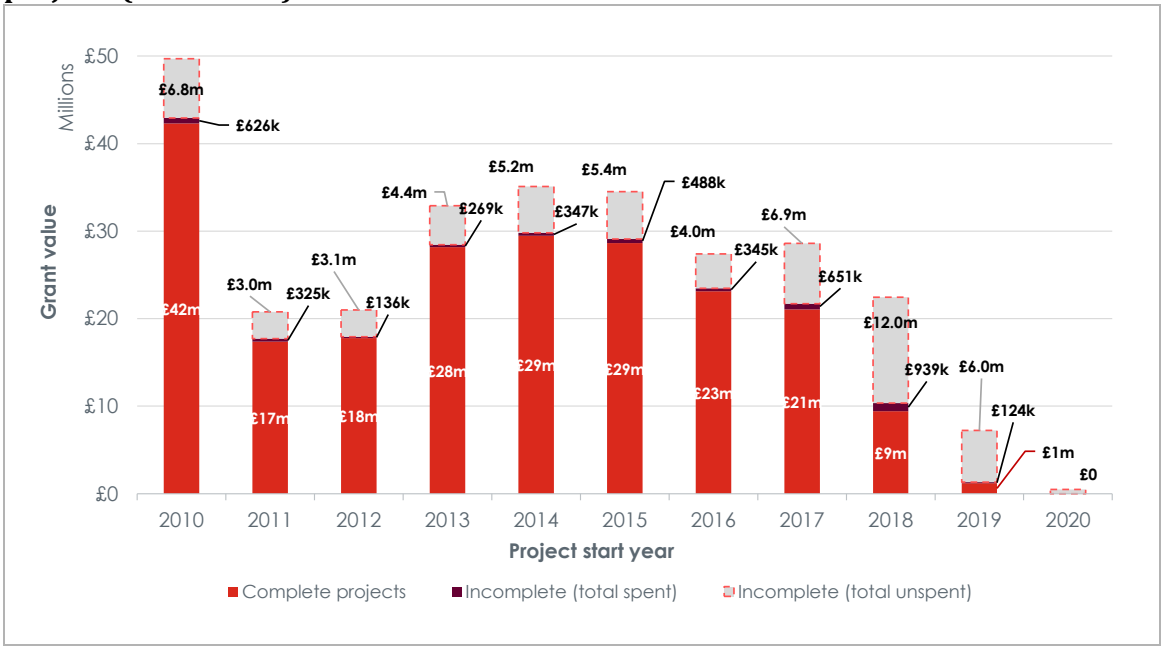
3.3 Between 2010 and 2020 the KTP scheme approved £280m grant funding[8] for a total of 2,774 projects. **A total of 2,154 projects were completed** during this period, and these were allocated 78% of all grant funding approved, to the value of £219m. The annual budget for projects completed ranged from £17m to £42m. The remaining £61m, or 22%, of all grant funding approved was allocated to projects that were incomplete (620 projects), of which we

[6] F1 projects are those that started and formally ended) and W3 are those that closed within at least four months of proposed end date, but still 'finished' with a final report.
[7] W2 projects are those that had applications approved but the project was withdrawn, and W4 are those that started but finished more than four months prior to the proposed end date, and did not submit a final report.
[8] This includes both the value of grants plus an additional +11% for each project that was allocated to the KB for wider costs.

estimate only £4.2m was spent[9]. This means **the actual amount of grant spent by the scheme between 2010 to 2020 was £223m,** in nominal prices[10].

3.4 Figure 3-1 below shows a breakdown of grants allocated, sorted by project start year. This does not account for those that were funded during the study period but still active after 2020, so the amount of funding from 2018 onwards appears to tail off.

Figure 3-1: KTP scheme grant allocation, per start year for complete and incomplete projects (2010-2020)



Source: SQW analysis of UKRI KTP projects data for 2010 - 2020, completed projects includes F1 and W3 status only and incomplete includes W2 and W4 projects

3.5 **There were 25 different sponsors of completed projects**, with the majority of projects having either one (50%) or two (45%) sponsors, and a minority (5%) having three. Innovate UK was the most common sponsor, contributing grants to 93% of all beneficiary projects, at a value of £149.2m. The next most common were EPSRC (15% and £14.7m) and the Scottish Funding Council (11% and £10.9m).

Total scheme value

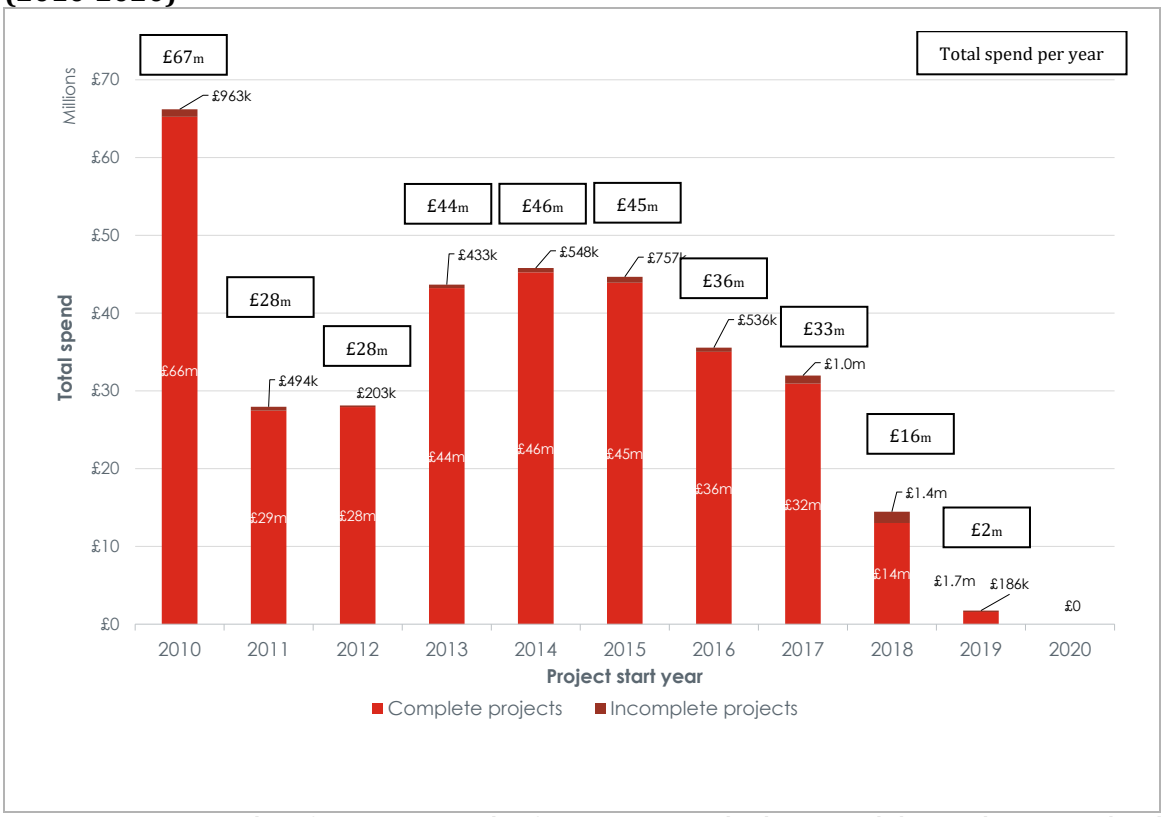
3.6 To calculate the total value of the scheme, business contributions must be factored in. As set out in Section 2, the match funding intervention rate is determined by business size, status and in some cases location.

3.7 **When combining grant funding and business contributions, the total spend of complete projects was £340m.** The total value of incomplete projects was £98m, and we estimate approximately £7m of this was spent by projects that were started but finished very early (i.e.

[9] Based on the assumption that 100% of W2 project costs were not spent, and on average only 25% of W4 project costs were spent, not including the additional 11% grant for KBs.
[10] i.e. not adjusted for inflation.

W4). This means **the total value of the scheme from 2010 to 2020 was £347m,** of which **64% was grant funding (£223m)** and **36% was business contributions (£124m),** in nominal prices**.** The chart below presents the amount of funding spent by the projects, sorted by start year and split by complete and incomplete projects.

Figure 3-2: Total scheme spend, per start year for complete and incomplete projects (2010-2020)



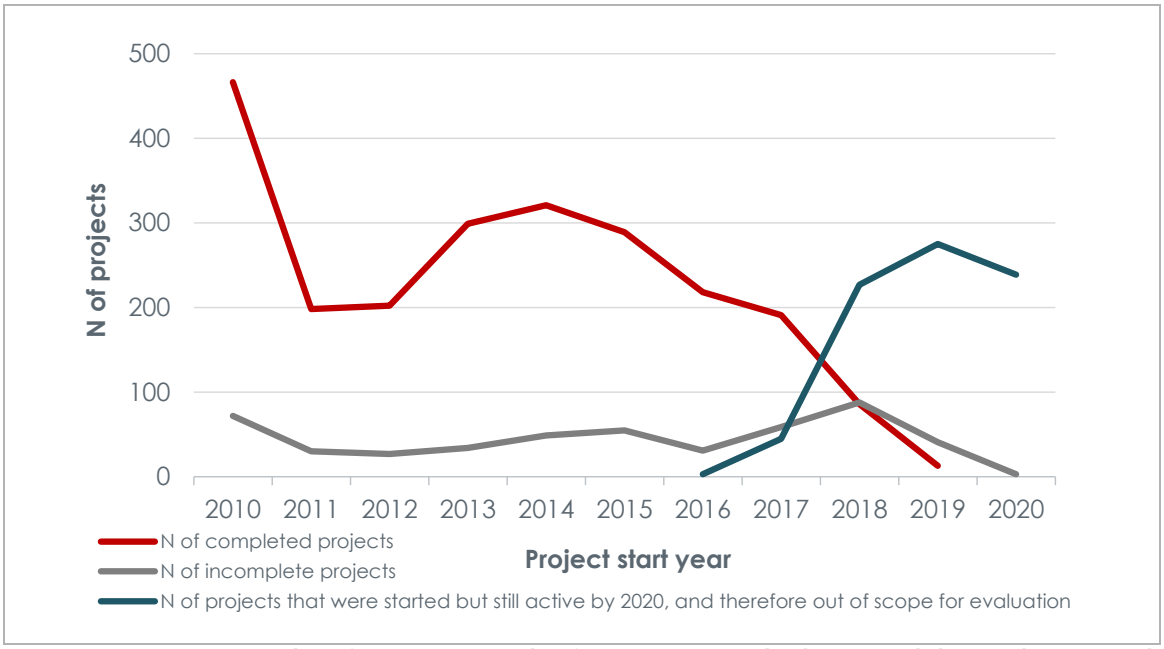
Source: SQW analysis of UKRI KTP projects data for 2010 - 2020, completed projects includes F1 and W3 status only and incomplete includes W2 and W4 projects

Project characteristics

3.8 Figure 3-3 presents the start year of the projects from 2010 to 2020, split by status**. Of the 2,154 projects that were completed (i.e. F1 and W3), the majority started before 2015.** There was a noticeably high number of completed projects that started in 2010, and a 'steady state' period between 2013 and 2015 of around 300 project starts per year (following two lower years). From 2016, the number of completed projects that started in those years fell, corresponding with a rise in projects that were still active after 2020, i.e. insufficient time had lapsed for them to have reached 'finished' status.

3.9 The annual intake of projects that were withdrawn or finished very early has consistently been around 10 to 15% of all approved projects, apart from a slight peak in 2018 (24% of all).

Figure 3-3: Total number of projects that started each year (2010 – 2020) split by status



Source: SQW analysis of UKRI KTP projects data for 2010 - 2020, completed projects includes F1 and W3 status only

3.10 The mean duration of completed projects was around two and half years. There was some variance within this, with those that finished early closing on average six months earlier than those that did not.

3.11 The mean grant size for completed projects was £91k, with the smallest grant for a project being £13k and largest being £328k. The average size of grant allocated to completed projects increased over the evaluation period, from £86k in 2010 to £119k in 2019. This is demonstrated in Figure 3-4.

Figure 3-4: Average grant allocated to completed projects annually (2010-2019)

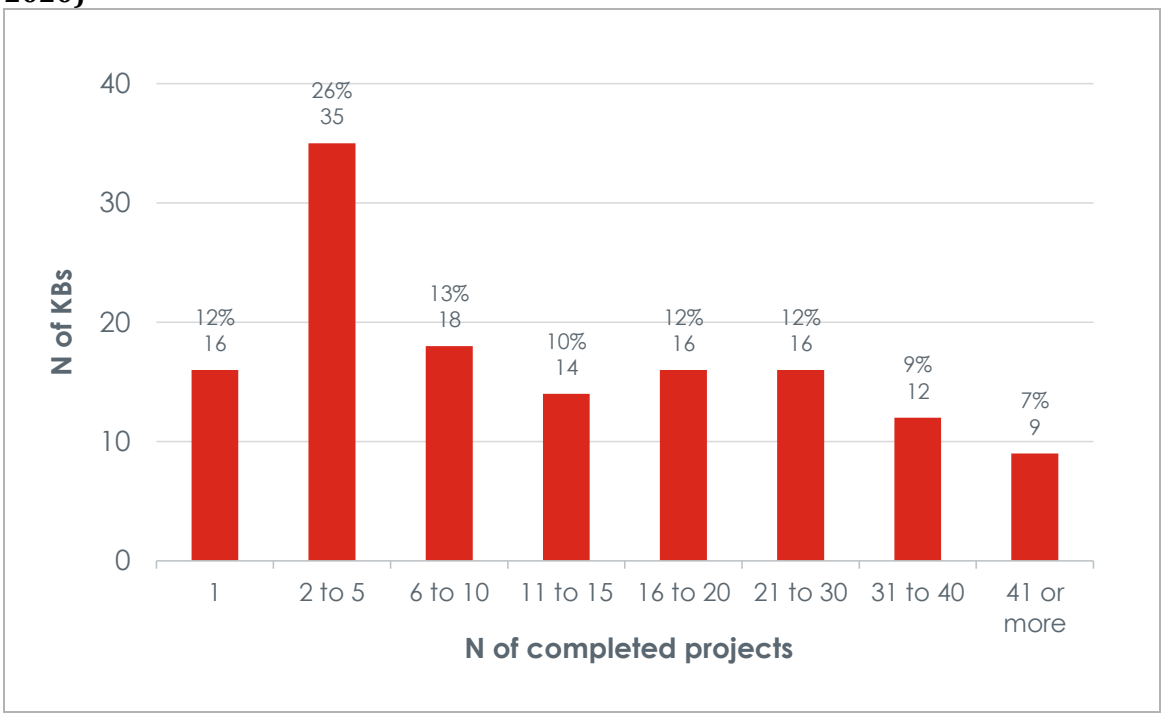
Source: SQW analysis of UKRI KTP projects data for 2010 - 2020, completed projects includes F1 and W3 status only

Partners involved

3.12 There were **1,868 unique businesses involved in at least one completed project**. Of the businesses that completed projects, 88% completed one, and the remaining 12% completed between two and four.

3.13 There were **136 unique KB organisations engaged in complete projects**. Figure 3-5 shows that the majority had multiple KTP projects, with the most common range being between two to five projects.

Figure 3-5: Range of completed projects each KB organisation was involved in (2010-2020)



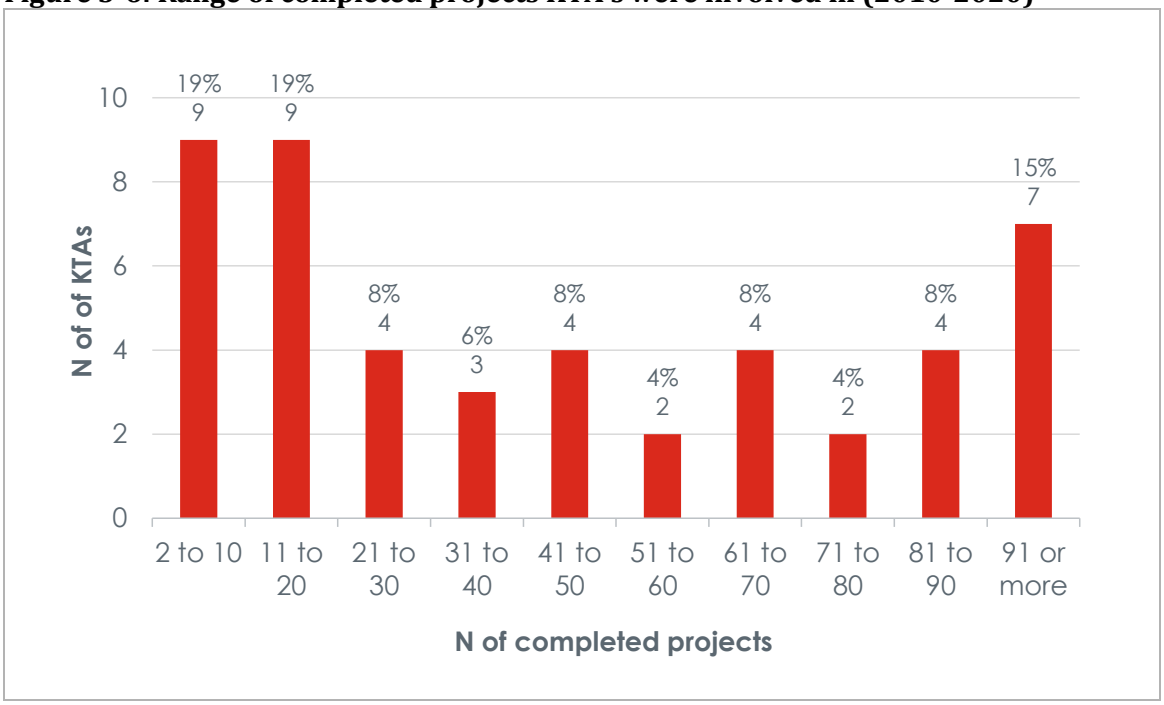
Source: SQW analysis of UKRI KTP projects data for 2010 – 2020, completed projects includes F1 and W3 status only

3.14 We estimate that there was a total of **2,246 associates employed in completed projects** during the evaluation period[11]. The majority of completed projects employed just one associate throughout, but a small proportion (4%) had multiple (up to four).

3.15 **There were also 48 Knowledge Transfer Advisors (KTAs) involved in completed projects**. On average, a single KTA was involved in 45 different completed projects over the study period. Figure 3-6 presents the total number of projects individual KTAs were involved in, which ranged from between 2 and 113. The distribution is skewed towards the upper and lower ends of the spectrum.

[11] This is based on the MI data's profile figure, which presented a ratio of number of associates: length of project. Where projects were given multiple profile ratios, we used the largest number of associates given across all ratios.

Figure 3-6: Range of completed projects KTA's were involved in (2010-2020)



Source: SQW analysis of KTP MI data, completed projects includes F1 and W3 status only

Partner characteristics

3.16 This section focuses on the characteristics and activities of completed projects only.

Businesses

3.17 **Across all 1,868 businesses with completed projects, 15% were micro, 36% were small, 24% were medium and 25% large**[12]. Small businesses were most likely to have completed one project over the evaluation period (36%), whilst medium and large businesses were more likely to be involved in several projects (over 50% of the businesses that completed 3 or 4 projects were large or medium sized). According to ONS Social Research Service (SRS) data, beneficiary businesses were most commonly in sectors of Manufacturing (37%), Professional and Scientific (20%), Information and Communication (12%) and Wholesale and Retail (9%). The remaining 22% were spread across several other industry groups.

3.18 We have also used the Beauhurst database to assess whether KTP businesses are classified as 'high growth firms' and therefore tracked in the database[13]. Overall, 16% of KTP-supported businesses met Beauhurst's 'high growth' criteria (299 businesses), typically because they were 'a 10% scale-up' (69% of those tracked), received equity funding (57%) and/or feature

[12] Business' size groupings are defined by number of employees, with microenterprises having 1 to 9 employees, small having 10 to 49, medium having 20 to 249 and large having 250 or more.
[13] Beauhurst classifies businesses as 'high growth firms' if they meet one or more of the following triggers: receiving equity investment or venture debt, receiving a large innovation grant, attending an accelerator, undergoing an MBO/MBI, reaching scale-up status, being an academic spin out or featuring on a selected high-growth list.

on a high growth list (46%). The Beauhurst data suggests a small proportion of businesses were university spin outs (13%, 39 businesses). Of these, one third were spun-out from their KTP KB partner (note, we do not know if these were linked in any way to the KTP project).

Knowledge Base organisations

3.19 Of the 136 unique Knowledge Base organisations involved in completed projects, the greatest number of projects completed was by Queens University of Belfast (98), followed by University of Nottingham (70), and the University of Strathclyde (69). KB organisations were most commonly higher education institutions (85%). One-tenth were research and technology organisations (RTOs) or research institutes attached to a University, and 5% were further education institutions. Based on the devolved nations and English regions, the greatest proportion of KB organisations supporting beneficiary projects were located in Scotland (15% of all), followed by the South East (14%) and the North West (9%).

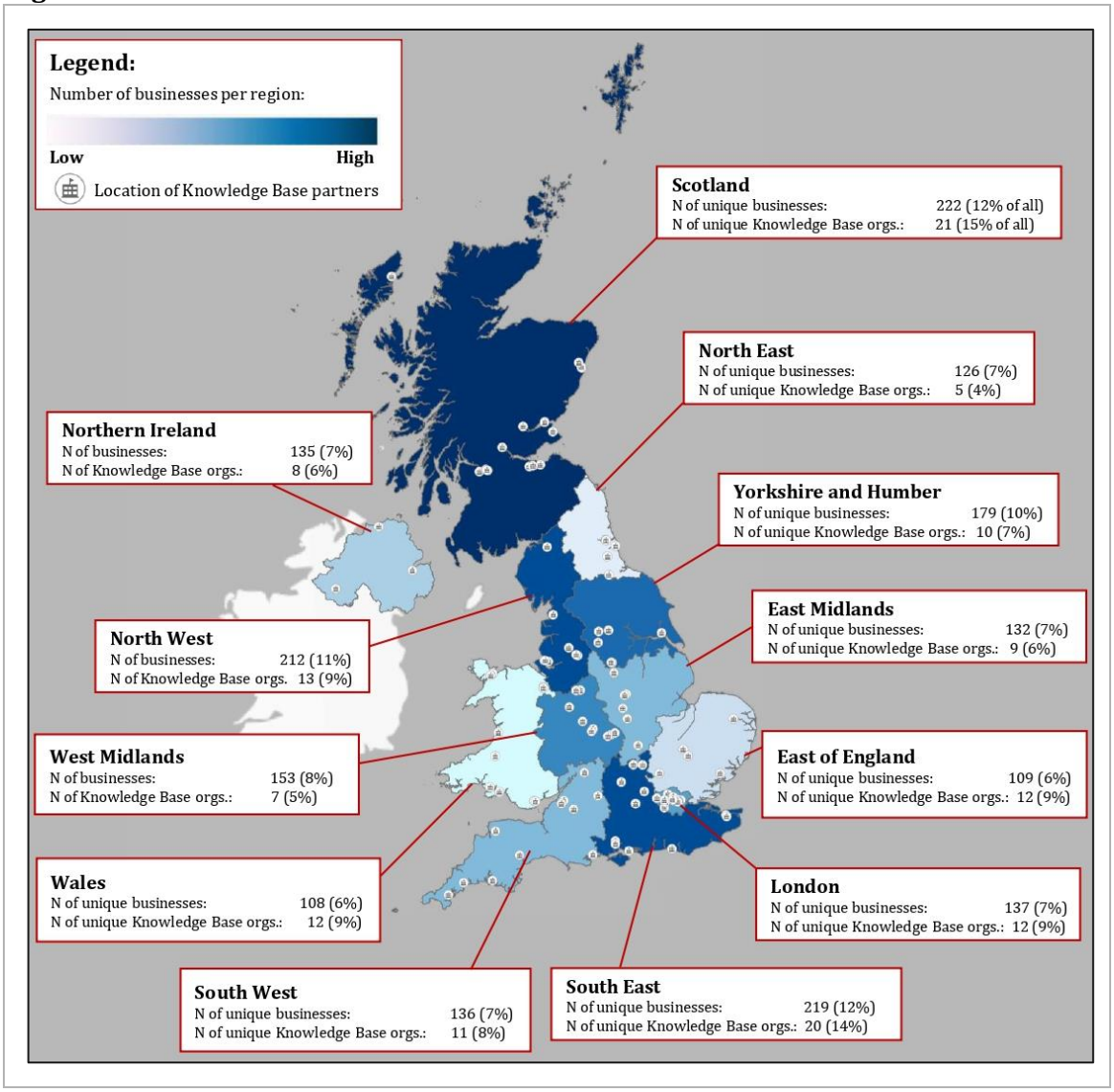
Associates

3.20 Of the associates involved in completed projects, almost all were involved in just one project, with 19 being involved in two, and one in three. Prior to starting their KTP, 44% of associates had level 7 qualifications (i.e. Master's degrees), 31% had level 8 qualifications (i.e. PhD). and 23% had a level 6 qualification.

Spatial distribution of projects and partners

3.21 As illustrated in Figure 3-7, the businesses involved in **KTP projects were well distributed across the UK**, with 75% of beneficiary businesses and 68% of the KB partners being outside of London and the Greater South East.

Figure 3-7: Location of beneficiary businesses and Knowledge Base organisations by region

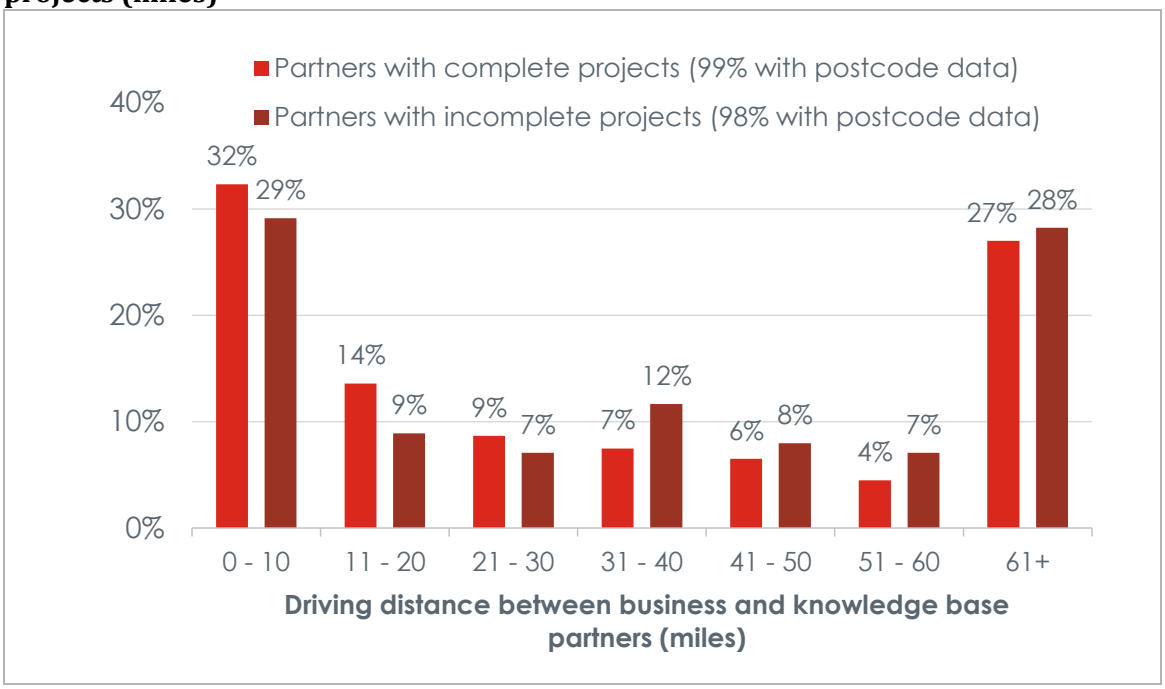


Source: SQW analysis of IUK monitoring data. Map produced by SQW 2022. Licence 100030994. Contains OS data © Crown copyright [and database right] (2022)

3.22 Nearly three-quarters of partners in projects were within 60 miles from one another[14]. A slightly higher proportion of partners with completed projects (i.e. F1 and W3) tended to be more closely located than those with incomplete project, as shown by Figure 3-8. We observe that 55% of beneficiaries were only 30 miles from one another, compared to 44% of non-beneficiaries. To note, during the evaluation period, the scheme recommended that KTP partners were no more than 60 miles apart to facilitate weekly meetings[15]. This has influenced the results we observe here, but this restriction has now been removed.

[14] This analysis was completed for only projects where postcode data was available. For relevant beneficiaries (i.e. F1 and W3 projects only) 99% of projects had postcode data (2126 of total sample of 2154), and for non-beneficiaries (i.e. W2 only), 98% of projects had postcode data (326 of 332).
[15] If partners were more than 60 miles apart, the scheme allowed fortnightly rather than weekly meetings

Figure 3-8: Driving distance between business and Knowledge Base partners in KTP projects (miles)



Source: SQW analysis of business/academic postcodes, where available (n=2,126 beneficiary projects and 326 non-beneficiary projects)

4. Design and implementation

4.1 Section 4 provides feedback on the design and implementation of the KTP scheme. This includes testing the extent to which the challenges faced by KTP participants, and their motivations align with the rationale and objectives of the scheme, and the strategic fit of the KTP scheme more broadly. We also discuss what has worked well (or less well) in terms of engagement and delivery. Note that some of the evidence presented here is based on consultations with stakeholders, and so often reflects their view of the situation now, rather than their view of the KTP scheme over the 2010 to 2020 period.

Rationale and motivations

The majority of businesses and academics surveyed were not new to engaging with each other, and most businesses were already innovation active, which is not aligned with the rationale. Nonetheless, information failures, risk and resource constraints continued to hinder business/academic engagement, which does align closely with the rationale for the scheme. The motivations of business, academic and associate partners also aligned with KTP aims.

Prior experience and challenges for businesses

4.2 Prior to the KTP, the majority of businesses surveyed were already innovation active and had experience of engaging with academics. For example, 81% had invested in R&D activities prior to KTP (70 out of 86). Of those, almost all had engaged in internal R&D (96%) and the majority had been involved in collaborative R&D (CR&D) projects with external partners (76%). Nearly two-thirds had previously engaged with academics (64%) through a range of mechanisms, typically CR&D projects, industrial placements, the use of facilities, skills development and training, and/or student projects. Furthermore, for the majority of businesses, their relationship with the KTP academic partner or the respective KB institution was not new: 38% had collaborated with KTP academic prior to project, and 49% had collaborated with the KB more generally before the KTP project. Therefore, across our survey sample, participating businesses were not new to this type of activity, which does not align with a rationale that is based on getting businesses involved in such activity for the first time.

4.3 Nonetheless, **88% of business respondents had faced challenges that hindered their engagement with academics prior to their KTP** (76 out of 86). For these businesses, the main issues appeared to be not knowing about academic experience available (62%, 47 out of 76) and/or not knowing how to access academics (58%), and/or a lack of resources/capacity within the business, including finance, to engage with academics (54%). These findings are closely aligned with feedback from consultees, where the key perceived barrier was businesses' lack of knowledge of how to access academic expertise. This included

not knowing who they should engage with, where relevant capability lies within KBs, and "where is the front door". A number of consultees stressed this was a particular challenge for smaller businesses, that lack confidence, existing networks and capacity/resource to navigate the university system. For example, different internal consultees stated that "*universities are so huge they don't know where to start*", and that "*sometimes smaller companies are a bit worried about how they might be dwarfed*". By comparison, consultees stated that larger corporates are more likely to have pre-established strategic relationships with KBs and "*know which universities can do what for them*". Other barriers preventing businesses from engaging with academics included differences in language meaning that *"businesses can't see how to make the connection to academics*" (internal consultee), and in ways of working/timescales with *"a perception that universities are slow*" (internal consultee).

4.4 When asked why KTP grant funding was needed to progress the project, the majority of businesses referred to resources, **specifically de-risking or enabling the investment** required for the R&D activity (50 out of 86). Stakeholders thought that KTPs played a role in de-risking business investment in R&D, especially for those who were new to this type of activity. As one internal consultee stated, the KTP model of academic engagement is perhaps lower risk than other mechanisms (e.g., contract work) for businesses because the 'project' is designed in collaboration with the Knowledge Base partner with the partner equally invested in "making it work".

> ***"We were a young company. Cash flow and business turnover was unpredictable, so secure funding was very valuable at the time"***
>
> **Beneficiary business survey respondent**

4.5 These findings support the original rationale for KTPs outlined in Section 2 relating to information failures, but not that KTPs were designed to support businesses that lack a track record in R&D and/or have no history of collaborating with the Knowledge Base. Even where businesses do have a track record, those information failures and resource constraints were still found to be a key challenge.

Prior experience and challenges for academics

4.6 We found a similar picture for academics: **the large majority of the academics surveyed had prior experience of working with businesses** (95%, 88 out of 93). For half of these academics, this prior experience was described as 'extensive' and for most of the remainder it was 'moderate'. It included CR&D, contract research and training activities. Many academics already knew the KTP business partner before the project (39% had collaborated previously, and 25% knew the business but had not collaborated). Furthermore, the **majority of academics had direct experience of working in industry themselves** (65%, 60 out of 93). They had also engaged in other public funding schemes before the KTP, notably with Research Councils, Innovate UK, European initiatives and other UK public sector grants.

4.7 Despite this, **82% of academics cited challenges that hindered their engagement with businesses prior to the KTP** (or their first KTP). However, from the academics' perspective, the issues were as much to do with businesses being unable/unwilling to fund academic inputs (54% of those facing challenges, 41 out of 76) as the academics lacking resource or capacity to engage with business (33%). Academics also found it difficult to find businesses to engage with (42%) and/or lacked knowledge of business needs (26%). Internal, external and KB consultees also consistently highlighted the lack of capacity as the main issue. This is driven, in part, by other competing priorities (both for the individual and institutional) and the lack of incentives to engage in this type of activity. Other key barriers for academics cited by consultees included the following:

- a lack understanding of whether academic ideas would have application in industry
- a lack of contacts with the business base, which was particularly an issue for early-stage career academics and/or academics from overseas
- a lack of awareness of the potential benefits associated with business collaboration
- differences in communications, whereby academics struggle to translate their research into business terms and relate it to what businesses might need
- cultural issues, where a minority of stakeholders stated that in some institutions a culture still exists whereby academics "*don't need to engage with businesses*".

4.8 These findings corroborate the rationale outlined above that (i) academics lack the resource/capacity to share knowledge with businesses without additional support and (ii) are unaware of the needs of businesses in relation to the expertise that they have to offer. The findings suggest there are also other more nuanced barriers across the academic base that hinder engagement with businesses, including networks, communication and cultural issues.

Motivations

4.9 Across all three KTP project partners (i.e., the businesses, academics and associates), the survey findings indicated that individuals' motivations for taking part in a KTP aligned closely with the original objectives of the scheme. The following points are important:

- For businesses surveyed (n=86), almost all were looking to embed new knowledge or skills (90%). Other key drivers included the development/commercialisation of new products (78%), new or increased capacity to innovate (69%), improving existing products (65%), or improving business practices (56%). Over two-thirds also hoped to strengthen their relationships with academics (69%). Using KTPs as a mechanism to generate IP/patents or raise follow-on private investment was less important to businesses.
- For academics surveyed (n=93), the main motivations were strengthening relationships with businesses (77%), increasing knowledge about industry challenges (73%),

informing research and teaching materials (73% and 66% respectively), publications (72%), and leveraging further income (63%). Interestingly, only around half saw KTPs as a route to progressing their career (49%). These findings were aligned with feedback from KB and KTA consultees, who highlighted similar motivations for academics, with references also made to contributing towards the REF impact statements and creating opportunities for student placements. Learning about commercialisation processes and developing relationships with industry were also mentioned by consultees as motivators but to a lesser extent.

- For associates surveyed (n=400), the large majority were looking to improve their career prospects in industry (90%), apply technical/research skills (80%) and develop business-related skills and capabilities (72%). KTPs were often seen as an effective bridge between academia and industry. Whilst still important to some, KTPs were less likely to be considered a route to progressing an associate's prospects in academia/research (44%). This may reflect, in part, the emphasis on the role of KTPs in supporting careers in commercial settings.

4.10 These findings suggest that KTP funding was, overall, targeted appropriately between 2010 and 2020 towards businesses/academics/associates whose own goals were well aligned with those of the scheme as a whole. This is an important test of the theory of change, to ensure the scheme was on the right track and delivering activities as intended to deliver outcomes/ impacts as intended. The one area for consideration, which we return to again later in the report, is the engagement with businesses that are new to collaborating with academia.

Strategic alignment

The purpose of KTPs aligns well with strategic priorities of KB institutions, and more widely with Government priorities for innovation. KTPs are viewed as important in the innovation ecosystem and do not appear to duplicate other forms of support. However, consultation evidence suggested that the scheme could be better aligned or integrated with the wider innovation support landscape in practice.

4.11 According to the large majority of KB consultees and most external consultees (specifically the academic representative groups), **the strategic priorities of KB institutions have become more closely aligned with KTPs over the evaluation period and is now perceived to be strong**. Fourteen out of the fifteen KB representatives interviewed said that the KTP scheme was well aligned with their institution's priorities (and one was unsure due to their institution's strategic priorities being under review)[16]. This was evident across all types of institution consulted and those with more/less historical engagement with the scheme. That said, several consultees perceived alignment to be stronger in institutions with

[16] This aligns with findings from the academic survey: 67% of respondents said that KTPs aligned to their institution's strategic priorities relating to business engagement and knowledge transfer 'to a large extent' (62 out of 93) and 22% said they were aligned 'to some extent' (20 out of 93).

a greater focus on knowledge exchange and innovation. With the growing importance of demonstrating impact (incentivised by the REF and more recently the KEF), consultees have observed a shift in emphasis from teaching and/or research towards a more balanced remit that includes knowledge exchange (the latter is no longer perceived as a "third arm") and the need to diversify incomes has encouraged a greater interest in business engagement. KTPs were seen as a useful mechanism to do this.

4.12 The view across internal, external and KB consultees was that **KTPs do not duplicate other forms of support**, in part because the scheme is long-standing. Consultees said that new interventions should be, and have been, designed not to overlap with KTPs. A small number of similar schemes were noted by consultees – including industry-funded PhDs, iCASE and impact accelerator accounts, the Research in Residence programme, and Degree Apprenticeships (and historically some ERDF schemes). However, KTPs were generally considered distinctive in their partnership approach, duration and focus compared to these other programmes.

> ***"KTP is unique and sits clearly on its own. I say this as a former company director relying on grant funding and being acutely aware of resources available to a firm. There is no replication across the government for the KTP scheme"***
>
> **KB representative consultee**

4.13 **KTA consultees broadly agreed that the KTP scheme aligns well with the wider offer of innovation support in their area.** For example, Smart grants, Innovation Vouchers and (in Wales only) Smart Partnerships were often cited as relevant feeder programmes into KTPs. The scheme was perceived to be an important element of the innovation ecosystem and its objectives/purpose aligned well with broader Government priorities relating to business innovation, productivity and growth. However, many consultees stated that, **even though the KTP scheme was well aligned with other innovation support *in theory*, it was not well integrated *in practice***. This was raised by both internal and external stakeholders, and a minority of KB consultees. A number of internal stakeholders stated that the KTP scheme is on the "*periphery*", not enough people within UKRI's own Research Councils understand it (and therefore do not integrate it effectively with their own portfolio of products), and it is seen as "a *nice to have, but in no way central and other schemes are not built around it*". Internal consultees suggested that more information could be shared across UKRI on KTP activities, progress and impacts. External consultees also found integration with KTPs a challenge. For example, one consultee stated that "*at the moment, I don't think we have a well-formed view about exactly where you would use a KTP vs a Smart grant or other support*". Similarly, other internal and external consultees suggested that KTPs could be better aligned with Research Council funding and that the support pathway post-KTPs could be clearer.

4.14 However, it is important to recognise this is a common issue across innovation schemes, not just for KTPs. As one consultee put it, there is a "patchwork quilt" of initiatives in place, especially in England. A question was also raised about whether other business support bodies (national and local) are incentivised to promote Innovate UK schemes and vice versa:

"I think the scheme is complementary but the mechanism of selling the schemes could be more joined up" (internal consultee). On the one hand, the KTP scheme is successfully generating benefits (as we discuss further below) and so some may question whether integration with wider innovation support matters. On the other hand, some representatives from UKRI were thought not to be fully aware of when to utilise KTPs. This may mean there are missed opportunities to (a) widen the reach of KTPs and (b) ensure KTP partners receive complementary support that might help them to maximise impacts further. We return to this point in Section 12.

Engagement and implementation

Engagement

The ability of academics to engage with KTPs is influenced by: general awareness, their capacity to set up and deliver projects, the capacity of a supporting KTA/TTO team, institutional priorities and senior backing; and perceived relevance of subjects/disciplines to KTPs. Cutting across this, engagement typically comes down to individuals acting as advocates for KTPs – the presence or absence of these within an institution appears to be a critical factor in take-up. For businesses, it was perceived that facilitated access and support from KTAs/TTOs has enabled engagement with the scheme. Lack of awareness and capacity, and project set-up timescales were thought to be important barriers.

4.15 A number of key factors have encouraged or hindered engagement of KBs with the KTP scheme. These are summarised in Table 4-1 and have been informed primarily by stakeholder consultee feedback (internal, external and KB representatives). Note, feedback was not gathered from businesses directly on this topic. Some common themes are evident for both academics and businesses that hinder engagement, including **awareness of the scheme, capacity to engage** (and perceived or actual administrative requirements to set up a project) and **the influence of criteria on accessibility** (e.g., disciplines such as humanities for academics, or businesses with less R&D experience). For academics, institutional prioritisation and incentives are important. For businesses, the length of time between application and starting the project was also raised.

4.16 A final point on engagement and accessibility relates to equality and diversity. Whilst monitoring data is not available for the gender or ethnicity of all participants, the survey found that 89% of respondents to the academic survey and 74% of respondents to the associate survey were male. Widening the scheme's reach in this respect may be a point for Innovate UK to consider in future.

Table 4-1: Key factors influencing engagement with KTP scheme

KB engagement	Business engagement
• **Capacity and time**: this was the most commonly cited factor hindering academic involvement in KTPs by KB consultees. This related to both forming a KTP project and significant time commitment needed before the project starts (several KB consultees felt that the application process is too long, complicated and overly bureaucratic) and then during delivery, especially the time need to support the associate. There was some concern that the KTP resources were insufficient to cover the time required to implement a KTP effectively in practice. Small KBs have reportedly found it difficult to engage with KTPs because of a lack of capacity or funding (e.g., HEIF) to support knowledge exchange activities. • **Government incentives and metrics**: the REF, and more recently the KEF, requirements to demonstrate impact and the direct link to funding mechanisms (and also the Knowledge Exchange Concordat) have been important drivers according to KB and internal consultees, encouraging greater interest among KB institutions to increase their knowledge exchange activities. • **Institutional priorities and political drive from within institutions at senior level:** this provides "a top-down push", resource and profile for departments or KBs to increase KTP numbers, embed KTPs into the culture of the institution and put in place appropriate incentives for academics to participate in KTPs. This was raised by KB consultees and a minority of internal and external consultees. • **Explicit targets relating to KTPs**: KB consultees described how some universities have introduced specific aims relating to their engagement with the KTP scheme (and in one case, this is explicitly part of their strategy at an institutional level). This has promoted rapid growth in the number of KTP projects. For other institutions, the aims associated with KTPs are more broadly set to "grow the numbers" or "diversify the portfolio" into other KB departments. Overall, out of 15 KB consultees, 13	• **Awareness of, and access to, the scheme**: several internal and external consultees noted that the KTN has helped to raise awareness of the scheme through events, direct engagement and via the KTP website. In Wales, Innovation Officers on the ground across Wales also help to link businesses to the scheme. The longevity and consistency of the KTP brand has provided "stability" in what is a complex innovation landscape and therefore helped in terms of engaging businesses in the scheme. However, lack of awareness is still a key barrier to businesses engaging with the KTP scheme. External stakeholders in particular flagged the need for much greater awareness of KTPs. • **The time between project idea and start:** the perceived long lag time between initiating the project idea, developing the proposal, receiving approval and then recruiting an associate was commonly highlighted by internal, external and KB consultees as a factor that deterred businesses from engaging with the scheme. Businesses have plans/roadmaps and need solutions as quickly as possible. • **Capacity of businesses to engage**: notwithstanding the value of KTA/TTO support above, internal and external consultees suggested that the lack of time and resources for micro and small businesses to get involved has been a barrier to engagement. KTPs are a significant investment for smaller companies, and this can make them unappealing. • **IP agreements:** a minority of KB consultees suggested the misperceptions about IP agreements can deter businesses. As one consultee noted, companies "*are very concerned about paying royalties*", even though the consultee's institution does not receive royalties from the companies. • **KTP criteria:** there was a perception amongst a minority of consultees (internal and KB representatives) that the threshold of 'innovativeness' of KTP projects is getting higher, i.e., to meet the KTP criteria projects were

KB engagement	Business engagement
stated that the KB institution has the ambition to grow their number of KTPs. • **The KB's specialist expertise in relevant subjects**: internal and KB consultees suggested that subjects which were seen to lend themselves to KTPs, such as engineering, tend to drive KTPs. Some disciplines, such as humanities, have found it harder to engage with KTPs because of difficulties in translating their skills to the business world and making them relevant to potential partners. There was also a concern that the KTP application process and criteria favoured commercial and economic outcomes/RoI, which made it difficult for socially/environmentally focused proposals or those related to intangibles to succeed. • **The interest/experience of individual academics in KTPs:** linked to the point above, engagement with KTPs appears to be strongly dependent on the interest and prior involvement of specific individuals. As one KB consultee stated, "*as academics get promotions and take on a different role, their involvement with KTPs often falls off. If they move to different institutions, they usually take their KTPs with them*". • **Dedicated capacity and responsibility for the KTP scheme within the institution:** there is evidence from internal and KB consultees to suggest that "*strategic investment in the KTP manager*" (alongside clear target setting, as noted above) can enable "transformational" growth in KTP projects. • **The longevity and consistency of the KTP scheme:** as one consultee stated, the KTP scheme is seen as a "*safe model*" for academics to engage with businesses. That said, a number of KB/internal consultees also felt that more awareness raising is needed amongst academics. KTPs were described by two consultees (one KB and one internal) as "*the best kept secret*".	expected to be highly innovative. Consultees had also observed a shift to a more research definition of innovation, rather than focusing on projects which "may not be the very latest academic thinking" but deliver good products that are innovative to the business. This generated a perceived concern that this made KTPs less accessible for some businesses, and potentially could deter those who had not engaged with KBs before. This aligns with findings from the beneficiary business survey, where the large majority of respondents were already innovation active prior to their KTP.

Source: SQW synthesis of consultee feedback

Project initiation

Survey feedback suggests that KTP projects were typically initiated by businesses, or jointly by multiple partners, counter to the previously held perception that the KB initiates.

4.17 One of the wider research questions for this evaluation was around who instigates KTPs. According to businesses surveyed, the business plays an important role in initiating KTPs: 53% of projects covered by survey were initiated by business, and 21% were joint initiation. This was corroborated by the academic survey, where 31% said their KTP project(s) was initiated by the business and 30% said it was a joint initiative. In both surveys, very few respondents said the KTP was initiated by the KTA or someone else from the KB institution (e.g., TTO). Consultees were more likely to believe that the academic/KB partner initiated KTPs but agreed that initiation by KTAs/TTOs was less common. Consultees also concurred that KTPs were typically based on existing contacts or relationships between academics and businesses (as discussed earlier in this section).

Satisfaction with KTP processes and implementation

Overall levels of satisfaction with KTP processes and project implementation were high, especially in terms of partnership formation and developing a shared vision, application/approval processes, project management and monitoring requirements, and support provided by the KTA. Two areas that received more mixed feedback were the associate recruitment processes and marketing/promotion of the scheme.

4.18 As part of the beneficiary surveys, we asked businesses, academics and associates to rate their satisfaction with KTP processes and implementation (where relevant to each respective group) on a scale of 1 to 5, where 1 was very unsatisfied and 5 was very satisfied. Table 4-2 presents the results, grouping processes/implementation into categories, based on the proportion of respondents scoring each one highly (i.e., 4 or 5 out of 5). As illustrated below, **overall levels of satisfaction with KTP processes were high**, especially in terms of partnership formation, application/approval processes, monitoring requirements and support from the KTA. There was more mixed feedback on associate recruitment processes and marketing/promotion of the scheme, which aligns with qualitative evidence from consultees. **Satisfaction with KTP implementation was also very high**, notably in terms of partner commitment and shared vision, project planning and management, the value of academic inputs, associate capabilities and academic/business support for the associate. Further details on satisfaction scores are provided in Annex D-1.

Table 4-2: Beneficiary survey: feedback on KTP processes and implementation: satisfaction rated on a scale of 1-5 (where 1 is very unsatisfied and 5 is very satisfied)

Level of satisfaction	KTP processes	Source of feedback
KTP processes		
>75% of respondents scored 4 or 5 out of 5	Ease of forming the KTP partnership	Academics, businesses
	Developing the KTP project	Businesses
	Application and approval process	Academics
	Monitoring requirements	Academics
	Support from KTA	Academics, businesses, associates
	Associate recruitment and induction	Associates
50-75% of respondents scored 4 or 5 out of 5	Associate recruitment process	Academics and businesses
	Interaction with KB during development of project	Businesses
<50% of respondents scored 4 or 5 out of 5	Marketing and promotion of KTPs	Academics
KTP implementation		
>75% of respondents scored 4 or 5 out of 5	Partner commitment to the project	Academics
	Shared vision for project amongst partners	Academics, businesses (note, associates scored slightly lower)
	Clear IP agreement	Academics, businesses
	Well-structured project plan	Academics
	Value of academic team's knowledge in relation to project	Businesses, associates
	Capabilities of associate	Businesses
	Delivery of activities in line with project plan	Businesses (note, associates scored slightly lower)
	Support from academic staff from the KB organisation	Associates
	Support from the business	Associates
50-75% of respondents scored 4 or 5 out of 5	Support from non-academic staff at KB organisation	Businesses, associates
	Interaction with KB post-award	Businesses, associates
<50% of respondents scored 4 or 5 out of 5	None	

Source: SQW analysis of beneficiary surveys with businesses, academics and associates

4.19 The associate survey found that the large majority of respondents did use their KTP training budget (91%, 363 out of 400), but they used typically less than £500. This was used for a variety of purposes, including attending training courses (in management and technical

topics) and conferences, and contributing to gaining qualifications. Satisfaction with the training received was high[17].

Activity additionality

KTPs have brought about R&D activities that would not have gone ahead or not in the same form without KTP funding, i.e., almost all activities were fully or partially additional.

4.20 Finally in this section, we explore whether KTP project activities would have gone ahead in the absence of funding, as an indicator of additionality. Overall, **the majority of businesses and academics said the projects would probably or definitely not have gone ahead anyway** if a KTP grant had not been available (67% for businesses and 75% for academics). This is very similar to evidence from the close out reports, where 65% of businesses said they definitely/probably would not be making similar progress without the KTP (n=1,947).

4.21 Most of the remainder said the KTP project may have gone ahead, but in almost all cases, the activities would have been compromised in some way. For example, in the business survey 32% of respondents said the project probably or definitely would have gone ahead anyway (27 out of 86). However, these would have differed in terms of scale (59%), timing (52%) or nature (41%). Only one respondent out of 86 said the project would have gone ahead anyway in exactly the same way. Feedback from the academic survey corroborated this: where academics thought the project would have gone ahead, most said projects would have been smaller in scale, taken longer or been different in nature (notably less focused and limited in scope). Businesses appear to be slightly more optimistic about projects going ahead in some form without KTP funding than academics.

Table 4-3: Activity additionality – survey results: in the absence of KTP funding, do you think the project would have gone ahead anyway in some form?

	Businesses		Academics	
	Count	%	Count	%
Yes, definitely would have gone ahead	10	12%	0	0%
Yes, probably would have gone ahead	17	20%	21	23%
No, probably would not have gone ahead	40	47%	33	35%
No, definitely would not have gone ahead	17	20%	37	40%
Don't know	2	2%	2	2
N=	86		93	

Source: SQW analysis of survey results

[17] When asked to rate training received on a scale of 1 to 5, where 1 is very unsatisfied and 5 is very satisfied, 83% of respondents rated the training as 4 or 5 out of 5 (n=363).

5. Business-level outcomes and impacts

5.1 In this Section, we present the evidence on the outcomes and impacts for businesses involved in KTP projects (i.e., project partners), testing the scheme's performance against intended effects set out in the logic model. The primary sources of evidence were the beneficiary business survey and case studies, which were triangulated with feedback from the stakeholder consultations and analysis of data from close out reports.

5.2 The beneficiary survey was completed by 86 businesses[18]. These businesses had been involved in 104 KTP projects and these projects had received £9.5m in grant funding in total. The sample was representative of the KTP population, for example in terms of the average grant award (£92k), the timing of the KTP, their size, and spatial and sector distribution. The KTP projects covered by the survey were mainly in advanced manufacturing and materials (31%), AI digital and advanced computing (24%) or energy/environmental technologies (23%).

Outcomes and impacts

There was strong and consistently positive evidence to suggest that KTPs have led to both process and product innovation across the majority of businesses involved (or will do so). KTPs were often strategically important to the business and formed part of wider growth agendas and business development activities. The large majority of survey respondents had observed, or expected to see in the future, an impact on at least one aspect of financial performance (productivity, profitability, employment and/or turnover). KTPs also have a longer-term legacy effect in terms of influencing perceptions of, and capability to undertake, innovation and engage with academia. Many of the relationships with academic/KB partners have continued since the project ended.

5.3 Before we present the findings on outcomes and impacts, there are two important contextual points to note.

5.4 First, as noted in Section 4, **the majority of businesses were innovation active and had experience of engaging with academia prior to their KTP.** The majority also had prior experience of engaging in other public funding initiatives relating to innovation and R&D (69%), notably with Innovate UK, other Government or European schemes, or universities. This is likely to influence their capacity/capability to generate innovation outcomes from the KTP project; the large majority were not new to this type of activity.

[18] With 86 respondents out of 1,868 unique beneficiaries margins of error are ±10% at the 95% confidence level. I.e., if half of the survey reports an outcome, we can be 95% confident that between 40% and 60% of the overall population achieved that outcome. The margin of error is the largest if the survey response to a question is 50%. For example, If 90% report an outcome the margin is ±6%.

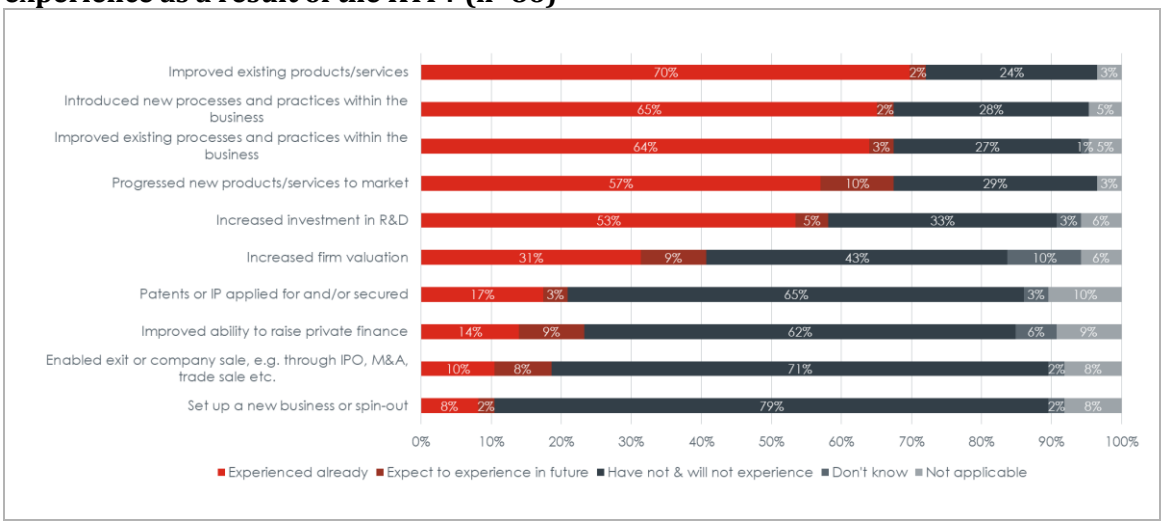
5.5 Second, KTPs were often strategically important to the business and formed part of wider growth agendas and business development activities. For example, when asked on a scale of 1 to 5 how strategically important the KTP project(s) was to their business[19], nearly two-thirds of respondents scored it 4 or 5 out of 5. This was explored further in the case studies, where we found KTPs were often directly linked to a range of planned business developments. These included: exploring new business models; expanding into new markets; increasing exports; re-shoring manufacturing; developing new product offers; changing internal approaches (e.g. the use of data or developing next generation machines); and/or enhancing digitalisation within the business. KTPs were found to support the delivery of these business plans by providing an evidence base to inform decision-making internally, providing empirical data that could be shared with customers to demonstrate the performance of new products, or supporting R&D that enabled businesses to explore diversification into new markets (whether this resulted in *"new direction"* for the business or indicated that these markets were not worth pursing). The contribution of KTPs to business strategies was evident in the close out reports, where many projects were specifically aimed at progressing new products that would enable businesses to become market leaders, have competitive products on the market, or enable a new strategic focus (e.g. in digitisation or automation) that would facilitate growth. As set out in the scheme aims above, KTPs are intended to help a business progress *'a specific, strategic innovation project'* and these findings suggest it has been targeted appropriately in this respect. This is also important context for the findings on business performance below, and the econometric results in Section 9.

Intermediate outcomes

5.6 Figure 5-1 presents findings from survey respondents on the intermediate outcomes observed to date and those expected in the future. As illustrated below, **KTPs have led to both process *and* product innovation across the majority of businesses involved (or will do so in the future)**. Linked to this, the scheme has encouraged businesses to invest more in R&D. Outcomes associated with patents, raising follow-on finance and exits/ company sales, and new start-ups are also evident, albeit less common – as we might expect for these types of outcomes.

[19] Where 1 is not at all important and 5 is very important

Figure 5-1: Business beneficiary survey: for each outcome, please can you tell me if this is something you have experienced to date, expect in future, or have not/will not experience as a result of the KTP? (n=86)



Source: SQW

5.7 We explore these outcomes in more detail in the paragraphs that follow:

- **Business practices and processes**: around two-thirds of businesses surveyed have introduced new processes/practices or improved existing ones (65% and 64% respectively). This included improving and automating design processes, data analytics, accelerating manufacturing processes, improved R&D and innovation processes, better management processes (e.g. gaining ISO9001 Quality Management Systems), and improving their approach to interacting with universities. The case study below provides an example of a KTP that helped to improve a business's internal processes and business model, leading to job creation, increased turnover and profitability.

Case study

The KTP involved an academic from the Department of Operations, Systems and Management at the University of Portsmouth, an associate, and Entec International Limited. Entec is a business based in the West Midlands which provides procurement and logistics solutions within the global maintenance repair and operational spares supply chain for blue chip clients within the fast-moving consumer goods sector. The project was delivered between March 2014 and September 2016. At the time, the business had a broader aim to change its business model from a margin to cost of goods sold to a service platform fee model and demonstrate the value of this proposition to customers. However, the business lacked the required technical expertise and experience and wanted to explore options with a knowledge partner. It was proactive in sourcing support, contacting the local business school which introduced them to the KTP scheme.

The primary aim of the KTP project, as set out in the application form, was "to develop a capability to exploit and demonstrate hidden value within an integrated procurement process along complex global supply-chains". The project focused on two key objectives: the development of a tool set to capture and describe the full value proposition of the Entec service, and the development of a new inventory profile or service. During the

project the business also extended its technical knowledge and capabilities, improved internal processes, and embedded best practice through learning from the knowledge base (e.g., interviewing techniques). Over the longer-term, changes made to Entec's business model through the KTP led to employment benefits, increased turnover and profitability, and increased investment readiness. More widely, the KTP raised the business's awareness of the need to invest in individuals to develop skills, and improved perceptions of the value of engaging academic expertise across the business. The KTP helped to strengthen relations with the knowledge base partner, and the relationship has been sustained since the KTP ended (including taking on Masters students).

The KTP enabled the associate to develop their business and management skills, improve their technical and applied research skills, and develop strong networks at the business and knowledge base. Since the KTP, the associate has remained employed by Entec and is now Business Intelligence Manager, leading a team of analysts at the business to deliver business analytics, maintaining a relationship with the knowledge base.

In the absence of the KTP project, consultees said the benefits would not have been achieved at all. The business explained that the project would not have happened without the knowledge gained via the knowledge base and the associate, which they would not have been able to access without the KTP scheme. For the associate, the career development and progression opportunities would not have happened without the KTP: "I have been working for the same company for pretty much nine years now and I would not have stayed this long. What I have developed during the KTP is I have a sense of owning now which made me stay [at the company] for a long time and I am happy".

The three-way partnership and regular engagement which facilitated knowledge exchange, strong buy-in to the project across the business, regular interactions with the KTP team, pre-existing relationships between the knowledge base and the associate, and proximity between partners were the key factors that helped to deliver a successful KTP.

- **Improving existing products/services**: over two-thirds of businesses surveyed have improved existing products or services (70%). The case studies provided examples: one business established and embedded sophisticated modelling within its data analytics team which has improved the business's ability to effectively manage its energy services; another benefited from improvements to several existing chemical products within its portfolio from short projects that the associate undertook in parallel to the core KTP project. The case study box below provides a further example of how the knowledge gained via the KTP has enabled a business to develop new, strategically important products.

Case study

The KTP involved a Professor of Pharmaceutical Microbiology at Cardiff University, an associate, and GAMA Healthcare ('GAMA'), a manufacturer and distributor of innovative Infection Prevention Control (IPC) solutions such as cleaning and disinfectant wipes and other biocidal products based in London. The project was delivered between February 2016 and April 2019. Prior to this KTP, the Professor and GAMA had worked together before, including on two other KTPs which were not directly related to this project.

The KTP project was prompted by upcoming regulatory changes and improvement on efficacy against stringent microorganisms including non-enveloped virus and mycobacteria. However, when the KTP started, GAMA's R&D team had limited experience in working with viruses and mycobacteria and in innovative intelligent formulation design to enable new products to be commercialised at pace.

The key benefit of the KTP for the business was the knowledge acquired, and development of new core formulations following the biocidal product regulation (BPR) that were effective against stringent microorganisms. Following the completion of the KTP, the formulations required further refinement before commercialisation (e.g. to reduce production cost) funded by the business. During the Covid-19 pandemic, demand pressures and supply chain issues meant that the business had to prioritise its products for healthcare settings. However, the KTP research enabled the business to apply the knowledge according to commercial demand and to respond quickly supporting the high demand for IPC solutions. More widely the project was considered strategically important to the business, to increase the business's research knowledge ensuring biocidal products delivery and broad-spectrum efficacy. It is also expected to deliver wider societal benefits: developing more effective products will contribute to reducing the spread of infections in healthcare and other settings.

The KTP enabled the associate to develop their business and management skills. After the KTP, the associate was employed by GAMA and has maintained a relationship with the academic. For the academic, the KTP resulted in internal research publications and helped to maintain a relationship with GAMA (which included a fourth KTP).

In the absence of the KTP project, consultees said that benefits would have been achieved but on a smaller scale and/or they would have taken longer to have been realised. The project is likely to have proceeded without KTP funding, but in a different form (e.g. a PhD or via testing in a university lab led by a technician/research assistant/associate). The KTP offered a "natural route" to undertake more applied research, access to leading academic expertise for the business, and provide the opportunity to deliver a more in-depth project.

The quality of the associate, the level of engagement by the business, the experience and commitment of the KTP advisor, and regular and frequent communication between the partnership, were the key factors that helped to deliver a successful KTP.

- **Technological progression and commercialisation**: the KTP had enabled over half of respondents to progress new products/services to market (57%, 49). Of these, the majority of respondents said that at least some products/services were new to market (63%) with most of the remainder new to the business (33%). The survey findings suggested KTPs are a useful mechanism to support R&D across the Technology Readiness Level (TRL) scale, as around half new products/services were at the stage of 'formulating and developing the concept for innovations' when the project began (49%, 24 out of 49). Of those, three quarters now have their product/service in the market place. Figure 5-2 shows the TRL when the KTP started (A) and at the time of the survey (B). As illustrated below, nearly three-fifths of all businesses stating that the KTP enabled technology progression (59%, 22 out of 39 who were able to comment) have now reached commercialisation and/or are looking to scale-up or have reached maturity in market.

Figure 5-2: Beneficiary business survey: technology readiness level prior to KTP ('A') and now ('B') (n=39)

Source: SQW

- **Increased investment in R&D:** just over half of survey respondents had increased their investment in R&D due to the KTP (53%, 46)[20]. We asked businesses to quantify this, but only 29 out of 46 were able to do so. This amounted to an additional £13.5m investment in R&D since the KTP project that was attributed to KTPs (excluding KTP match funding), which represented 14% of total R&D expenditure across those businesses. This was equivalent to £467k per business that observed the outcome and could quantify the effect. Stakeholder consultees also provided a small number of examples from their knowledge of the scheme where KTPs have helped businesses to apply for other innovation funding and/or helped to make the case internally for more investment in R&D.

- **Patents and IP:** whilst fewer businesses have applied for or secured patents as a result of the KTP (17%, 15), this still amounted to 64 patents secured across the sample.

- **Raising finance and exits:** KTPs appeared to have less impact on a business' ability to raise finance (14% achieved to date, 12) or enabling an exit or company sale (10%, 9). These outcomes were not generally expected to arise from KTPs. That said, where KTPs had an impact on a business' ability to raise finance, half of those businesses had raised private sector investment already (6). Four of those businesses were able to quantify and attribute to KTP, and this amounted to £5.5m in total (around £1.4m per business). In

[20] This is slightly higher than the proportion that had or planned to invest in R&D in the close out data (67%, n=1,979), although that may have included some optimism bias at the point of project closure.

terms of exits, we found KTPs had enabled businesses to strengthen their IP capability, financials and efficiencies, which in turn had led to trade sales/acquisitions. More generally, two-fifths of businesses surveyed thought that their (self-reported) valuation had or will increase as result of the KTP.

- **New start-up/spin off businesses**: Only a minority of KTPs had led to start-ups/spin outs (seven of the businesses surveyed had created spin-outs). This has resulted in new businesses that employ 31 full-time equivalent staff across the sample. The case studies provided an example of this, where a Belfast-based television production company established a spinout business in VR services and content production during the KTP project (this was one of the original aims of the project) and one of the associates became the Product Lead at the spinout. Since the project ended, the spinout has increased staff from five to just over 20, secured a further £2 million of funding and is preparing for a product launch in the summer of 2023. The spinoff business has been identified by Digital Catapult as one of the top 10 start-ups to watch.

5.8 It is encouraging to see outcomes still being attributed to the KTP, even where the project finished a number of years ago, exemplifying the sustainability of outcomes. These findings were corroborated by the associate survey, where associates who were subsequently employed by the KTP business partner had also observed these benefits in the business and the large majority said the benefits were sustained. For example, of the 195 associates who accepted a job at the KTP business after the project ended:

- 94% had observed improved technical knowledge and skills within the business, and 96% of these associates said the benefits were sustained to the present day (if still employed at the business) or at least to the point they left (if now working elsewhere)
- 78% thought the KTP had improved business capability to introduce other performance enhancing practices, and 93% of these associates said the benefit was sustained
- 77% said the KTP led to an increased willingness to invest in R&D and innovation as a business, and 89% of these associates said the benefit was sustained.

Business performance

5.9 The survey explored whether KTPs had led to improved productivity, profitability, employment and/or turnover. Overall, **83% of respondents stated that at least one of these benefits had happened to date or was expected in future**.

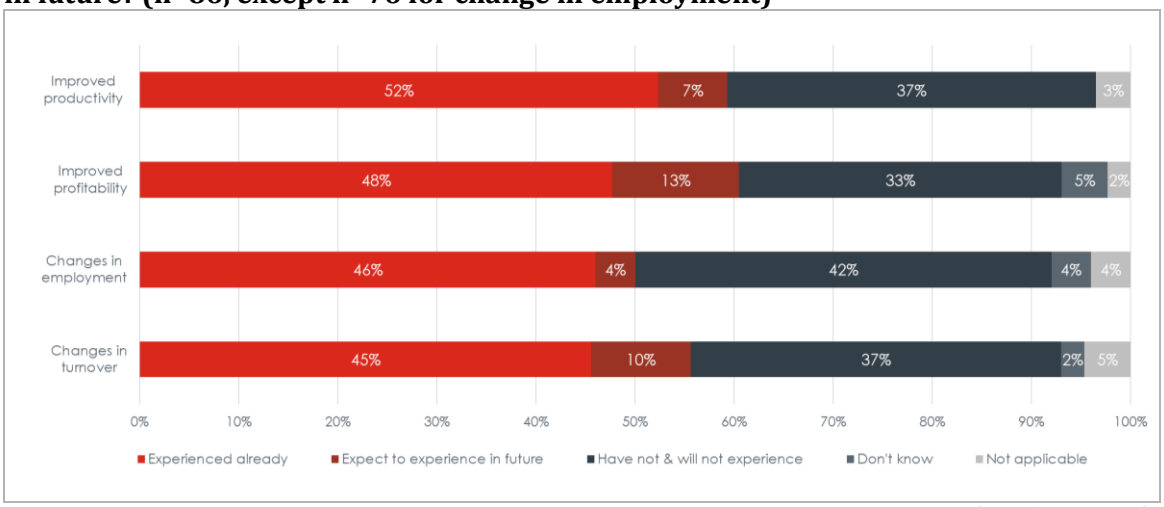
5.10 As illustrated in Figure 5-3, around half of respondents said their productivity and profitability had improved due to the KTP (52% and 48% respectively)[21]. A similar proportion had observed an increase in employment (46%) and turnover (45%):

[21] Close out data suggests that a substantial proportion of increased profits had or were expected to come from new products for new or existing markets, followed by new markets for existing products and improved efficiency. Improving the quality of products was not a key route to impact.

- Where employment was higher due to the KTP, this was relatively small in scale: typically one to five full-time equivalent positions per business (74% of those reporting an increase in employment fell into this category). These were **high quality and high value jobs**. For example, of all the jobs created in the sample (137), the highest share were in R&D positions (43%). A further 8% were in director/senior official roles. The remainder were in production, sales and customer service functions.

- Where businesses said that turnover had increased (45%, 39), the amount of additional turnover attributed to KTPs was nearly £62m. This is equivalent to £1.6m per business observing the benefit (or £719k per business across the whole sample of 86). **Exports were a key source of the additional turnover**: 62% of the additional turnover attributed to KTPs were exports (£38.4m). It is worth noting that the majority of businesses surveyed were exporters prior to the KTP (64%).

Figure 5-3: Business beneficiary survey: as a result of the KTP project, have there been any changes to your business performance to date, or do you expect any changes in future? (n=86, except n=76 for change in employment)



Source: SQW analysis of survey results

5.11 As we discuss further in Section 9, the econometric evidence suggests impacts are observed during the KTP project, as well as after completion. The case studies helped to illustrate how some KTPs have quickly translated into benefits, with examples as follows:

- One case study involved an engineering consultancy business. The KTP associate was highly skilled and generated insight soon after starting the project. The business was able to use this knowledge as part of its offer to customers immediately, contributing to the business securing new customers in the UK and abroad. Furthermore, the business has found that some potential customers were interested in the business's wider investment in R&D and innovation, and the KTP has been a useful way to demonstrate this.

- In another case study, five 'predictive alarms' for internal operations were developed during the KTP project and were implemented effectively, resulting in an estimated £3-4 million saving on predictive maintenance in the first-year post-project (see case study box below).

- In a third example, the associate encouraged the ambitions of the business (i.e. encouraged the business to develop new products, rather than improve existing ones). During the project three new chemical products were developed, alongside wider improvements to existing products (outside of the KTP project). These changes combined led to a 21% rise in sales of chemical products in the last year of the KTP project.
- Finally, through the course of one project a cloud-based software solution for managing engineering class libraries was developed and was *"being sold and turning a profit before the KTP project ended"*.

Case study

The KTP involved an academic and associate from the University of Strathclyde, and Aggreko, a business supplying power, temperature control and energy services equipment and expertise. It was delivered between April 2017 and March 2020.

Discussions around a KTP were prompted in early 2017 by Aggreko, which had an established relationship with the academic partner. At the time, the business's analytics team was just starting to take shape and was working to understand how data analytics and machine learning could be applied by the business. Academic support was needed to enhance the business's skillset in data analytics and machine learning, as well as its understanding of how to use data to improve business operations. The overarching goal of the KTP was to apply machine learning and advanced analytics techniques to Aggreko's data sources in two key areas: modelling the cost of assets across their lifecycle and understanding what decisions could be made based on this information, and developing predictive models to understand asset conditions.

The key benefit for Aggreko during the KTP was the improvement to internal operations. The KTP helped to establish and embed sophisticated modelling within the data team, which was not previously used. Five predictive alarms were developed during the project, resulting in significant cost savings to the business. Since the project ended, Aggreko has built on the KTP's modelling work to see how they could get more value from their data. Aggreko now have 23 predictive alarms.

Other benefits for the business during the KTP included making multi-million-pound savings on predictive maintenance as a result of the first set of predictive alarms, increased productivity and improved attitudes towards working with academia. Key benefits for the associate included increased technical knowledge, particularly their understanding of data analytics and machine learning, and improved confidence, such as in public speaking. Following the KTP, the associate was offered a position at Aggreko and has since been promoted to the position of Senior Data Analyst. Other longer term benefits included ongoing improvements to internal operations and capacity within the business, increased savings and profitability, talent attraction and retention due to Aggreko's use of sophisticated technology, and further collaboration between the business and academic.

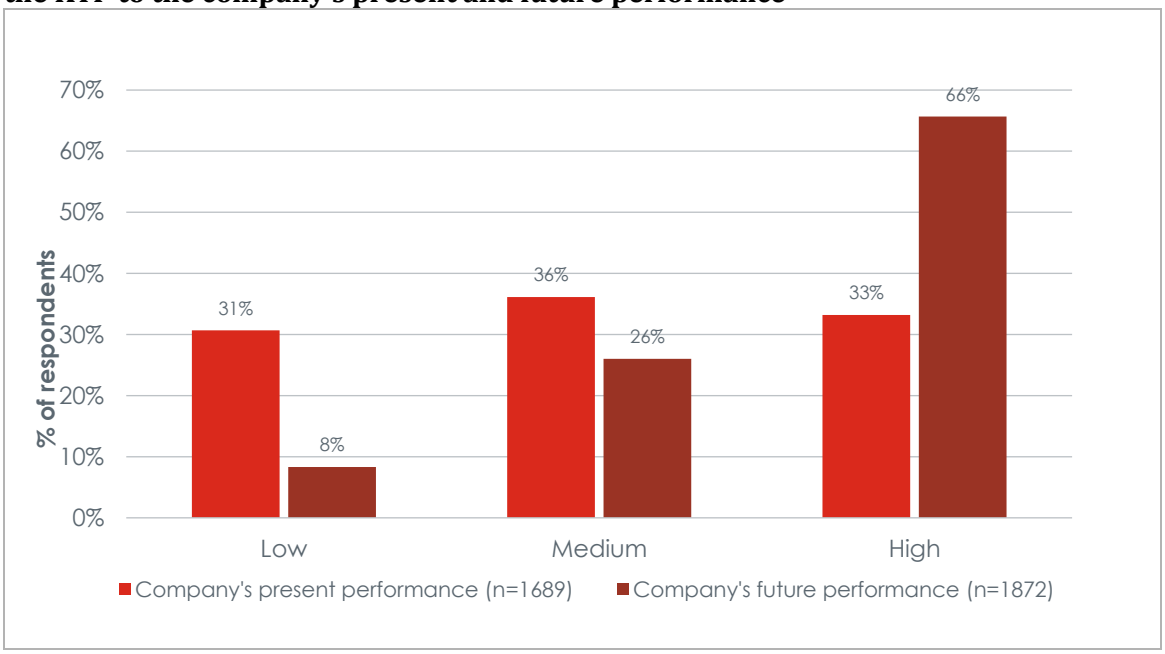
In the absence of the KTP project, the benefits described above would have taken longer to realise. The industry partner described the KTP project as an 'accelerator' for progress, as it enabled Aggreko to bring in skills and expertise needed to apply statistical modelling to their data and demonstrate the value of investment in this area.

Key factors that enabled the success of the project included having high-level project objectives which gave the KTP members scope to explore their task in depth, successful

matching of academic partners to business needs, and close proximity between partners which enabled in-person, collaborative and frequent meetings.

5.12 The close out database provided further evidence on the financial impact of KTPs across all completed projects. Whilst the quantitative data on turnover impact etc is not sufficiently complete/reliable to use, the database provided some information on how significant the results of the KTP were to the business's performance at the time of project close and in future. As illustrated below, the majority of KTPs were expected to have a 'high' significance in future.

Figure 5-4: Close out data: Overall, how significant do you believe are the results of the KTP to the company's present and future performance

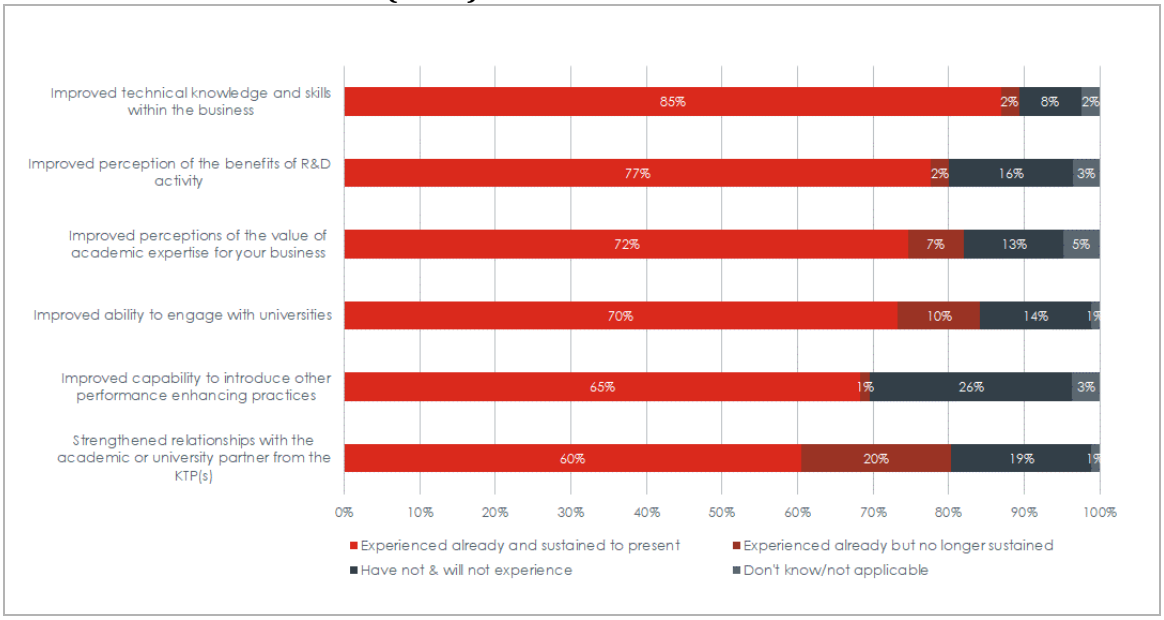


Source: SQW analysis of close out database

Wider benefits to business

5.13 Figure 5-5 captures wider benefits arising from the KTP projects and the extent to which they are sustained, based on feedback from the beneficiary survey. Even though most businesses taking part in the survey were already innovation active and had prior experience of engaging with academia, **the large majority have improved their perceptions of, and capability to, undertake innovation and engage with academia as a result of the KTP. Moreover, KTPs were found to be having a longstanding legacy effect for most businesses in this respect**, whereby these qualitative benefits have been sustained after the KTP ended. We explore these benefits in more detail in the paragraphs that follow.

Figure 5-5: Beneficiary business survey: have you experienced any of the following wider benefits from the KTP? (n=86)



Source: SQW analysis of survey results

Innovation culture and capabilities

5.14 As illustrated above, 87% of business respondents have improved their technical knowledge/skills within the business as a result of the KTP, 79% improved their views towards the benefits of R&D activity, and 66% have improved their capability to introduce other performance enhancing practices, and almost all have sustained these benefits. The case study box below provides an example of how the KTP has helped to embed innovation within a business more effectively than consultancy or contract R&D. These cultural benefits were also corroborated by associates who were employed by the KTP business after the project ended[22].

[22] In the associate survey, 94% of associates who were subsequently employed by the KTP business partner (n= 195) agreed KTPs that improved knowledge and skills within the business, 79% said that businesses were capable of introducing other performance enhancing practices, and 77% said businesses were more willing to invest in R&D.

Case study

The KTP involved two senior academics in the University of Surrey's Chemistry Department, an associate with a PhD in Chemistry, and Advanced Engineering Ltd, a chemical products company in the air conditioning and refrigeration industry that was based in Basingstoke, now part of the Aspen Pumps Group. The project was delivered between February 2014 and February 2017. At the time, the business faced several market changes, notably increased competition and legislative change driving the need to modify products. A lack of internal expertise in chemistry motivated the business to seek external support, leading to a new working relationship with the academics from Surrey.

Whilst the original aim of the KTP was to improve existing products, the associate was keen to enhance the ambitions of the project. In parallel to developing three new products that were subsequently commercialised, the associate delivered a number of shorter projects to improve existing products within the business's existing product portfolio. During the project the business saw process and culture changes, including an embedded approach to innovation, which could not have been obtained by consultancy or contract R&D. It has successfully completed the implementation of R&D functions to support and strengthened its brand in the market. This has successfully boosted the business's sales, whilst at the same time enabled the business to establish a network of UK/EU customer channels for its innovative products. The university drew on the knowledge gained through the KTP to introduce formulation chemistry in the university's 'Industrial Chemistry' module.

Over the longer-term, the KTP has contributed to a "new direction" for the business, with R&D now considered a core part of its operation. An R&D department was established after the KTP, and the associate was appointed as head of the department. Revenue generated from the new and improved products supported the growth of the business, and was thought to have contributed to the business's buyout by a larger group. The products developed during the KTP have continued to generate royalties for the University. The relationship between the partners has been sustained, facilitated by the associate becoming a Visiting Lecturer at the University of Surrey. This mutually benefits the university and business by offering industry insights to students and providing the business with continued access to university facilities and staff. The academics continue to have a partnership with the business, validating some of their academic research through closer working relationships, and enabling the development of better understanding of industry.

Without KTP funding, the project would have likely gone ahead in another form (e.g. a PhD project), which would have meant a more academic focus. The KTP may have helped to facilitate a stronger focus on commercial outcomes. Even though the associate thought their career would have progressed without the KTP, it would have perhaps taken 3-5 years longer, because the KTP provided a "spotlight" on their work and capabilities. This is evident with the prompt certification of the Associate as a Chartered Chemist from the Royal Society of Chemistry and a Chartered Scientist from the Science Council.

Consultees suggested that the key factors that led to a successful KTP included well-defined project aims at the outset, a high-calibre associate, additional support from Surrey University's Business School, and strong buy-in to the project across the business. A pro-active and neutral KTP Adviser enhanced the impact of the project by helping to ensure an effective use of resources, and ensuring that the Associate's agendas (in project implementation and personal development) were protected and amplified.

5.15 The stakeholder consultees observed KTPs leading to increased capabilities and skills within the businesses, and noted how cultural shifts were a key outcome from KTPs. For example, one KTA stated that KTPs have provided businesses with "*a set of new capabilities that will facilitate future growth*", including knowledge development and collaboration skills. An internal consultee had observed how KTPs prompted businesses to reflect on wider barriers to growth and fundamentally changing business practices/models moving forward as an indirect result of the KTP experience. There was also anecdotal evidence from consultees to suggest that some businesses have found the project-based approach to R&D (and associated management structures/processes) used in KTPs helpful and have since integrated this way of working into their day-to-day practices.

5.16 Whilst the majority of businesses surveyed had prior experience of R&D, KTPs were also considered to be an effective mechanism to engage businesses that have limited R&D experience by stakeholders consulted. Changes in the innovation cultures and capabilities were thought to be most prominent for this group of businesses, as illustrated by the adjacent quote. The way in which KTPs enabled many businesses who did not have prior experience or capacity for R&D to engage in this type of activity was a theme evident in the close out reports.

> ***KTP in particular is good at drawing in companies that have not done R&D in the past. We have a lot [for whom] this is their first serious step into doing proper R&D. Whether you call that innovation diffusion or whatever you want to call it we are a really important scheme for drawing in SMEs and being the first important step on their journey***
>
> **KTA Consultee**

Engaging with academia

5.17 The business survey found **79% of respondents placed greater value on academic expertise and were now better able to engage with KBs.** Whilst most businesses had sustained these benefits, they were slightly less likely to do so than the innovation outcomes above. The picture was similar for businesses' relationship with the academic or KB partner from the KTP – **80% had strengthened their relationship with the KB partner,** but some of these were no longer in touch. This outcome was more likely to occur where the business already knew the KB.

5.18 Where business relationships with academia have continued after the KTP, just over half of this group said they have a continuous relationship with the KB partner from their KTP (56%, 29 out of 52). This includes businesses who had not previously collaborated with academic/KB, suggesting the KTP has enabled them to establish a strong ongoing relationship in a short space of time. A further 13% of businesses engage with the KB partner more

> ***[The KTP project] has given us the confidence and knowledge to navigate the academic and institutional sector more coherently for our gain***
>
> **Beneficiary business survey respondent**

than once a year. Ongoing relationships have involved collaborative R&D projects, the use of the KB's equipment or facilities, industrial placements for students, graduate recruitment or in a skills development/training capacity. We also found that some businesses have had further academic placements in their business (33%) or done a subsequent KTP (25%), suggesting they value the embedded nature of academic engagement. The majority have also engaged with other KBs since the KTP (71%, 61) and the nature of this engagement is slightly more varied than above and more likely to focus on CR&D or the commissioning of contract research. Businesses noted that, as a result of the KTP(s), they have a better understanding and ability to collaborate with academic, as well as improved relationships with universities. A small minority of respondents said the KTP had led to reputational benefits for the business, whereby academics are more interested in engaging with the business.

5.19 These findings were corroborated by the associate survey, where 74% of associates who were subsequently employed by the KTP business partner (n= 195) said that the KTP had strengthened relationships with the KB partner (and 87% of these said the benefit had been sustained). Three-quarters (76%) also thought the KTP had improved the business's perceptions of the value of academic expertise and their ability to engage with KB organisations (and these benefits had been sustained).

Other benefits and disbenefits

5.20 More broadly, businesses have found **KTPs a useful mechanism for recruitment** after the project has ended**.** The process of engaging with the associate has been particularly useful, enabling businesses to employ graduates on a trial basis and, in many cases, then recruit them. For some, this was an unexpected benefit of KTPs. One respondent also suggested the KTP has helped to professionalise the business particularly in terms of recruitment. Stakeholder consultees also noted how KTPs can be an effective way for the business to recruit individuals with the necessary skills and a good understanding of the business, and typically a "good fit".

> ***"From our perspective, internal research capacity was limited [before the KTP]. Doing the KTP instilled confidence and allowed us to undertake direct research ourselves and have more confidence in commissioning from think tanks and other entities"***
>
> **Beneficiary business survey respondent**

5.21 Finally, another benefit noted by a KB stakeholder consultee highlighted the cultural impact associates can have on the businesses involved in the KTP project:

"I think that there have been cultural benefits of the scheme, I guess this is kind of for the companies, but we find that a lot of our associates are international students or PhD graduates. […] The company will find that they are getting different perspectives – that is a really good benefit which is not expected or captured. For example, we have had a company which recruited

an Indian [associate] and they ended up opening a branch in India which is something they had not thought about before; she brought a new dimension. A lot of our associates are female as well, we find that a lot of engineering companies have a male workforce, so it is good there."
KB consultee

5.22 There was limited evidence of spillover effects from this evaluation. One third of businesses responding to the survey said they have shared knowledge gained through KTP with other businesses (34%, 29), but there was limited evidence from the case studies on this. We explore wider local benefits for place in Section 8.

5.23 **The majority of businesses did not report any adverse consequences of participating in the KTP** (71%, 61). For those that did, this mainly related to the level of resource required to operate the KTP successfully, manage the administrative side of a KTP, and support the associate (which, for some, was greater than anticipated). A minority experienced issues with unsuitable associates, which absorbed more time than expected and distracted from wider business activities. Only two respondents encountered issues related to IP/knowledge ownership. The close out reports pointed to a minority of cases where the KTP did not work as planned, notably where academic inputs did not deliver as anticipated, which has led to some caution in pursuing this type of activity in future.

Additionality and contribution

In the absence of KTP funding, business outcomes would have taken longer, been smaller in scale and/or different in nature (typically lower quality) or would not have been achieved at all. Deadweight is low. However, it is important to acknowledge that, in the majority of businesses, other influencing factors (before and after the KTP) played a role in achieving outcomes. The KTP was often one part of the story and its relative importance varied across businesses.

5.24 A key aspect of the evaluation was testing the extent to which the outcomes observed above were additional, i.e. would not have been achieved at all, or not as quickly or at the same scale, in the absence of the KTP.

5.25 As shown in Table 5-1, **for the majority of businesses surveyed, outcomes were considered to be partially additional** (65%, 53), i.e. taking part in the KTP has meant that outcomes have been accelerated, greater in scale and/or different in nature than would otherwise have been the case. Even though some benefits may have occurred anyway, the results suggest these would have been compromised in some way:

- Where businesses said outcomes would have taken longer, half said it would have taken three years or more. The case studies suggest that, in these instances, KTPs have helped to de-risk investment and ensure that resources were more focused on implementing and embedding learning from KTPs.

- Where businesses said outcomes would have been smaller in scale, the large majority (65%) said benefits would have been halved or less.
- Where businesses said outcomes would have been different in nature, this generally meant lower in quality, e.g. the research would have been 'less accurate' with 'more mistakes', or their understanding/knowledge would have been reduced.

5.26 **Nearly a third of businesses said outcomes would not have occurred at all without the KTP** (30%, 25), which represents full additionality. We explored the reasons for this further in the case studies, and found this was mainly because businesses lacked the relevant skills/expertise and would not have taken the risk in what was perceived to be 'experimental' research. Interestingly, some case study businesses said consultancy could have provided a short term solution to the challenges faced, but sustained benefits would not have occurred.

5.27 **The level of deadweight was very low**: only 5% of respondents said they would have achieved the same outcomes anyway, even if they had not done the KTP.

Table 5-1: Beneficiary business survey: would the benefits described above have been achieved anyway in the absence of the KTP project(s)? (n=82)

	Count	%
Full additionality: Would not have occurred at all	**25**	**30%**
Partial additionality:	**53**	**65%**
Would have occurred but later	26	32%
Would have occurred but at a smaller scale	24	29%
Would have occurred but different in nature or quality	24	29%
Deadweight: All the benefits would have occurred at the same scale, speed and quality	**4**	**5%**

Source: SQW analysis of survey results. Note, partial additional categories were not mutually exclusive.

5.28 To test the role of KTPs in generating benefits further, beneficiary survey respondents were asked about other factors that may have contributed to the outcomes discussed in above and the relative importance of the KTP project(s).

5.29 **The large majority businesses identified other influencing factors that played a role** (95%, 82), while four did not know. Most had undertaken further innovation and R&D since the KTP (71%), in part following on from the KTP but also reflecting the fact that most were innovation active businesses already. Businesses also indicated that earlier R&D activities prior to the KTP played a role (59%), alongside wider investment activities by the business (reinforcing the earlier point that KTPs were often part of a wider investment strategy, 48%) and wider business support/advice (38%). Wider economic drivers were also noted by over half of respondents (56%).

5.30 Despite the wider factors outlined above, **around half of businesses surveyed stated that the KTP project played an important contributory factor alongside others** (52%) in achieving benefits. In the case studies, subsequent R&D activities (that were either directly

or indirectly related to the KTP project), alongside enthusiasm and willingness to invest from business leaders and sufficient capacity to implement changes (e.g. new processes), appeared to be the most important other factors.

5.31 For the remainder of survey respondents, views were more polarised: **a third said that the KTP contributed but was less important than other factors**, highlighting wider business development activities taking place alongside the KTP and external drivers; whereas **for a minority, the KTP was the key driver of change**, with 11% stating that KTP was *the* most critical factor. For the latter, businesses in the case studies described how KTPs were a critical in their product development 'journey', and the technical skills of the associate were particularly important to success.

Table 5-2: Beneficiary business survey: what has been the relative importance of the KTP(s) in achieving the benefits compared to these other enabling factors? (n=83)

	Count	%
The KTP was critical relative to other factors	9	11%
The KTP was important and contributed alongside other factors	43	52%
The KTP contributed to outcomes but was less important relative to other factors	27	33%
Don't know	4	5%

Source: SQW analysis of survey results, n=83 as 3 did not provide a response to this question.

6. Associate outcomes and impacts

6.1 In this Section, we present the evidence on the outcomes and impacts for associates involved in KTP projects, assessing these in relation to those expected as per the logic model. The primary source of evidence for this section was the associate survey, which has been triangulated with feedback from stakeholder consultations, case studies and monitoring data.

6.2 The associate survey was completed by 400 associates.[23] These associates had been involved in 405 KTP projects and these projects had received £39m of grant funding in total. The sample was representative of the KTP population in terms of the timing of the KTP and project status. At the time of the survey, the highest proportion of associates covered by the survey were aged between 35-44 (54%, 215) and 25-34 (35%, 141), and the majority of respondents were male (74%, 297).

Outcomes and impacts

Overall, there was strong evidence that KTPs have led to both benefits for capabilities and/or skills and career progression across the majority of associates involved (or will do so). Specifically, the large majority of survey respondents had observed an impact on their business skills (including innovation and commercialisation and wider project management) and/or an impact on their research and technical skills. KTPs had also positively affected associates' career ambitions, employment opportunities and earnings. Benefits were sustained after the KTP project ended and knowledge had been disseminated more widely, with examples from both industry and academia.

6.3 More widely, there are two important contextual points to highlight with regard to the associates surveyed before we present the findings on outcomes and impacts:

- First, **the majority of associates surveyed (75%, 299) had a Masters or PhD prior to their KTP** (those with a PhD were typically 1 year post award (65%, 80)) and some had academic or industry work experience (44%, 175). In addition, just under half of associates had engaged with the KB partner prior to KTP (45%, 181), mainly as a student (81%, 146) or as an employee (28%, 50). These prior experiences will have likely positively influenced capabilities with regard to generating outputs for both the other project partners and their own personal development through the KTP project.
- Second, when asked why they were motivated to take part in the KTP project(s), **motivations aligned with purpose of KTPs**, specifically to improve industry career prospects (90%, 359), apply technical and research skills (80%, 318), and develop

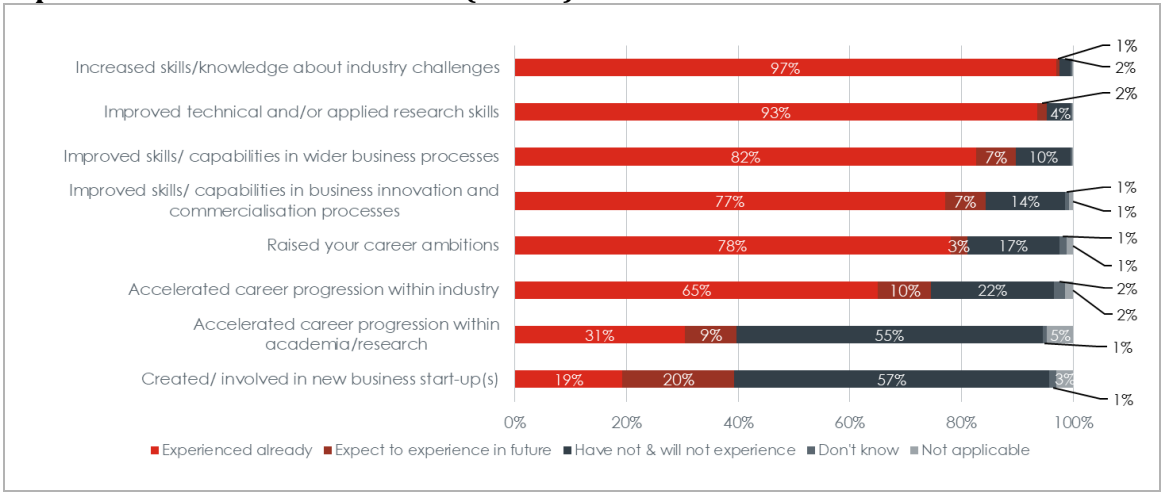
[23] With 400 respondents out of 2,295 beneficiaries, margins of error are ±4% at the 95% confidence level if the survey response to a question is 50%. If 90% report an outcome the margin is ±3%.

business-related skills and capabilities (72%, 289). More widely, almost half were motivated to improve their career prospects in academia/research (44%, 174).

Intermediate outcomes

6.4 Figure 6-1 presents findings on the outcomes observed to date by survey respondents, plus those who have not experienced benefits to date but expect them to occur in future, based on the intended intermediate outcomes listed in the logic model. The outcomes can broadly be grouped into two key themes, namely that **KTPs have (or will have) led to benefits for capabilities and/or skills** and that **they have led to career progression across the majority of associates involved.**[24] More widely, albeit less common, the scheme has encouraged some associates to create or be involved in new business start-up(s).

Figure 6-1: Associate survey: for each outcome, please can you tell me if this is something you have experienced to date, expect in future, or have not/will not experience as a result of the KTP? (n=400)



Source: SQW analysis of survey results

6.5 These outcomes are discussed in more detail in the paragraphs that follow:

- **Improved business skills:** around four-fifths of the associates surveyed cited that the KTP had allowed them to improve their skills/capabilities in wider business processes, e.g., enhanced project and business management skills, awareness of how businesses operate, and improved professional and interpersonal skills (82%, 329), as illustrated in the case study box below. In addition, over three-quarters of respondents reported having improved skills/capabilities in business innovation and commercialisation processes as a result of the KTP (77%, 308), particularly in terms of how that fits within the business and the skills needed to do it. This aligned with stakeholder consultation feedback which consistently indicated that KTPs have led to improvements in associates' capabilities in terms of innovation processes, commercialisation and exploitation, and managerial skills.

[24] This aligns with feedback from the close out database, where associates were asked as to what level they felt the KTP experience has helped their professional development, with around three quarters stating it had a high level of impact (77%, 1,646).

This was reportedly achieved through the project (practical experience and exposure to senior management), associated training and mentoring from the KTA, and through gaining *"exposure to customers, employers and stakeholders"*. More widely, almost all associates reported having improved their knowledge about industry challenges as a result of the KTP (97%, 387), likely linked to wider exposure to business processes throughout the project.

Case study

The KTP project involved an academic based at Edinburgh Napier University, an associate who was undertaking a postgraduate degree in software engineering (at Edinburgh Napier), a second associate who joined from China, and an Edinburgh-based industry partner, The Environment Exchange (t2e). t2e provides an online marketplace that allows buyers and sellers of Packaging Recovery Notes (PRNs) to trade throughout the United Kingdom. The project began in May 2010 and completed just under two years later in December 2012.

In early 2010, t2e was seeking to redevelop its underpinning IT infrastructure (a web-based trading platform), which had been in place since 1998 and was no longer fit for purpose. Alongside this, the business was exploring an avenue of business diversification into the market for recovered paper. t2e therefore sought to bring in an associate through the KTP to develop a new trading platform which could also support business diversification into the market for recovered paper. The KTP allowed this software development to be carried out in house and develop internal capabilities, rather than outsourcing the work.

The associate successfully developed the new platform, which was launched in the market shortly after the end of the KTP (at which point the associate was a permanent member of staff). The development of new internal systems, which helped to develop internal skills and capabilities and could support the business's progress towards diversification, was a clear benefit for t2e. The entry into the market for recovered paper did not succeed and so there were no lasting benefits in this respect. Despite this, the platform has "stood the test of time" and, at the time of the study, continued to support t2e's principal workstream in the PRN market, demonstrating the long term nature of the benefits arising from this KTP. In the absence of the KTP, the business would have looked for other options to develop the software, such as outsourcing to a software developer or recruiting. However, this would have taken longer and/or been more costly as well as potentially less successful.

The associate benefited from participation in the KTP. Notably, they gained "hands on industry experience" and improved skills, including communication skills and managing ambiguity. The associate's experience of the KTP made their CV "stand out" and gave them more talking points in interviews, which led to accelerated career progression, when the associate left t2e. Without the KTP, the associate would have progressed in their career, albeit more slowly and possibly would not have reached such a senior position as they are in now.

The key enabling factor in achieving these benefits, highlighted by both consultees, was the complete integration of the associate into the business. The associate noted that they "felt just like an employee of the firm" and was based in the business's office full-time. This was key to understanding how the business operated and therefore how the

platform needed to function, and also to giving the associate the hands-on experience which was so valuable to their career progression.

- **Improved applied research and technical skills:** in line with the aims of the scheme, the evidence indicates that KTPs have had a positive impact on associates' technical and/or research skills (93%, 373). This is reflected in over half of associates surveyed reporting that they have gained qualifications as a result of the KTP project (54%, 216). A range of qualifications were identified by consultees, most commonly covering technical skills, e.g. engineering or software coding, or project management skills, including PRINCE2 or Chartered Management Institute qualifications (c.40% each)[25]. Other specific qualifications identified by individuals included masters level qualifications. The case studies provided further examples of the types of technical skills improved through KTPs, including software, data analytics, machine learning and web development skills.

> ***"I covered every role required for a software project – leading it, reporting on it, ensuring it was progressing on time, developing the software itself, and managing the budget"***
>
> **Case study consultee – associate**

> ***"Learning how your research fits into the wider business and societal challenge, and how you translate it into a proper commercial venture"***
>
> **Associate survey respondent**

- **Raised career ambitions and progression:** as we discuss further in the following sub-section, the survey evidence indicated that KTPs had a positive impact on associates' career ambitions (78%, 312) and accelerated their progression within industry (65%, 260). The case studies provided an example of this, where the KTP experience meant the associate's CV *"stood out"*, leading to an acceleration in their career which after 10 years was *"only just starting to fade now"*. More widely, career progression was not limited to within industry, with almost a third of associates surveyed reporting that the KTPs had accelerated their career progression within academia/research (31%, 122).

> **"The biggest is accelerating career development […] plus the experience of leading a strategically important project in the business working with CEOs […] it is not an opportunity that many recent graduates would get"**
>
> **KTA Consultee**

- **New start-up/spin off businesses:** a smaller proportion reported that KTPs had led to them creating or being involved in the creation of new business start-up(s). This was

[25] The close out database provides additional detail on qualifications gained by associates through the KTP, overall, it indicates that around a quarter of associates registered as a candidate for the Diploma (Level 5) in Management through the KTP (24%%, 516).

reported by almost a fifth of survey respondents (19%, 77) and represented 136 new businesses in total. Of these respondents, the majority stated that the business (or businesses) were still active (88%, 68) and predominantly small enterprises (<50 employees). Reflecting on whether they would have set up the business start-up(s) if they had not taken part in the KTP, associate feedback suggested that these effects were fully or partially additional (44% and 45% respectively). An example of an associate setting up their own business using the skills and experience gained through the KTP is provided below (with the associate then drawing on the KTP and business experience in a university teaching role). The case studies also provided an example of how KTP experience had helped the incubation of a business more widely. In one case, a KTP associate had since moved KB institution and become Head of Innovation within their new institution. In their new role they have established the business incubation programme to support spinouts, noting that the KTP project had played an important role in this: *"I have an academic background and I have a view of how business works [via the KTP]".*

Case study

Commencing in 2010, the KTP involved two academics at the University of the West of Scotland (UWS), an associate who had recently completed a BSc in Marketing at UWS, and Orb Group International, a promotional merchandise distributor based in Glasgow. The KTP sought to create an e-commerce strategy for Orb, which had previously focused on acquiring clients through its sales team and had limited expertise relating to e-commerce.

The KTP initially involved an assessment of existing customer satisfaction and an 'environment scanning' exercise to understand market opportunities and potential competitors. Informed by these activities, Orb began developing digital solutions (i.e. online stores for consumers, B2B merchandise ordering) for potential customers. This coincided with a promotional showcase, which was led by the KTP associate, to engage with potential customer businesses. By the end of the KTP, the business had developed a range of digital solutions for its customers.

Following the KTP, the associate continued to work as a Marketing Manager at Orb for another two years, before establishing their own marketing consultancy business while undertaking a post-graduate qualification at UWS. The associate then went on to undertake a PhD closely related to the KTP. Orb has continued to develop digital solutions, which have now become a core part of its current business.

The KTP led to a number of benefits. The business expanded its clientele through a new service offer, leading to significant business growth, to a point where it has sold the sports merchandising arm of the business. Orb has maintained relationships with large customers and been able to increase its level of repeat custom, as its digital solutions have become embedded within the client's processes, while word-of-mouth recommendations have led to acquisition of new customers.

For the associate, the KTP enabled 'fast tracked' career progression. The skills developed through the KTP were critical to establishing their own consultancy business, and the

clients they worked with during the KTP provided credibility and a strong professional network for developing the business. The associate is currently working on a PhD related to the KTP alongside their role as a Senior Marketing Lecturer at UWS and Head of the business school's Marketing, Events and Tourism unit. The associate includes digital skills gained via the KTP (such as SEO and web development) within their teaching material in an effort to improve employability of UWS's marketing students.

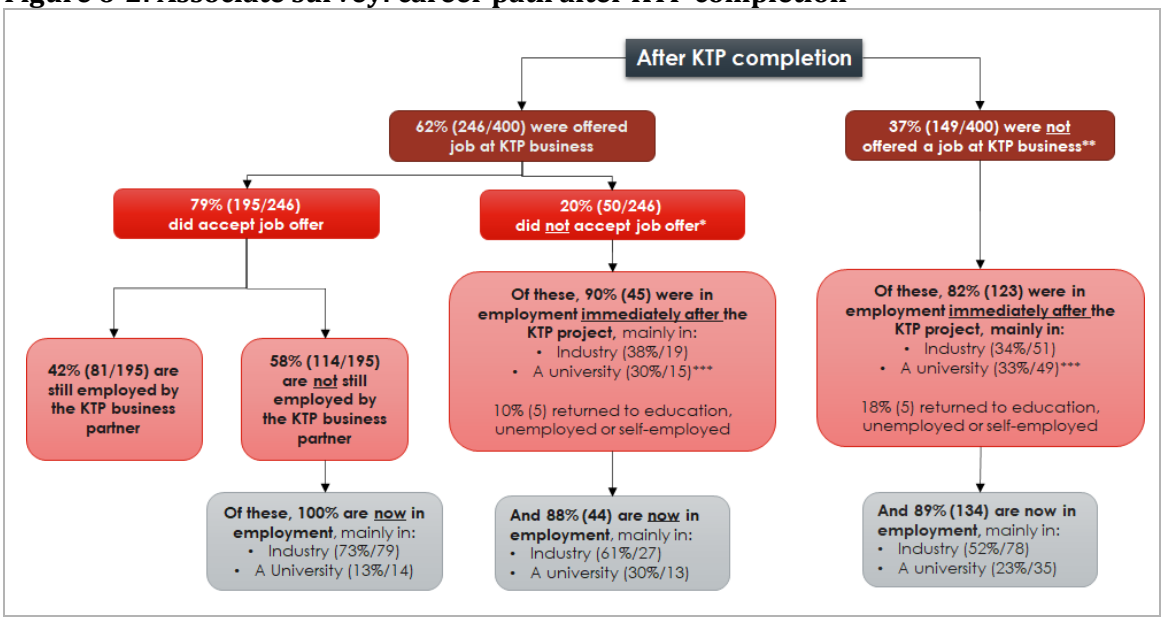
The success of the KTP has contributed to UWS's reputation as an industry-engaged university. KTPs are central to UWS's industry engagement strategy, and in 2022, the UWS KTP Centre won the award for Knowledge Exchange at the CeeD Industry Awards. This KTP was used as a model case for the value of management KTPs.

A well-engaged industry partner who is willing to invest in the KTP, and associated activities, was critical to the success of this KTP. The flexibility of the KTP was also helpful, as the activities undertaken during the KTP were not fully foreseen at its outset.

Career path and earnings

6.6 Figure 6-2 captures the career path for associates post-KTP completion, based on feedback from the associate survey. Overall, **the vast majority of associates surveyed have progressed in their careers in industry or academia.** We explore these benefits in more detail in the points that follow.

Figure 6-2: Associate survey: career path after KTP completion



*Source: SQW analysis of survey results. Note: * 1 did not respond; ** 5 did not respond; *** the remainder were employed in research organisations, public sector or charities*

6.7 Post-KTP, the majority of associates surveyed were offered a job at the KTP business (62%, 246), with most of these accepting the offer (79%, 195). The case studies provided examples of the types of roles associates have gone on to secure at the KTP business, many of which were senior positions, for example Senior Data Analyst, Product Lead, Business Intelligence Manager, and Head of R&D. Of those who did not accept the job offer or were not offered a job

at the KTP business, the majority were in employment immediately after the KTP project finished (90%, 45 for those not accepting the job at the business; and 82%, 123 for those not offered a job at the KTP business), predominantly in roles in industry or at a knowledge base organisation.

6.8 **Of those who accepted a job at the KTP business but have now left (58%, 114), associates generally stayed for up to four years,** with around a quarter staying for up to two years (28%, 32) and a third staying for two-four years (35%, 40). It is important to note that these figures partly reflect the amount of time that has passed in some cases since the KTP completed. The case studies provide examples of this: in one an associate continued working at the KTP business for two years post-KTP, before setting up their own business utilising the skills and networks that they had gained; in another case the associate had to relocate and therefore sought new employment after one and a half years working for the KTP business.

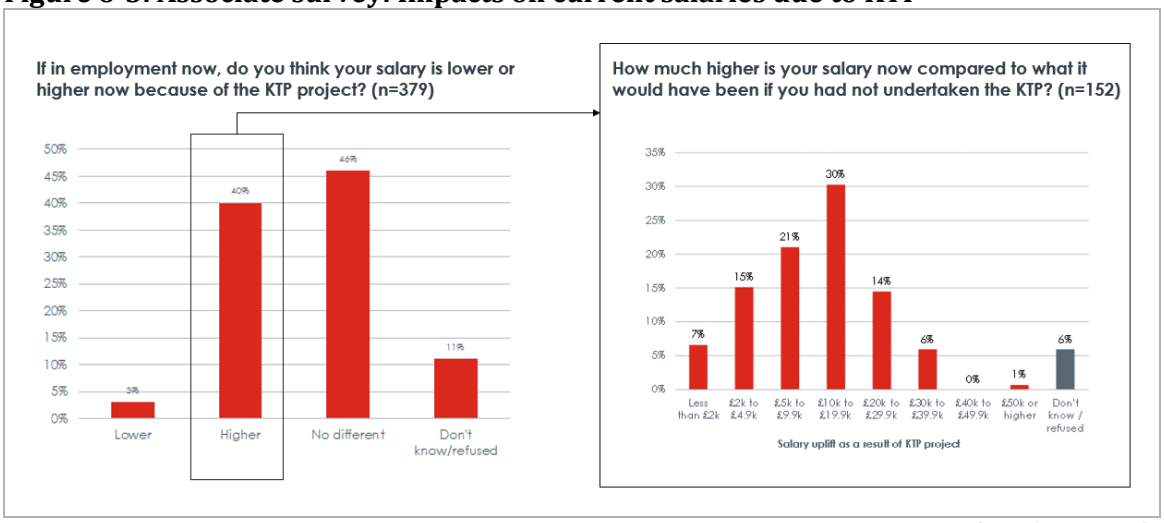
6.9 With regard to current positions across the 400 associate respondents, **a fifth remained employed by the KTP business (20%) and almost one-half were employed elsewhere in industry (47%).** Nearly one-fifth worked in academia (17%), some were in other employment (including self-employment (14%)) and a small minority were not in employment (i.e., unemployed or studying) (3%). Detail on associates' current roles within industry and academia is as follows:

> ***"We see a lot of them retained and see them take up a reasonably senior role. Lead roles and working on sustainability and innovation"***
>
> **KTA Consultee**

- **Industry**: associates worked for businesses across a mixture of different sectors, most commonly manufacturing (31%, 84), services (26%, 69), information and communication (11%, 29) and professional and scientific (10%, 27). All consultees were in professional roles, with those most frequently identified including senior roles (e.g. manager, director or senior official; 26%, 81), R&D management roles (18%, 56) or in an R&D professional occupation (21%, 63).
- **Academia**: associates currently employed in academia worked in a wide range of roles, most commonly lecturer (26%, 17), senior lecturer (15%, 10) or research fellow (12%, 8).

6.10 The impact on associates' careers not only related to their progression, but also to their salary level, with **two-fifths of consultees reporting that their salary was higher now because of the KTP project (40%, 152).** Whilst it is difficult for associates to quantify the precise effect, of those who said their salary was higher, almost a third said it was currently £10k-£19.9k higher than it would be if they had not undertaken the KTP (30%, 46), while just over a fifth said it was £5k-£9.9k higher (21%, 32).

Figure 6-3: Associate survey: Impacts on current salaries due to KTP



Source: SQW analysis of survey results

6.11 **Those associates surveyed who now work in academia noted a range of benefits for their academic/research career**. These included improved capacity for business engagement (76%, 71), more industry-relevant research (65%, 61), and more industry-relevant teaching materials (53%, 50). The KTP was also noted to have benefits for funding secured since the project, with around a quarter having leveraged further public or charitable research funding and/or leveraged further commercial funding (28%, 26 and 24%, 23 respectively), with the total amount attributable to the KTP being £2.2m (n=14) and £1.1m (n=8) respectively. These benefits were explored further in the case studies. For example, one associate noted that as a result of the digital skills gained during the KTP they ensured digital skills (such as web development) were included in teaching materials and sought to teach industry relevant skills to improve the employability of students. Another associate has continued to be involved in KTPs as an academic partner, as they *"had such a positive experience"*, they were *"keen to promote the scheme to students and support the knowledge transfer process"*.

Sustained benefits and disbenefits

6.12 More broadly, case studies provided examples of how **benefits for associates have been sustained** since the KTP project completed. As would be expected, for those who were offered employment after the KTP, a sustained benefit has been continued employment at the business or, for those who have left, continued engagement with the business. Similarly, several associates who were consulted as part of the case studies reported continued relationship with the academic.

6.13 More widely, other benefits to associates that were identified in the case studies included continued involvement in KTPs as an academic partner, income from royalties associated with the IP generated during the project, and influenced from the KTP on further postgraduate qualifications (e.g. on Masters or PhD activities).

6.14 It is important to note that just over a quarter of associates surveyed indicated they had experienced adverse effects as a consequence of participating in the KTP (27%, 107). Key themes identified amongst these respondents included poor working conditions in the business leading to high pressure, stress, bullying and in a minority of cases leaving the project (17%); a lack of engagement between partners limited potential learning opportunities (7%, reinforcing the earlier point that KTPs require a whole team approach and commitment at the outset); and finally the business closed meaning the KTP stopped and employment ended at short notice (4%).

Knowledge spillovers

6.15 There was evidence to suggest that KTPs have had a spillover effect through the wider transfer of knowledge by associates. Overall, **the majority of associates currently working in industry but not at the KTP business said that they had shared the skills and knowledge gained as a result of the KTP with other businesses they have worked for since the KTP ended** (85%, 178). The benefits of this for those businesses particularly focused on improving existing processes and practices in the business and introducing new processes and practices in the business (84% and 80% of associates reporting these effects respectively), with others noted including progressing new products/services to market (57%, 102) and increased investment in R&D (42%, 75). An example from one case study illustrated this point with an associate having trained new staff within the business.

6.16 More widely, of the 400 associates surveyed, two fifths have shared the skills and knowledge gained as a result of the KTP with other businesses they have *not* directly worked for since the KTP ended, e.g., through collaborative relationships or dissemination of best practice. Again, this was reported to have resulted in improvements to existing processes and practices within these third-party businesses (72%, 12), improvements in existing products/services (67%), and the introduction of new processes and practices in the business (62%). We note that we have not been able to verify these effects.

6.17 The case study box below provides an example of how knowledge and experience gained by a KTP associate has been beneficial in their current role at a research organisation, informing their advisory work with a range of other businesses in the region and nationally. The case study also shows the value of the networks gained through KTPs for all three parties.

Case study

This project involved Rotary Engineering, a small Sheffield-based engineering business specialising in the design and manufacture of equipment for use in coil manufacturing, electric motor repair and industrial electromagnets, an academic from Sheffield Hallam University (SHU) specialising in art and design, and an associate who had recently completed a PhD at SHU before the KTP commenced. The KTP project developed a novel method to manufacture high value, patterned metal laminate material using friction-stir welding, notably for use in the decorative metals industry. The ultimate aim was to commercially exploit the material as a new revenue stream for the business. The project was delivered between December 2014 and December 2015.

Rotary and SHU had worked together prior to this KTP (including through KTPs on different topics) and already had a strong relationship. Rotary lacked the expertise, capacity and resources internally to invest in the novel and uncertain manufacturing process required to meet commercial aims, and the KTP enabled them to have a dedicated associate with expertise in friction-stir welding.

The project was delivered as planned. The business's experience in innovation, alongside its prior experience of working with SHU (and other universities), helped to underpin the success of the KTP project. Other factors that were key to successful delivery included: having a dedicated person to explore the new market opportunity (especially as a small business); the way in which the associate provided an access point for the business to tap into the university's wider network of expertise, and then crucially, apply this directly to the business's needs; the KTP structure (with clear milestones and KPIs); buy-in within the business and support to the associate; and the proximity between partners to facilitate regular face-to-face communication.

In the year after the KTP ended, Rotary and SHU secured follow-on European funding to progress the manufacturing process further and then set up a spin out company to commercialise the material. The associate was recruited to take forward the spin out, Rotary continued to invest and the academic remained involved. Unfortunately, due to technical challenges in manufacturing at scale, the lack of an established market for the niche product, and challenges in securing external private investment, the spin out recently ceased trading.

Nonetheless, the KTP still delivered benefits for those involved. It helped to strengthen Rotary's relationship with SHU and the "knowledge network" across the city region more broadly (for example, if Rotary cannot meet a customer's needs, they are now better able to signpost to other experts at SHU). It has helped to strengthen the business's reputation and knowledge in innovative and "forward thinking" ventures, which is useful when looking to recruit or engage with potential new customers (including in international markets). The associate valued the experience of working in a small business, gaining exposure to commercialisation and business processes alongside progressing technical R&D. The associate now works at the Advanced Manufacturing Research Centre on the Advanced Manufacturing Park in the Sheffield City Region, and is benefiting from the local networks established and the knowledge and hands-on experience gained through the KTP in this new role. For example, they have been able to use their skills in how to engage with businesses and understand their needs, and have drawn on their knowledge in the design of degree apprenticeships.

6.18 Finally, the case studies provided evidence of how learning from the KTP has spilled over into academia:

- KTP associates returning to their KB institution had delivered presentations about their experience.
- One associate became a visiting lecturer at a university on the 'Industrial Chemistry' module. The module did not previously include any lectures from industry, so the academic thought it would be advantageous for students to hear about the "real life" application of chemistry. The role was reported to be advantageous for the business too because they have continued access to university facilities and staff.

Additionality and contribution

In the absence of KTP funding, associate outcomes would have taken longer, been smaller in scale and/or different in nature (typically lower quality) or would not have been achieved at all. Deadweight was low. However, as with the business findings it is important to acknowledge that, for the majority of associates, other influencing factors (before and after the KTP) played a role in achieving outcomes.

6.19 The associates surveyed were asked to reflect on the extent to which the career outcomes observed above were additional, i.e., would not have been achieved at all, or not as quickly or at the same scale, in the absence of the KTP.

6.20 As shown in Table 6-1, **the majority of associates surveyed considered outcomes to be partially additional** (66%, 263), i.e., taking part in the KTP has meant that outcomes have been accelerated, greater in scale and/or different in nature than would otherwise have been the case. Even though some benefits may have occurred anyway, the results suggest these would have been compromised in some way:

- Where associates said outcomes would have taken longer, 51% said it would have taken one to three years longer and 29% said it would have taken three to five years longer. As an example, one case study remarked that the KTP provided a "spotlight" on the associate's work which accelerated their career progression, while another felt they might have "got stuck" at a lower grade without the KTP project.
- Where associates said outcomes would have been smaller in scale, the largest proportion (42%) said benefits would have been half as big or less.
- Where associates said outcomes would have been different in nature and quality, this generally focused on the different career paths they would have taken, e.g. they would have worked in a different sector or profession entirely, and they would have reduced industry experience and therefore fewer opportunities in their career, with resultant implications for job quality, status and salary.

6.21 Nearly a fifth of associates said outcomes would not have occurred at all without the KTP (17%, 67), i.e., full additionality. This was explored further in the case studies, with associates reasoning that they felt it was unlikely at that point in their career that they would have got the same experience / development opportunity via another means. Meanwhile, the level of deadweight was low, only 13% of respondents said they would have achieved outcomes anyway if they had not done the KTP.

Table 6-1: Associate survey: would the benefits to your career described above have been achieved anyway in the absence of the KTP project(s)? (n=397)

	Count	%
Full additionality: Would not have occurred at all	**67**	**17%**
Partial additionality:	**263**	**66%**
Would have occurred but would have taken longer	170	43%
Would have occurred but at a smaller scale	64	16%
Would have occurred but different in nature or quality	83	21%
Deadweight: All the benefits would have occurred at the same scale, speed and quality	**50**	**13%**
Don't know	**17**	**4%**

Source: SQW, n=397 as 3 did not identify any benefits so were routed to skip this question. Note, partial additional categories were not mutually exclusive.

6.22 To test the role of KTPs in generating benefits further, associate survey respondents were asked about other factors that may have contributed to the career outcomes discussed above and the relative importance of the KTP project(s).

6.23 **The vast majority of associates identified other influencing factors that played a role in achieving the benefits** (97%, 384 of 397). The large majority of associates noted that the employment positions they held following the KTP (74%), and qualifications and training undertaken following the KTP (47%), had played a role in achieving the career benefits, which likely reflected the time that had passed since the KTP projects. Associates also felt that their experience prior to the KTP, including qualifications and training undertaken (71%) and employment positions (44%) played an important role. This was confirmed via feedback from case studies, where associates' education qualifications and previous employment positions/roles were cited as important in enabling benefits. Wider economic drivers were also noted by two fifths of survey respondents (44%), while careers advice received and support from elsewhere were noted by 43% and 37% respectively.

6.24 In addition, beyond those listed above, associates identified a range of personal factors which had played a role in them achieving the benefits, with key examples including advice and encouragement received from other individuals (including family and friends, KTAs, support staff at the knowledge base and wider academics), personal drive and ambitions, and involvement in third party organisations (e.g. Institute of Mechanical Engineers and research groups at universities).

6.25 Reflecting these other influencing factors (Table 6-2), the majority of associates surveyed stated that the KTP project was an important contributory factor alongside others (55%) in achieving benefits. For the remainder, around a quarter said that the KTP contributed to outcomes but was less important relative to other factors, and nearly one-fifth said the KTP was *the* most critical factor.

Table 6-2: Associate survey: what has been the relative importance of the KTP(s) in achieving the benefits compared to these other enabling factors? (n=393)

	Count	%
The KTP was critical relative to other factors	104	26%
The KTP was important and contributed alongside other factors	217	55%
The KTP contributed to outcomes but was less important relative to other factors	65	17%
Don't know	7	2%

Source: SQW, n=393 as 4 did not provide a response and 3 did not identify any benefits so were routed to skip this question.

7. Knowledge base outcomes and impacts

7.1 In this Section, we present the evidence on the outcomes and impacts for academics involved in KTP projects (i.e., project partners) and the wider KB organisations involved in the scheme. The primary sources of evidence were the beneficiary academic survey and case studies, and in-depth stakeholder interviews (including representatives from 15 KB organisations).

7.2 The academic survey was completed by 93 academic project partners.[26] These academics had been involved in 138 KTP projects and these projects had received £13.2 m in grant funding in total. The sample was representative of the KTP population, for example in terms of the average grant award (£92k), the timing and duration of the KTP, their size and spatial distribution, and the number of KTP projects academics had participated in. The survey also included academics from a range of different types of KB institution.

7.3 As outlined in Section 4, most academics surveyed were not new to working with businesses. The majority of academics surveyed had prior experience of working with businesses as an academic, including the KTP business partner, and/or had worked in industry themselves. It is important to bear this in mind when considering the findings below.

Outcomes and impacts – for KB project partners

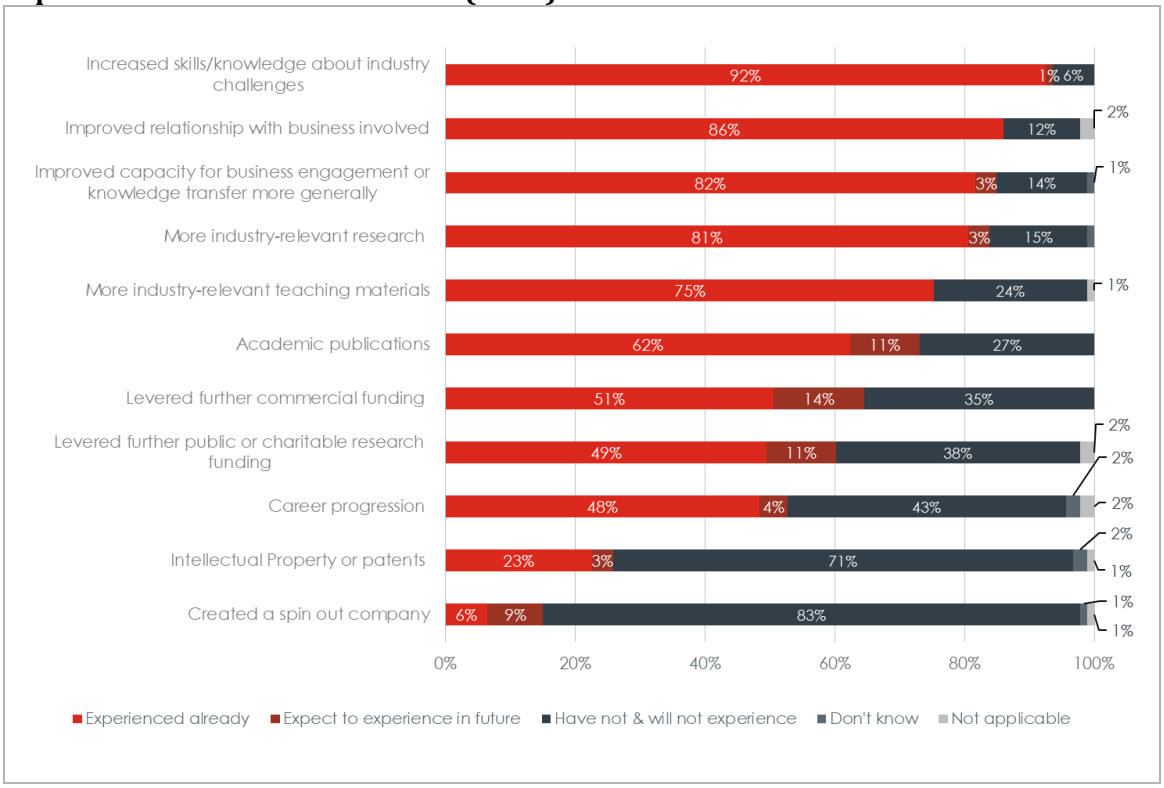
Key benefits for academics taking part in KTPs included improved knowledge of industry challenges, leading to more industry-relevant research and teaching materials, academic publications, and the leverage of further funding. Academics were better equipped to engage with businesses and have strengthened relationships with businesses involved in their KTP projects. KTPs have also helped to progress academic careers. Benefits were sustained after the KTP project ended and disseminated more widely, leading to potential spillover effects.

7.4 As illustrated in Figure 7-1, the key benefits for academics taking part in KTPs appear to be three-fold: first, a large majority of academics surveyed had **improved their knowledge of industry challenges,** with a feedback loop to their academic work through more industry-relevant research and teaching materials and (to a lesser extent) academic publications and further funding levered; second, most have **improved their outward-facing knowledge transfer abilities** and were more able to work with businesses; and third, academics have **strengthened relationships with businesses** involved in their KTP projects. KTPs as a route to career progression seem to be less prominent for academics than associates, as might be

[26] With 93 respondents out of 1209 academics in our population margins of error are ±10% at the 95% confidence level if the survey response to a question is 50%. If 90% report an outcome the margin is ±6%.

expected, but was still important for some. A smaller proportion of academics have generated IP and/or spinout business from the KTP, which was an unexpected effect of the scheme.

Figure 7-1: Academic beneficiary survey: for each outcome, please can you tell me if this is something you have experienced to date, expect in future, or have not/will not experience as a result of the KTP? (n=93)



Source: SQW analysis of survey results

7.5 We explore these outcomes in more detail in the paragraphs that follow:

- **Increased knowledge of industry challenges**: 92% of academics reported an improvement in their knowledge of industry challenges as a result of the KTP. KB consultees described how academics benefited immediately from entering a "live" business setting, engaging with businesses and learning how to successfully apply their knowledge. This exposure to industry knowledge, experiences and data has meant these benefits are realised quickly.

- **More business-relevant research and teaching:** for the majority of academics, their KTP has helped to ensure greater industry relevance of their research and teaching (81% and 75% respectively), as illustrated by the case study below. Several KB and internal consultees observed KTPs opening new areas of research interests for academic project partners. As noted by one KB consultee "quite a lot of our academic colleagues report their research direction being influenced by the research they are undertaking in KTPs". Many of the consultees from KB institutions and external HE representative bodies also said that KTPs have informed teaching and, in doing so, improved the quality of teaching and student experiences. Consultees also cited examples of KTP associates and businesses

delivering guest lectures. There was evidence from the consultations and close out data of student placements and projects created at graduate and post-graduate level to run in parallel to KTPs, as well as opportunities created after KTPs had ended due to strengthened relationships with businesses.[27] Indirectly, these knock-on benefits should help to strengthen the employability of students.

Case study

The KTP involved two academics from the Bartlett Schools of Planning and of Environment, Energy and Resources at University College London, an associate, and KSBC Plc. KSBC is a business that provides office relocation consultancy and project management advice relating to building service capabilities and technological infrastructure, based in London. The project was delivered between August 2016 and January 2019. The academics had been involved in previous KTP projects and understood the benefits of the scheme. The project was jointly initiated by the university (knowledge base) and the industry partner. There was no previous relationship between the two partners, with the business approaching UCL with an idea leading to a KTP application being submitted.

The rationale for the project was to fill a gap in the commercial property sector to cater for increasing demand for technology for businesses who are considering taking occupation of a new office. The overarching goal was "to develop a robust, automated and standardised framework for evaluating a building's technological service characteristics in terms of its technological availability, readiness and capacity in support of relocation activities.". Through the project, the associate developed guidance and protocols for on the ground assessment, alongside an app for the business to utilise.

During the project, the KTP enabled the associate to develop their business, management, technical and applied research skills, to raise their career ambitions, and to gain valuable experience. The academics reported they received improved knowledge of industry challenges, opportunities and spin-out possibilities.

The academic and associate were able to take their learning and experience forward. Following completion of the KTP, the associate secured a position at University College London working on research impact before moving to another institution where they are now Head of Innovation. In their new role, the associate has established a business incubation programme, which supports academics to create business spinouts. The KTP experience has informed the academic partner's teaching materials and research, which are now more industry-relevant (e.g., the academic now runs a module on 'proptech', using the KTP as a case study), and improved their capacity for business engagement and knowledge transfer (e.g., off the back of the KTP, the knowledge base secured a sponsored PhD through the UBEL Doctoral Training Centre).

[27] Close out data shows that 3,988 undergraduate research projects, and 3,049 postgraduate research projects were established as a result of KTPs.

In the absence of the KTP project, feedback suggests the outcomes described above would not have occurred at all. KTP funding was key in enabling the project to go ahead and reducing the risk for all parties involved. For the associate, benefits for them in terms of skills development and their career trajectory would not have happened without the project.

Consultees suggested that the project worked well because knowledge, support and guidance was shared openly with the associate by the knowledge base, the associate was situated in the business environment, and the three-way partnership facilitated knowledge exchange.

- **Leverage of further funding:** around half of the academics surveyed had leveraged further commercial funding as a result of the KTP (51%, 47), and a similar proportion had leveraged further public or charitable research funding (49%, 46). Across the sample, this amounted to £272m in total, of which £83m came from commercial sources and £189m from public/charitable sources. One of the case studies demonstrated how an academic is still benefiting from royalties associated with the IP generated during the KTP project. A further example is provided in the case study below.

Case study

This KTP involved an academic from Ulster University's School of Computing, an associate with a PhD in Computer Science (from Ulster University) and the Verbal Arts Centre, or 'Verbal', a Derry/Londonderry-based charity. Verbal is the only artistic/cultural organisation of its kind on the island of Ireland, working through storytelling and the arts to support positive mental health, resilience and cross-community dialogue in areas of high-level sectarianism, community conflict, deprivation and marginalisation. The KTP was delivered between February 2018 and October 2020 and aimed to develop an AI-enabled chatbot tool that would form a key component of the charity's first digital bibliotherapy service.

All partners were satisfied with how the KTP was delivered. Despite disruption during Covid-19 and some challenges managing expectations between feasibility of objectives, time required for the associate to learn new skills, and developing new processes in the charity, the project was delivered to plan. The associate successfully developed the tool, which was subsequently released as the 'WellRead' service in mid-2020, meaning the KTP met its aims. The service received high interest initially, but demand dropped relatively quickly, with Verbal stating that "the focus of the user experience was not quite right, with an incorrect emphasis on the child and not the parent, which stalled take off [during Covid-19] as we hoped". However, the tool remained an asset to the charity and was re-developed into another service that has since been successful.

A range of benefits were achieved by the partners. The KTP led to Verbal releasing its first digital service. The KTP also supported the development of other new digital services, by directly providing the foundations for subsequent services, and increasing the charity's confidence in managing and investing in digital capabilities. To continue the work of the KTP, Verbal has since recruited two software developers and invested in external consultancy support, meaning the project has led to a sustained uplift in the charity's digital capacity.

The KTP provided all partners with significant learning and professional development opportunities. The associate gained skills and experiences in software engineering, project management and communication that directly helped them to secure a university lectureship role after the KTP. The associate has continued to apply skills gained from the KTP in this role, notably in ensuring their research is well-aligned with industry needs. The associate has ongoing interests in supporting knowledge transfer in this capacity, and is now a KB partner for other KTP projects. Similarly, the academic was able to further their research interests and gain valuable insight into the process of applying innovative academic concepts within industry. As a result of the KTP, three research papers were published between the academic and associate.. The academic also drew on the KTP and its outputs in bids for additional funding for progressing research in this field, and has successfully secured four major grants with a combined value of over £7m.

The academic and charity had previously worked together on an Innovation Voucher project, which provided a helpful basis for delivering the KTP. The academic also had significant experience delivering KTPs in the past, enabling them to provide high quality guidance throughout and support mitigation against risk. This was important due to the "exploratory nature" of the KTP, and because this was the first R&D project Verbal had completed in this field.

- **Publications:** 62% of academics surveyed stated that the KTP had led to publications, and a further 11% expected publications to be generated in future. Across the sample, KTPs had led to 173 academic publications, with an average of nearly two publications per respondent to date. The close out database supports this finding, and suggested it could be as high as c.1,370 papers that had been published/submitted to refereed journals across all closed projects, giving an average of 0.6 per respondent (n=2,154), although this was at the point of project closure and will not capture publications since then. These findings were also corroborated by consultation evidence, where the role of KTPs in increasing the number of high quality academic outputs and publications was cited as one of the key benefits arising from the scheme by many of the KB and HE representative consultees.

- **Career progression:** almost half of the academics surveyed said that the KTP helped their career progression (48%, 45). Academics also noted how the KTP had improved their professional networks, reputation and recognition. The consultations provided further insight on the role of KTPs in career progression within academia. According to several KB and KTA consultees, in many cases KTPs can directly contribute to promotions and even be set as a requirement for promotion, as illustrated in the adjacent quote. In some cases, consultees said the impact of KTPs on career progression has been transformational, although this can depend on incentives and performance metrics within each institution.

> ***"We also introduced an incentive scheme at the university to reward academics engaged in knowledge exchange and the KTP scheme specifically. I can say that 80% of promotions in the most recent year at [the consultee's institution] were active 'KTPers'. It is not just lip service, we are actually rewarding and promoting individuals who engage with the scheme"***
>
> **KB representative consultee**

- **Creation of spinouts**: the number of academics who have created a spinout from the KTP was six. Whilst low in absolute terms, it is encouraging to see this type of entrepreneurial activity arising from KTPs, which was unexpected.

> ***"Career outcomes are a key impact. A KTP can be career-defining. For one academic, the publications that came out of a result of the KTP were the most cited of their career"***
>
> **KB representative consultee**

7.6 **There is strong and consistently positive evidence to suggest that KTPs have a longer-term legacy effect for academics**. Almost all academics surveyed said the benefits gained from the KTP were sustained after it was completed (95%, 88) and three-quarters of those academics continue to reap the benefits now (76%, 67). The majority of consultees also believed that many benefits were sustained in the longer term, such as accelerating career development, understanding how to engage with businesses, and ongoing relationships with businesses (as well as wider institutional-level legacy effects, which we discuss further below).

7.7 **There was evidence to suggest that KTPs had led to potential spillover effects.** Most academics surveyed had shared the knowledge gained through KTPs with other academics (84%) and many had also shared with other businesses (57%). Mechanisms that facilitated spillovers were explored further in the case studies. In addition to improving teaching materials, creating placement opportunities and publications, as noted above, the knowledge gained has been disseminated through conference presentations (including internationally). In one case study example, the academic has become a member of the British Standards Institution (BSI) and has since informed a number of international standards (and therefore is expected to have a global impact) - the academic believed their involvement in KTPs

enhanced their reputation in the field, enabling them to work with the BSI as well as other industrial partners.

Additionality and contribution

The evidence gathered points to high levels of outcome additionality amongst academics. For most survey respondents, outcomes were fully or partially additional (the rate of full additionality is higher than for businesses or associates). Deadweight is low. Moreover, for most academics surveyed, the KTP was the only factor that led to the benefits, a critical factor or made an important contribution alongside other factors.

7.8 As part of the survey, academics were also asked whether the benefits described above would have been achieved anyway in the absence of the KTP. Overall, additionality for academics appears higher than businesses and associates. As shown in Table 7-1, **45% of respondents said outcomes were fully additional**, i.e., they would not have been achieved at all without KTP funding. **A further 52% cited partial additionality**, whereby outcomes would have been achieved later, at a smaller scale and/or differed in nature or quality. For academics, KTPs have played an important role in accelerating outcomes. **Deadweight is very low.**

7.9 The case studies indicated that, where outcomes were fully additional, this was because academic partners lacked the resources or incentives to engage with businesses and said there were no alternative ways to pursue research that would lead to the same level of benefits. Where outcomes were partially additional, academics explained that they could have engaged in alternative forms of industry engagement (e.g., student projects) or shorter more academic led projects, but this would have reduced the benefits observed. Again, these findings reinforce the rationale for the scheme.

Table 7-1: Academic beneficiary survey: would the benefits described above have been achieved anyway in the absence of the KTP project(s)? (n=93)

	N	%
Full additionality: Would not have occurred at all	**42**	**45%**
Partial additionality:	**48**	**52%**
Would have occurred but later	27	29%
Would have occurred but at a smaller scale	18	19%
Would have occurred but different in nature or quality	17	18%
All the benefits would have occurred at the same scale, speed and quality	**2**	**2%**
Don't know	1	1%
Refused	0	0%

Source: SQW analysis of survey findings. Note, responses for partial additionality (i.e., 2-4) were not mutually exclusive

7.10 Academics were also asked about other factors that may have contributed to the outcomes above and the relative importance of the KTP project(s). **A minority of respondents said the KTP was the only factor that led to the benefits** (13%, 12), i.e., no other factors played a role. All other academics acknowledged that other factors had played a role (87%). These included other support from elsewhere and/or their institution, or other business/knowledge transfer activities they were involved in. Nonetheless, **KTPs played a key role in achieving benefits for academics** (more so than businesses). As shown below, the KTP made an important contribution alongside other factors (44%) or was the critical factor (39%) in achieving the benefits described above.

Table 7-2: Academic beneficiary survey: in light of this, what has been the relative importance of the KTP(s) in achieving the benefits previously discussed compared to these other enabling factors? (n=93)

	N	%
The KTP was the only factor in achieving the benefits	**12**	**13%**
Where other factors were identified, the relative importance of the KTP:		
The KTP was critical relative to other factors	36	39%
The KTP was important and contributed alongside other factors	41	44%
The KTP contributed to outcomes but was less important relative to other factors	14	15%
Don't know	1	1%
Refused	1	1%

Source: SQW analysis of survey findings

Outcomes and impacts – wider benefits for KB institutions

KTPs have benefited KB institutions more broadly, by improving their reputation and profile, improving attitudes towards business engagement and innovation, and widening and strengthening business networks. KTPs also provide material on impact for REF/KEF case studies. The cross-disciplinary nature of some KTP projects has also helped to strengthen relationships within institutions.

7.11 As part of the academic survey, we asked respondents to reflect on the extent to which KTPs have a wider impact on their KB institution. The results are presented in Figure 7-2 and suggest that KTPs are benefiting KB institutions more broadly, by **improving their reputation and profile**, and **improving attitudes towards business engagement and innovation.** A minority of KB and other consultees also highlighted the impact of KTPs on institutions' reputation for knowledge exchange and being business-friendly, and the way in which KTPs had influenced KB institutional cultures/attitudes towards business engagement. The latter was facilitated where KTP academics were promoted to senior positions. For other institutions where business engagement was already a priority, consultees said KTPs have still helped with progress in this area.

> ***"Reputationally, [the KTP scheme] has been really positive. Not just in the business community but being able to talk about the portfolio is good. It has contributed to things such as student recruitment. As a lot of associates are graduates so there is an employability benefit to offer and advertise"***
>
> **KB representative consultee**

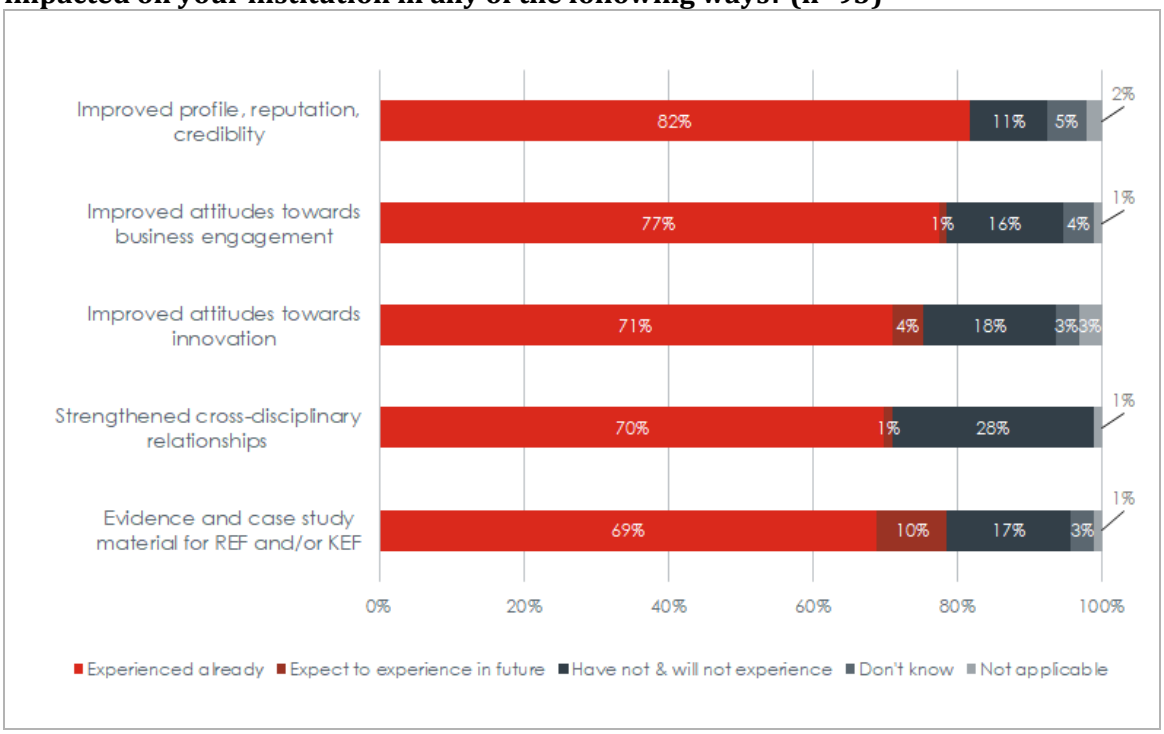
> ***"[My institution was] always minded to do knowledge exchange but lacked the confidence to do it and KTPs accelerated what was already there"***
>
> **KB representative consultee**

7.12 Linked to the point above, a key long-term benefit reported by most KB representatives and other consultees were the **relationships developed with KTP companies**, which regularly led to further engagement (e.g., use of facilities or collaborative R&D projects) and the development of strategic partnerships. KB and KTA consultees described how KTPs have created "*a network*" and "*strong ecosystem of businesses that can be called on for future relationships and referrals*", and act as a "*gateway for companies to access the whole of the university's resources*".

7.13 Survey and consultation feedback also suggested that KTPs help to **strengthen cross-disciplinary relationships *within* institutions**. The role of KTPs in supporting collaborations between different academic departments at the KB was also noted in the case studies and by a minority of KB and internal consultees, reflecting the inter-disciplinary nature of some KTP projects.

7.14 KTP projects have contributed to the evidence base for REF and/KEF case studies. Over two-thirds of academics surveyed said their institution had used KTP evidence in this way. Almost all KB, KTA and HE representative consultees corroborated this. They stated that KTP impacts were regularly used as part of REF/KEF assessments to demonstrate impact, which in turn has potential benefits in terms of further funding for the institution as part of the wider package of material and evidence produced.

Figure 7-2: Academic beneficiary survey: Do you think the KTP scheme as a whole has impacted on your institution in any of the following ways? (n=93)



Source: SQW analysis of survey findings

8. Impacts of the KTP scheme on place

8.1 This Section explores whether there was evidence on if and how KTPs have generated place-based benefits. This responds to the research question relating to mechanisms through which KTPs bring about regional impacts. The primary sources of evidence were feedback from consultations, surveys and case studies.

The KTP scheme has had a wide reach across the UK, with the majority of projects located outside of London and the Greater South East. Local benefits appeared to be relatively ad hoc and small scale, which reflects that these were not designed in to the scheme. The local benefits included local employment created as a result of KTP-generated business growth, KTP businesses being better able to contribute to local cluster development, and wider knowledge transfer to local businesses. There was also an example of KTPs being purposefully integrated locally to help strengthen an area's innovation ecosystem.

8.2 It is important to start this Section by acknowledging that KTPs were not designed or set up to deliver local impacts specifically. It was and currently remains a 'place-agnostic' intervention. Even so, with growing policy interest in levelling up, the evaluation has explored whether KTPs do generate place-based benefits (and, if so, how). We have explored this from two angles: first, the scheme's reach in terms of its funded activities; and second, the extent to which projects funded generated local benefits where they were based (or even elsewhere).

Spatial distribution of KTP inputs

8.3 As illustrated in Section 3, **the KTP has a wide reach across the UK** with 75% of beneficiary businesses and 68% of the KB partners being outside of London and the Greater South East. This equated to £158m or 80% of total grant value spent outside of London and the Greater South East between 2010 and 2020.

8.4 In Table 8-1, we also compare the location of KTP beneficiary businesses to the level of deprivation across England. [28] As illustrated below, **KTPs have supported businesses to grow across areas with a mix of deprivation levels**: the distribution of KTP businesses broadly mirrors the geography of deprivation, with, for example, around one fifth of KTP businesses in the 20% most deprived areas of England.

[28] This analysis has been completed on business beneficiaries in England only (75% of total), as the IMD does not cover Scotland, Wales and Northern Ireland.

Table 8-1: Location of KTP businesses in England compared to Index of Multiple Deprivation

IMD decile rankings for Lower Super Output Areas (LSOA)[29]	N of beneficiary businesses	%
20% most deprived LSOAs	300	22%
21% to 40%	279	20%
41% to 60%	284	21%
61% to 80%	300	22%
20% least deprived LSOAs	219	16%
Total	**1382**	

Source: English Indices of Deprivation, 2019

8.5 In addition to KTPs being seen as a relatively accessible Innovate UK scheme (as discussed in Section 4), a key feature of the scheme's design and delivery has been the regionally based Knowledge Transfer Advisors (KTAs) across the UK. KTAs are embedded within research institutions and have acted as an intermediary to facilitate access to the scheme and help to convene KTPs locally. The KTAs have also played a wider convening role in helping businesses to connect with KBs or find associates to form a KTP project across the UK. This was particularly important for businesses based in areas without any (relevant) KB expertise in close proximity, enabling them to draw on expertise from elsewhere to innovate and grow.

8.6 Moreover, the KTP scheme has recently trialled having additional capacity-building and networking support in some places that were lacking the capacity to apply by increasing the number of KTAs in these areas. Whilst this was beyond the timeframe in scope for this evaluation, it demonstrates how the scheme has adjusted the degree of facilitated access to reflect differences in capacity across different areas. It is expected to take a few years before changes in capacities and behaviours can be assessed, but a long-term commitment to capacity building has scope to widen the reach of KTPs further.

Generating place-based benefits

8.7 We have explored whether KTP investments across the UK have led to benefits for the place in which they were located (and/or other locations). **The survey results suggest KTP projects have generated some benefits for their surrounding areas, though the results are mixed and proved difficult to confirm**: 26% of beneficiary businesses surveyed and 57% of academics surveyed suggested that KTPs had local benefits.

8.8 We sought to explore these further through the case studies and found some (albeit limited) examples of local benefits. These were **typically ad hoc and small scale**, but included **local employment created** as a result of KTP-generated business growth, KTP businesses being

[29] Lower Layer Super Output Areas (LSOAs) are administrative spatial boundaries that have an average population of 1,500 people, or 650 households.

better able to **contribute to local cluster development,** and **wider knowledge transfer to local businesses**. For example:

- A KTP involving a Belfast-based television production company generated employment in Belfast and was expected to continue to do so moving forward. Additionally, the business was said to have made an early contribution to the creative sector in Northern Ireland, which was described to be considerably more vibrant today than it was when the KTP began.
- In Scotland, the growth of a business's data team, resulting from the KTP, has provided employment opportunities in Glasgow.
- A software business in Scotland has built on its success and become involved in Glasgow's 'Smart city' project, working to deploy smart systems and technologies. The business has also interacted with the City Observatory project.
- The KB was provided with a free version of the software programme developed during the KTP which was used at a nearby college in Middlesborough for learning purposes.
- In Sheffield, a KTP associate was employed by the Advanced Manufacturing Research Centre (AMRC). The associate was sharing knowledge gained from the KTP in relation to the manufacture of materials with a range of local (and national) businesses via the AMRC's consultancy services. Therefore, this provides an example of how KTPs have helped to boost the skills and knowledge of a key organisation within a local cluster in the city region.

8.9 A number of stakeholders consulted believed that KTPs should benefit the places in which they are located and noted the increasing drive for KBs to "*forge a more involved and meaningful role in the local ecosystem that they work in*". These consultees pointed to evidence to suggest that, in some places, **KTPs were playing a role in strengthening innovation ecosystems**, particularly where there was a critical mass of KTP projects, and they were explicitly integrated into wider innovation support in the area. Essex and Belfast were cited as interesting examples of this. The majority of KTA consultees also stated that **KTPs aligned well with strategic priorities in their local area** (7 of 8), although several consultees perceived this to be "*serendipitous*" and "*scattergun*" rather than strategically planned.

> ***[The University of Essex's rapid increase in KTP projects] has stimulated innovation in the region. [It is] not all due to KTP, but KTP has helped the investments they have made in an innovation centre. KTP companies quite often set up their R&D in that centre. Now when you get things like that happening it is easier to draw in other agencies too; very symbiotic.***
>
> **KTA consultee**

8.10 An internal consultee pointed to a KTP project which focused on deprived communities and the significant economic divide from neighbourhood to neighbourhood in the North East and considered the ways in which to bring communities together and improve social cohesion. This project was social science led, and so whilst was not likely to generate a high commercial return, it was expected to deliver social place-based benefits.

8.11 It is also worth noting that **our econometric analysis suggested that a project's location (i.e., region) did not influence business impacts**, so we can conclude that the scheme has delivered benefits across the UK and can continue to do so in the future. We discuss this further in Section 10.

Looking forward

8.12 A key question arising from this analysis is whether there is scope to maximise place-based impacts further in future. For example, would other places benefit from adopting Essex's model of integrating KTPs into the local innovation support ecosystem more explicitly? In places where there are multiple KTPs that align closely with local specialisms/priorities, is there scope for facilitating synergies between them? These suggestions would need to be actively instigated by Innovate UK and/or by local partners, and a case-by-case approach may need to be taken (not least to recognise the commercial sensitivities associated with some KTP projects).

9. Quantified impact analysis

Econometric analysis of business impacts

The results from our econometric analysis suggest that KTPs have had a positive statistically significant impact on the employment and turnover growth of beneficiary companies. This positive impact was significant both during and following the KTP. The effects started in the first year of KTPs, which is likely to be explained by two points: i) opportunities for associates to make a difference early on in their time working with partner businesses; and ii) the fact that KTPs may be part of a broader set of business development actions. Effects were sustained until three years after the KTP has finished. We found no statistically significant relationship between KTPs and productivity as estimated using the ratio between turnover and employment.

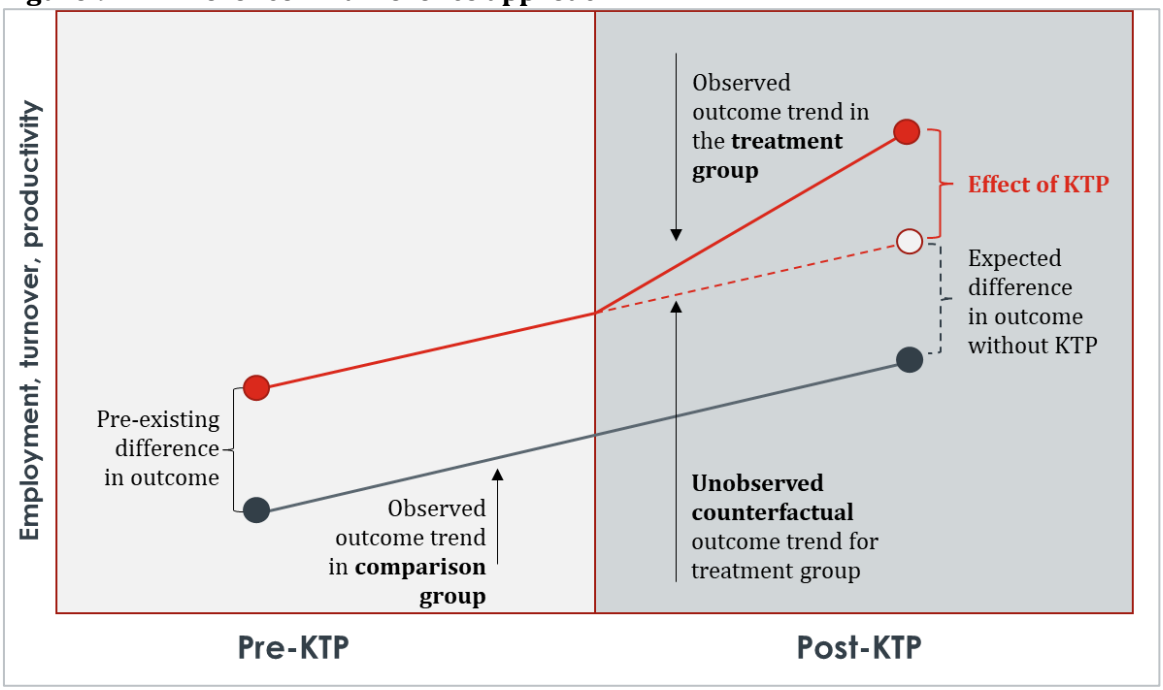
Approach

9.1 To estimate the net effects of KTPs on the business performance and productivity of beneficiaries, we followed a quasi-experimental approach – difference-in-difference (DiD).[30] This method compared the changes in outcomes over time between the treatment group – KTP beneficiaries (F1, i.e., those fully completing, and W3, i.e., those completing but finishing early) – and the comparison group – a group of businesses that did not take on a KTP but are similar in observable characteristics. DiD estimated the net effect of KTP support, as only the growth that was observed in the treatment group *beyond* what was demonstrated by the comparison group is attributed to the scheme. Figure 9-1 illustrates this principle.

9.2 DiD analysis corresponds to level three on The Maryland Scientific Methods Scale (SMS) providing robust evidence of the KTP scheme's impacts on businesses.[31] In contrast to a pure time-series (differences across time) or cross-section (differences across treatment and non-treatment groups) regression, DiD is able to mitigate biases in the estimates arising from the selection of the treatment group and outside factors. For example, KTP businesses may be innovation-active businesses that were expected to be on a fast growth trajectory even without the programme.

[30] A quasi-experimental approach attempts to establish a cause-and-effect relationship in environments where a scientific experiment with random assignment of treatment is not feasible.
[31] This scale was first introduced in Farrington *et al.* (2003). It ranks evaluation methods on a scale from one to five with higher numbers indicating more robust methods. Randomised control trials are typically placed at level five, while a cross-sectional comparison of treated and untreated groups, or before and after comparison of the treated only, with no additional controls is normally scored as one. A guide to the up-to-date version of the scale is available at https://whatworksgrowth.org/

Figure 9-1: Difference-in-difference approach



Source: SQW

9.3 Central to DiD analysis is an assumption that in the absence of KTPs, supported and unsupported businesses would have followed the same trajectory (known as the parallel trends assumption). If this assumption is violated, then the analysis may under- or over-estimate the effect of support by wrongly attributing the effects of pre-existing group differences to the scheme. For example, if KTP beneficiaries grew quicker than the rest of the economy before the scheme, a comparison against the whole business population will overestimate the effect of KTP support.

9.4 The following section sets out our approach to data-linking, identifying a suitable comparison group (using a statistical matching technique – propensity score matching, PSM), selecting the most appropriate specification for a DiD model, and how, as much as possible, ensured our findings are robust estimates of the true impact of KTP support.

Identification of a pool of potential comparator businesses

9.5 To establish a counterfactual, i.e., what would have happened in the absence of KTPs to the participating businesses, we linked data on KTP beneficiaries (F1/ completed projects and W3/ finished early projects) to businesses from the wider business population using the Business Structure Database (BSD) accessed through the ONS Secure Research Service (SRS).[32]

9.6 As a first step, we identified a pool of 10,000 potential comparator businesses in the Beauhurst database, ensuring that the selected businesses had similar data availability and

[32] Office for National Statistics, released 10 November 2021, ONS SRS Metadata Catalogue, dataset, Business Structure Database - UK, 10.57906/7kh0-0910

were well matched in key characteristics[33] to KTP beneficiaries. Using this 'initial filter' had two advantages: (1) it allowed us to use Beauhurst characteristics not available in the BSD for statistical matching which substantially improved the quality of the comparison groups; (2) it sped up the analysis by reducing the computational demands of our models (as we preselected 10,000 out of more than two million businesses available in the BSD).

Data-linking to the BSD

9.7 We linked the monitoring information held by Innovate UK on KTP participants and Beauhurst data on both KTP participants and the 10,000 pre-selected potential comparators to administrative data on turnover and employment held in the BSD.

9.8 Out of the 1,868 unique KTP beneficiaries, 1793 (96%) were successfully identified in the BSD., with a few more observations being dropped at the data cleaning stage due to insufficient data on their observable characteristics. The final number of unique beneficiaries used in the analysis was 1,658 (89% of all beneficiaries).

9.9 For our analysis we considered several alternative comparison groups, three identified with propensity score matching from the pool of the pre-selected 10,000 comparator businesses (A-C below), and one based on businesses from the monitoring information provided by the client (D below).

- (A) Our 'preferred comparison group' identified with PSM using the fully completed (F1) and finished early (W3) KTPs as beneficiaries.
- (B) A comparison group identified with PSM but using only the fully completed (F1) KTPs as beneficiaries.
- (C) A comparison group identified with PSM but using only businesses that had exactly one successful (F1 or W3) KTP.
- (D) A comparison group of successful KTP applicants where the KTP never started or was withdrawn (W2).

9.10 The results across our preferred and three alternative specifications were broadly consistent and we highlight any differences that emerged in our discussion below.

Propensity Score Matching (PSM)

9.11 We used PSM to identify comparison groups of companies with similar observable characteristics to the treated group. This approach reduced the influence *of selection bias* on the results. The beneficiaries may be systematically different from the rest of the business population, and if this is not accounted for the findings may be inaccurate. For example, KTP

[33] To improve our matching models in the SRS, we only selected companies that shared a five-digit SIC code with at least two KTP beneficiaries. We also selected businesses to match the proportion of KTP beneficiaries "tracked" by Beauhurst and only chose businesses with data in their financial statements and businesses that have a website on Beauhurst.

businesses were much more likely to be tracked by Beauhurst, large and manufacturing companies than the wider business population.

9.12 In using PSM we sought to create a comparison group consisting of businesses that were as likely to undertake a KTP as the actual beneficiaries. This imitates a 'random' allocation that could have been achieved during a randomised control trial.

9.13 Drawing on both business characteristics recorded in the BSD as well as in Beauhurst to inform our matching model, and considering availability of data for KTP beneficiaries, the final variables we used for our matching were as follows:

- **Beauhurst:** the Beauhurst tracking status of the business (tracked, not tracked, ceased tracking); and the credit rating of the business.
- **BSD:** whether the business was in operation before 2010; age of the business (old, medium, or young); size of the business in 2009 (micro, small, medium, large); sector of the business (by SIC group); company status of the business (company, not-for-profit, local authority, etc.).

9.14 Annex F sets out the pre-matched and post-matched distributions of the probability to do a KTP. The graphs in Annex F show that the matching was successful in reducing bias in observable characteristics of the distribution of KTP businesses against the wider business population. This was reaffirmed through tests of sampling bias between the treatment and comparison group presented in Table F-2.

9.15 It is important to note that PSM is only able to match businesses on observable characteristics, i.e., characteristics that are recorded in the datasets available. Differences in unobservable characteristics may remain. For example, the propensity to seek support, the management style of businesses, and growth ambitions are all unobservable and likely to be correlated with both businesses' success over time, as well as their likelihood to apply for a KTP. Therefore, to ensure the robustness of results, it was important to consider multiple complementary comparison groups.

9.16 We repeated the process set out above and achieved a similar quality of match for our alternative specifications (B) and (C). For specification (D), no matching was undertaken. Examining the distribution of propensity scores and tests for whether biases were present both suggested that successful applicants where the KTP did not start or was withdrawn were statistically significantly different in observable characteristics to KTP beneficiaries. Specification (D) was therefore considered to be an unreliable comparison group.

Difference in differences analysis

9.17 To estimate the net impact of a KTP on business growth we used a regression-based difference in differences analysis. To account for the differences in funding, timing and length

of KTPs, rather than just calculating the DiD statistic, we estimated our DiD models in a panel data regression[34]. Specifying the DiD model in this way has several advantages:

- A common practice in DiD analysis is to 'recast' the data in terms of the year supported. The problem with this approach, however, is that it is unclear which year should be "the year of support" for unsupported businesses. Furthermore, if a business has multiple KTPs, we are only able to use one of the KTPs in the regression analysis. Finally, as highlighted in section 3, the length of a KTP varied significantly and by recasting the data we were not able to fully account for differences in treatment length.
- Without recasting the time variable, KTPs are allowed to "switch on" and "switch off" over the evaluation period. For each beneficiary, the KTP "switches on" at some point during the evaluation period and for the comparison group it stays "switched off" throughout. An added benefit of this approach is that businesses who undertook a KTP towards the end of the evaluation period can act as a comparison group for the years in which they have not undertaken a KTP – effectively boosting our sample size for these years through a "pipeline" methodology.

9.18 Table 9-1 shows the regression estimates of the net impact of KTPs on supported businesses' employment, real turnover, and productivity (as measured by the ratio between turnover and employment):

Table 9-1: Difference in differences analysis of impacts of KTP support

	(1) Ln(employment)	(2) Ln(real turnover)	(3) Productivity
KTP ongoing 1st year	0.0769*** (5.47)	0.0904*** (3.95)	-39.97 (-1.11)
KTP ongoing 2nd year	0.146*** (9.05)	0.140*** (5.42)	155.7 -0.93
KTP ongoing 3rd year	0.180*** (10.31)	0.193*** (6.87)	201.2 -0.95
KTP post support 1st year	**0.167*** **(10.08)**	0.157*** (6.25)	-133.9 (-1.03)
KTP post support 2nd year	0.124*** (6.83)	0.120*** (4.56)	-159.8 (-1.04)
KTP post support 3rd year	0.0760*** (4.24)	0.0678** (2.5)	-187.3 (-1.06)
Group trend	0.0250*** (6.12)	0.0187*** (3.45)	-13.34 (-1.16)

t statistics in parentheses
*Level of statistical significance: * p < 0.1, ** p < 0.05, *** p < 0.01*
All regressions include time and business fixed effects and cluster-robust standard errors. Group specific trends are included to account for the possibility that even after matching treatment and control businesses were on a different growth trend before the KTP.

[34] This had a specification similar to the model with variable timing of treatment as suggested in Goodman-Bacon (2018).

Source: SQW analysis

9.19 Our findings indicated that KTPs had a large and statistically significant benefit to business growth on both employment and turnover. The effect on both employment and turnover were positive and significant from year one of the KTP and were sustained for three years after the KTP had ended. The cumulative net difference in annual employment and turnover growth between KTP businesses and the comparison group was largest between the third year of ongoing support (for those businesses with at least three years of KTPs) and the first year following support. Almost all[35] of the results are statistically significant at the 1% level.[36]

9.20 The results on employment and turnover were specified with the outcome variable "log-normalised". When the original data does not follow the bell curve of a normal distribution, we can log transform this data to make it as "normal" as possible so that the statistical analysis results from this data become more valid. In other words, the log transformation reduces the skewness of our original data.

9.21 The reported coefficient can be interpreted approximately as the net additional growth rate associated with treatment. For example, the highlighted coefficient 0.167*** suggests that in the first year post support, KTP businesses have on average (approximately[37]) 16.7% more employees relative to their pre-treatment level than non-KTP businesses. The three stars indicate that this difference is statistically significant at the 1% level.

9.22 Figure 9-2 and Figure 9-3 graphically demonstrate the impact of KTP support on business growth in turnover and employment.[38] Here the vertical axis shows the natural logarithm of employment and turnover, indexed so that the year before the KTP started the variable is equal to 100. Comparing these figures to Figure 9-1 summarising the DiD approach, they highlight how both the treatment and the comparison group experience growth on a similar trajectory before the KTP project and how the growth path of KTP beneficiaries diverges following support.

9.23 Unlike our findings for employment and turnover, **we found no statistically significant effect on productivity as measured by the ratio of turnover over employment.** There are, however, known measurement issues with the productivity proxy as the ratio of turnover over employment. Data on productivity is 'noisy' and volatile, especially when the analysis concerns fast-growing businesses, as when such a business is hiring additional workers, there may be a time lag before these workers become fully productive. From this perspective, we

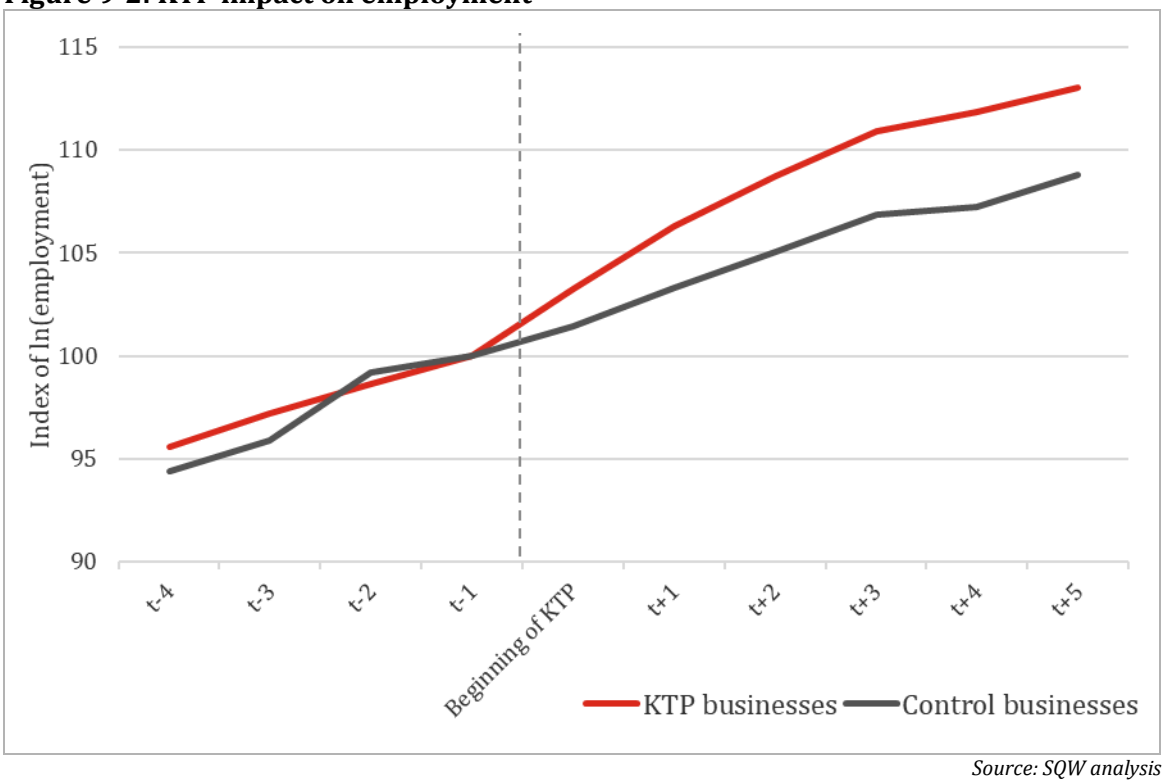
[35] The third year post-support was significant only at the 5% level for turnover growth.
[36] To be "statistically significant at the 1% level" means that data such as this is only observed in *at most* 1% of samples if there is no association between the explanatory variable of interest (KTP engagement) and an outcome.
[37] To calculate the exact interpretation of the coefficient you use *exp(coeff)-1=impact.*
[38] Note that to generate these graphs, the data had to be recast in terms of the year of support and the demonstrated impacts are not exactly equal to the estimated impacts of Table 9-1. Note also that the vertical axis is an index of a logarithm, and the shown growth is illustrative only and does not reflect estimated % growth in employment or turnover.

note that KTP beneficiaries did not experience a temporary 'dip' in productivity despite being on a steep growth trajectory in terms of their employment.

9.24 Of particular interest in the analysis was the finding that KTPs had a statistically significant effect on employment and turnover during the first year of the KTP. We found this surprising as we expected there to be a short time lag between starting the KTP and the effect on business performance, especially for turnover. Two points potentially explain the findings:

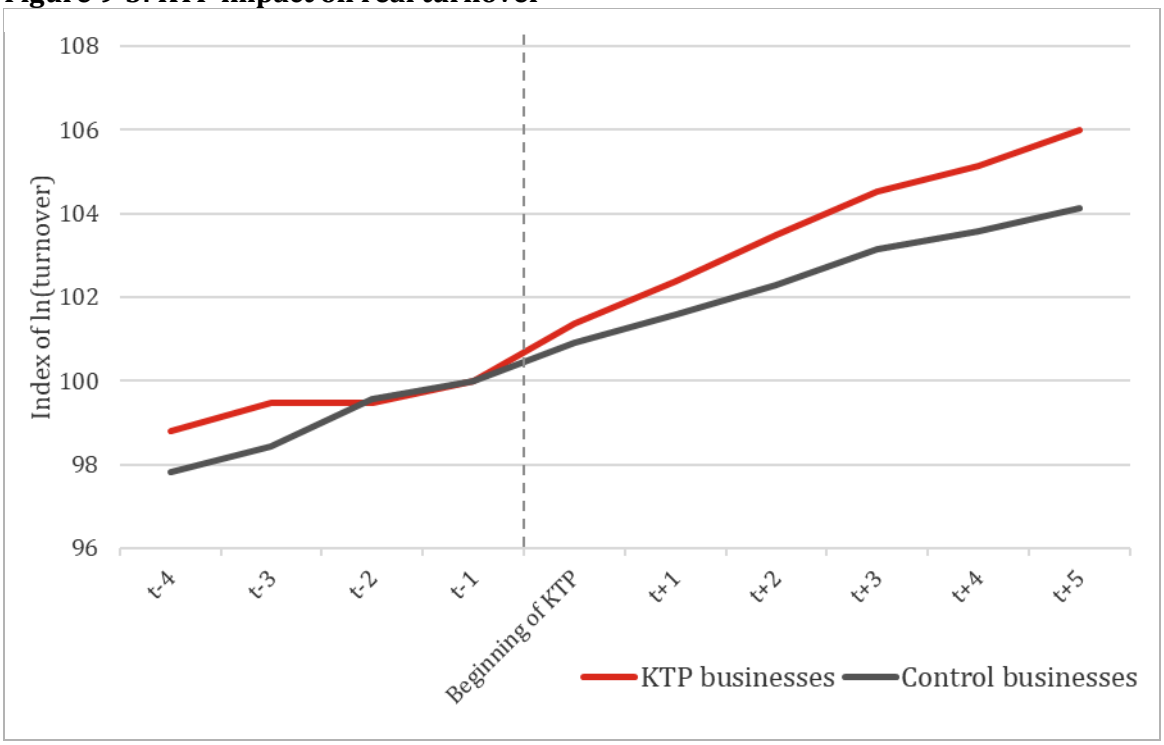
- First, associates were potentially able to bring about some 'early wins' once the KTP began, for instance through smaller initiatives within the business alongside the core of the KTP project. The evidence from the case studies backed this up.
- Second, as previously reported, KTPs were often found to be one part of a broader set of activities designed to develop the business. Therefore, the apparent early effects of the KTPs on performance may be partly attributable to this wider set of actions that businesses were undertaking.

Figure 9-2: KTP impact on employment



Source: SQW analysis

Figure 9-3: KTP impact on real turnover



Source: SQW analysis

Impact by business size

9.25 We have carried out DiD regression analysis to compare the impact of KTPs on micro/small (<100 employees) and medium/large (100+ employees) businesses. This highlighted two key messages: (1) KTPs are associated with statistically significant positive growth for both small and large companies; (2) In percentage terms, small companies grow faster after a KTP than large companies. For all periods during and after a KTP, this difference is positive. However, the difference in growth is only statistically significant for employment from the second year of the KTP onwards and for turnover only in the second year of the KTP. More details can be found in Annex F.

Sensitivity analysis

9.26 To ensure the robustness of our results we tested for the impact of KTPs on employment and turnover across several model specifications, definitions of the treatment group, and selections of the group of comparison businesses. These included the following:

- The three alternative specifications of the comparison group set out in the Propensity Score Matching (PSM) subsection above:
  - a model where only completed KTPs (F1) and not finished early (W3) KTPs were used as beneficiaries
  - a model where businesses with multiple KTPs were removed from the analysis

  - a model where the comparison group was not identified with PSM but defined as businesses that were accepted to a KTP, but the KTP did not start (W2).
- A simpler panel model where all treatment and post-treatment years were treated equivalently and we did not distinguish between the first, second, and third year of each.
- An alternative model that distinguished companies by their size but compared SMEs against large companies and not small enterprises against medium and large companies.
- An alternative, "classical" DiD panel model where time was recast so all KTPs started at t=1 and treatment switched on at t=1 for all KTP businesses and did not switch off.

9.27 Our results were robust to these different model specifications. Across all of the specifications tested, KTPs were statistically significantly associated with increased growth in both turnover and employment. The results from the analysis presented in this section have fed through to our impact and value for money analysis presented in section 11.

10. Factors influencing KTP performance

10.1 In this Section, we explore factors that have helped or hindered outcomes being achieved through KTPs, assessing the evidence against the original theory of change and underpinning assumptions. This analysis draws on consultation feedback, surveys, case studies, close out reports and econometric analysis. We also comment on factors that did not appear to influence outcomes/impacts.

Key factors that influence the success of KTPs included: the three-way and industry-led partnership model, with dedicated resource and knowledge transfer via an embedded associate and quality relationships between partners; a strong and realistic plan at the outset, with aligned goals and buy-in from all partners; close alignment between expertise and need; and having a structured project. Within the business, strategic fit and prioritisation of the KTP by the leadership team was important, alongside buy-in across the wider team. The fit, motivation, capability and calibre of the associate was "instrumental" to the success. Proximity between partners can be helpful, but was not always necessary; in some cases, alignment of expertise and need was more important. Neither the region nor sector of the business were significant determinants of growth as a result of the KTP.

Factors that do influence performance

Three-way partnership model with quality relationships

10.2 **A three-way and industry-led partnership** enables an associate to focus exclusively on the project and provides the necessary access to expertise from the KB and buy-in from the business. This was raised by consultees, in partner surveys, case studies and close out reports. A distinctive feature of KTPs as a knowledge transfer mechanism is the intention to embed knowledge within the business and have a longer-term legacy effect. The associate's role in **doing the knowledge transfer as a key individual based at the business** has been critical to success. It has provided dedicated resource and capacity to focus on the challenge/ opportunity in question, and applying and tailoring knowledge and skills in a context where they are situated on a day-to-basis (and therefore have a better understanding of business needs). Embedding knowledge also depended on complementary activities within the business, such as the associate developing learning resources/user manuals, delivering presentations, training other staff, and providing shadowing opportunities for staff to understand new processes (as well as the businesses' capacity, culture and responsiveness, as we discuss further below). The R&D outputs themselves also helped to encourage businesses to embed the findings – for example, where the project proved concepts, gave management confidence to adopt and integrate new tools/methods (rather than outsourcing). There was also evidence from close out reports to suggest that businesses have

changed policies and protocols to ensure learning from KTP is actioned, or invested further (typically using internal or grant funding) to ensure that KTP knowledge was fully embedded.

10.3 The presence of a **strong, realistic plan at the outset, with aligned vision and buy-in from all partners** was considered critical to success. This was identified in the consultations, surveys, case studies and close out reports. Consultees and beneficiaries highlighted the importance of allowing sufficient resource for a **detailed project planning** phase (even pre-application) to clearly and collaboratively define the vision and purpose of the project. **Close alignment between academic expertise, associate skills and business needs** was also raised as being important by the large majority of academics, associates and businesses surveyed[39]. Projects have struggled where partner priorities or goals have been misaligned, or objectives were not clearly articulated or were overly ambitious at the outset (leading difficulties in managing expectations or excessive time spent replanning and refocusing).

10.4 The **quality of partner relationships** was important[40]. This was aided by regular contact and collaborative working between partners. Almost all academics surveyed and the majority of businesses said regular contact was important in achieving benefits[41]. As discussed above, in many cases, some partners knew each other before the KTP, and so had foundations on which to build. According to close out reports, this also meant less time was needed in the preparatory stages and more resource could be invested in the R&D activities. Communication and language barriers, and differences in ways of working, have hindered progress in some projects.

10.5 **Strong and structured project management** was found to be key to success. The business and associate were central to this, and consultees also highlighted the ongoing support during implementation from KTAs/KT Managers (including advice, training, mentoring, admin support, and monitoring to keep on track). KTAs were described by one consultee as "*the linchpin of the whole process*". Stakeholder consultees and case studies noted the helpful structure and momentum provided by Innovate UK's monitoring arrangements. Regular meetings with monitoring officers also provided projects with the opportunity to reflect and an 'external' perspective on progress and direction, and encouraged project partners to maintain their focus on delivering outcomes.

10.6 Finally, Innovate UK's (and its predecessor's) **long term commitment** to the KTP scheme and this three-way partnership model has been important in success. Consultees suggested it has sent a signal to the KB regarding the UK's commitment to knowledge exchange. It has also enabled the retention of delivery/support staff with extensive experience (for example, in addressing challenges encountered by KTP projects). Furthermore, consultees commented on the **flexibility of the KTP model** and its ability to adjust to "*real world challenges*". The

[39] When asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, where 1 was not at all important and 5 was very important, 83% of academics rated this as 4 or 5, as did 82% of associates and 80% of businesses.
[40] For example, when asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, 92% of academics rated quality of relationships as 4 or 5 out of 5
[41] When asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, 96% of academics rated regularity of contact as 4 or 5 out of 5, and 82% of businesses.

flexibility of KTP projects was also noted in the close out data, where KTPs were considered to be a cost effective method to deliver innovation projects that allows for full creativity and tailoring to business needs.

Business characteristics and approach to KTPs

10.7 The evaluation evidence has found that the characteristics and approaches of business partners were important in driving the success of KTP projects. First, the **strategic fit and prioritisation of KTP within the business was critical.** This included the need for a strong fit between the KTP project and business strategy[42], a strong case for investment, and commitment to the KTP by business leadership (including those with decision-making powers).

10.8 Consultees noted how important it was for **staff across the wider business to fully understand and buy in to the project** to ensure knowledge was embedded, sustained and acted upon more generally across the business. The case studies illustrated this further, where projects appeared to be successful if the business understood the "ethos of KTP" (i.e. KTPs are a mechanism for collaborative R&D and knowledge exchange, rather than contracting academic expertise) and where there has been strong internal involvement to support project delivery (e.g. where sales and marketing team engaged and tested products developed).

10.9 The **capacity of the business to (i) deliver the KTP effectively and engage with the project and (ii) absorb the knowledge generated** by the KTP were found to be key enablers of success[43]. In part, this was linked to buy-in from the leadership team, their willingness to dedicate sufficient resource to the project and their openness/receptiveness to innovation. Outcomes have been hindered where businesses have lacked a willingness to fully engage in the KTP project or have had limited absorptive capacity. The close out data suggested that projects that were not fully scoped at the outset and/or involved small or inexperienced businesses have faced challenges in this respect.

10.10 Finally in this sub-section, the econometric analysis found that business characteristics such as age, size and whether they were classed as a high growth firm[44] were significantly associated with growth in employment and turnover achieved by KTP businesses. Smaller and younger companies were more likely to experience higher growth in employment and turnover. This is unsurprising as the analysis is based on growth rates, and so smaller and younger companies can more readily achieve higher rates of growth. It does not mean that KTPs with large/older companies do not lead to similar outcomes. There were mixed views from the consultations on the extent to which business size can influence

[42] When asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, where 1 was not at all important and 5 was very important, 87% of businesses rated this as 4 or 5

[43] For example, when asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, where 1 was not at all important and 5 was very important, 81% of businesses rated their capacity to engage with the project as 4 or 5 and 82% rated the importance of their capacity to implement changes identified in the KTP project as 4 or 5.

[44] Using Beauhurst tracking status

success. Some consultees (notably KTAs and KB representatives) have found that some small businesses can struggle with capacity to "create useful outputs" from a KTP, whereas others were perceived to be more agile with the potential for large impacts. Consultees have observed challenges in implementing change in large businesses where the KTP project lead from within the business did not have decision-making authority (or where the approval of change was highly bureaucratic).

Associate recruitment and approach to KTPs

10.11 There was consistent feedback from all sources of evidence that **the fit, motivation, capability and calibre of the associate** was "instrumental" to the success of a KTP project[45]. This emphasises the importance of effective recruitment processes, their embeddedness within the business, and support provided by the business, academic and KTA. Sufficient support for the associate appears to be particularly important, and requires capacity from the business (and others) to deliver this. The KTP offers significant 'in-role' and 'hands-on' learning for the associate, alongside dedicated training resource. The large majority of associates surveyed rated the latter as important in generating outcomes[46]. Associates also highlighted the alignment between the project and their own aspirations[47]. The consultations, case studies and close out data provided evidence of cases where issues with the associate had meant that a KTP project did not achieve its aims. Examples included delays in recruitment, associates not being suitably knowledgeable, skilled or broadly adept to the role, a poor fit between associate interests and business needs, or associates leaving the post with subsequent difficulties in finding a replacement.

Knowledge base expertise and approach to KTPs

10.12 The expertise and approach of the KB was important, though less extensively than the factors outlined above. This included having **relevant expertise for business needs**, and **proactive and senior support for KTPs** within KB institutions (as discussed in Section 4). The ability of academics to adapt their knowledge to meet the specific needs of businesses was identified in our theory of change assumptions as a factor that may influence success, but it was not raised as a key enabler or barrier in the evaluation. This may reflect the fact many academics had prior experience of working with (or in) industry, and therefore were well equipped in this area already.

Proximity between KTP partners

10.13 The econometric analysis found that the further the distance between the KB partner and the business the lower the effect of KTPs on business growth. However, this effect was

[45] For example, when asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, where 1 was not at all important and 5 was very important, 80% of businesses rated this as 4 or 5
[46] When asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, where 1 was not at all important and 5 was very important, 75% of associates rated this as 4 or 5
[47] When asked to rate importance of this factor to achieving outcomes on a scale of 1 to 5, where 1 was not at all important and 5 was very important, 79% of associates rated this as 4 or 5

only statistically significant for employment in the first year following the KTP. The case studies provided multiple examples of where close geographical proximity between partners had aided regular communication and better partnership working. However, this is not to say that distance between partners means that a KTP cannot work. Consultees highlighted that alignment between expertise and need were key, and for some projects where requirements were quite specialised, this meant that businesses could not access the right expertise in close proximity. It also depends on the nature of the project and how important face-to-face contact is in that context. The strength of partner relationships (including before KTPs) will also influence how successfully partners can work together at distance. Whilst outside of the timeframe of this evaluation, consultees for the case studies noted that the increase in remote working during Covid-19 has facilitated greater engagement between geographically dispersed partners. The experience of Covid-19 has also no doubt improved the skills of relevant parties to work remotely.

10.14 Our overall conclusion from this is that **proximity between partners can be helpful, but is not always necessary,** especially in projects where the alignment of expertise and need is more important and/or where businesses do not have the right expertise in their area.

Other project-related factors

10.15 The econometric analysis has found that **completing the full length of a KTP** also made a difference to employment impacts. Specifically, KTPs that finished early (W3) have a lower overall growth rate in employment than KTPs that were fully completed (F1) (though the effect on turnover was insignificant). Longer KTPs were more likely to grow in turnover between the start and the end of support, though this may just be observed as the time distance between before and after is longer.

10.16 The evaluation has identified other factors that have hindered outcomes from being realised, many of which are typical of R&D projects and reflect the risk/uncertainty associated with undertaking this type of activity rather than any 'failure' of the scheme. For example, the close out reports referred to R&D being more complicated than expected and therefore taking more time to deliver (and in some cases, not reaching commercialisation as intended by the end of the KTP project), R&D disproving a new technology, and difficulties in commercialising products due to market forces.

External factors

10.17 The evaluation identified a range of external factors that have influenced the success (or otherwise) of KTP projects. Specifically, this included:

- effective integration with other business support throughout the business's journey (the approach in Wales was cited as an example of where this works effectively) and wider support from the KB institution or elsewhere for academics

- Brexit and (towards the end of the evaluation period) Covid-19, which hindered associate recruitment, and decreased appetites for investment in R&D and innovation
- wider market barriers and economic uncertainty, for example creating challenges for businesses seeking to launch new products
- wider R&D activities and investment by the business before/after KTP, reflecting the finding that most were already innovation active and KTPs were part of a wider growth/investment strategy.

Factors that do not influence business performance

10.18 Based on the econometric analysis, the following factors did not appear to influence the impact of KTPs on business performance:

- **Number of KTPs undertaken:** Businesses on their second or third KTP did not appear to perform significantly better or worse than those on their first KTP.
- **Grant value:** The grant value appeared insignificant
- **Type of institution of the KB partner**: This was not a strong predictor for KTP performance.
- **Sector of the business partner**: This was not a strong predictor for KTP performance.
- **Region of business**: Overall, region was not a significant determinant of the growth of a KTP business following support. This suggested that KTPs were likely to deliver the outcomes described in this report across the country. One note was that Scottish businesses on average grew statistically significantly faster in employment for 3 years after the KTP.

11. Contribution and Value-for-Money analysis

11.1 This Section has two parts: first, we provide an overall assessment of the contribution of the KTP to achieving outcomes and impacts, structured using three key questions that underpin the Contribution Analysis approach; and second, we provide a quantified estimate of value-for-money (VfM) of the scheme.

Contribution Analysis

Overall, there is a reasoned theory of change for the KTP scheme, and activities have been broadly implemented as intended. There is consistently positive evidence that the expected results have occurred for businesses, academics and associates involved in projects, and the wider KB. The KTP scheme has made an important or critical difference to the outcomes observed, although the prior experience of those involved and alignment with wider growth/investment strategies within businesses has also been important in realising benefits.

11.2 As set out in Section 1, we have adopted a theory-based approach to the evaluation, using the logic model and theories of change as a framework to assess whether and how KTPs have brought about intended outcomes and impacts that would not happen otherwise (or not as quickly, to the same scale, and/or to the same quality). Contribution analysis is a theory-based approach that enables us to do this in a structured way. Below, we have synthesised the evidence presented in this report to assess the KTP scheme's contribution to observed outcomes and impacts by constructing a "contribution story" against three key questions.

Is there a reasoned theory of change, and have activities been implemented as set out in the theory of change?

11.3 There is a reasoned logic model and theory of change, as set out in this report. The primary challenges that hindered academic and business engagement were information failures (notably in terms of what academic expertise existed, what business needs were, and joining the two), risk and resource constraints. This aligned closely with the original rationale for the scheme. However, there was less evidence to support the rationale that businesses that lack a track record in R&D and/or have no history of collaborating with the Knowledge Base. The motivations of business, academic and associate partners also aligned with KTP aims, which suggests that the scheme was targeted appropriately on partners/projects that were seeking to achieve the outcomes set out in the KTP logic model. The purpose of KTPs also aligned well with strategic priorities of KB institutions, and more widely with Government priorities for innovation and growth.

11.4 Between 2010 and 2020, the scheme was delivered as intended in terms of supporting R&D projects that have a three-way partnership and focus on business-led challenges and opportunities. As a rolling scheme, there are no annual targets for KTPs for spend or the number of projects supported, so it is difficult to assess whether the scale of activity was as expected. That said, the number of completed projects has been consistently in the region of 200-300 in most years. Facilitated access and support from KTAs were important to raise awareness and encourage engagement with the scheme, alongside alignment with institutional priorities and incentives and senior backing from the academic perspective. In terms of reach, the majority of businesses were innovation active and had experience of engaging with academia prior to their KTP, and likewise most academics were not new to engaging with industry before their first KTP. There was some evidence of businesses and academics taking part without this background and prior experience, but given the rationale above, we might have expected to see more without a history of this type of activity.

11.5 The large majority of projects were completed as planned (in terms of timescales and objectives) and overall levels of satisfaction with KTP processes and project implementation were high. There have been some challenges in implementing activities as planned, notably where there have been issues relating to associate fit/retention, misalignment of partners' aims, a lack of partner communication, commitment or capacity to engage with the project, or wider issues (e.g. technical complexities associated with R&D or wider market forces). The nature and extent of these challenges are not unexpected for R&D and innovation programmes.

Is there evidence that the expected results have occurred?

11.6 Overall, the findings suggest what was expected to happen in the theory of change has been achieved, and routes to impact were broadly as anticipated. The KTP funding has enabled R&D activities that would not have gone ahead or not in the same form without KTP funding, i.e. almost all activities were fully or partially additional.

11.7 As a result of the KTP projects, the large majority of businesses have observed the intermediate outcomes set out in the logic model, in terms of process *and* product innovation, improved capabilities, and increased investment in R&D. In turn, this has led to sustained impacts on business performance, notably employment (including high quality jobs) and/or turnover (including exports). KTPs have a legacy effect for most businesses in terms of influencing perceptions of, and capability to undertake, innovation and engage with academia. Many of the relationships with academic/KB partners have continued since the project ended. Outcomes in the logic model associated with patents, raising follow-on finance and exits/ company sales, and new start-ups were less common – though we would expect this. There do not appear to be major unexpected or unintended consequences associated with the scheme for businesses. Challenges encountered by a minority mainly related to the level of resource required to operate the KTP successfully, manage the administration and support the associate.

11.8 Similarly for associates, the evidence suggested that the outcomes in the logic model have been achieved as expected. There was strong evidence that KTPs have improved associates' technical and business skills, helped to accelerate career progression, created employment opportunities (at the KTP business and elsewhere) and, for some, increased earnings.

11.9 KTPs have brought about benefits to academic project partners and their wider KB institutions as intended. Even though most academics had prior experience of engaging with industry, the majority have still strengthened relationships with businesses and improved their knowledge of industry challenges, which has led to more industry-relevant research and teaching materials, academic publications, and the leverage of further funding. KTPs have also helped to progress academic careers, but this outcome was less prominent than the other benefits noted above. KTPs appear to have a knock-on benefit for KB institutions, including their reputation and profile, improving attitudes towards business engagement and innovation, and providing material on impact for REF/KEF case studies.

Was it the KTP scheme, rather than other influencing factors that made the difference, or the decisive difference?

11.10 The evidence on outcome additionality and the relative contribution of KTPs suggests that the scheme did play an important, and in some cases critical, role in generating the outcomes observed. Businesses and associates were more likely to state that outcomes were partially additional rather than fully additional, but for academics there was more of an even balance between partial and fully additionality. For all partners, deadweight was very low, indicating the KTP has played a role and very few would have achieved all the outcomes anyway without that support. The evidence from the econometric analysis was strong in pointing to KTPs making a significant difference to employment and turnover growth rates of businesses, including over a sustained period both during and after the KTP projects.

11.11 However, other influencing factors have been identified that helped to facilitate outcomes. This included characteristics and behaviours of partners involved as well as external factors. It is important to recognise that prior experience of innovation and business/academic engagement (and in some cases, pre-existing relationships between partners), alongside the KTP funding, will have put many projects in a strong position to drive through the intended outcomes. Also, KTPs were often strategically important to the business and formed part of wider growth agendas and business development activities. This wider drive and investment (before, alongside and after the KTP) will have also played a role in improving business performance.

11.12 Therefore, the evidence indicates that the KTP scheme has made a significant difference to the intended outcomes, and this is likely to be alongside other complementary factors.

Value-for-money analysis

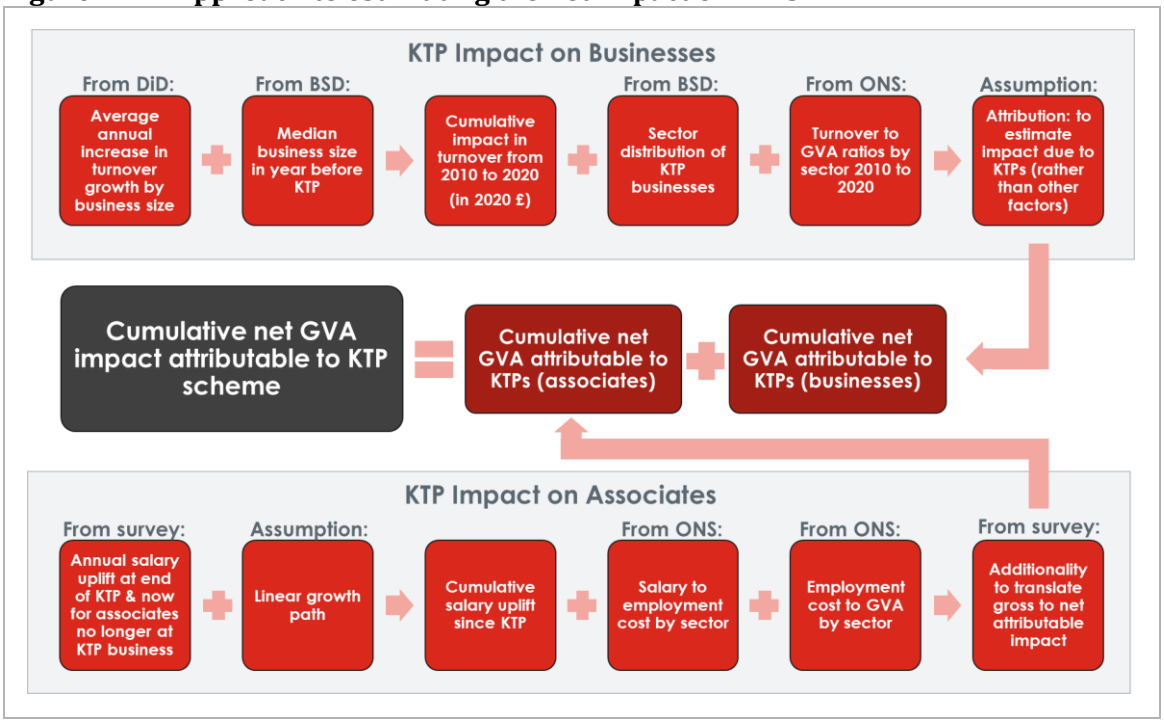
We estimate the impact of the KTP scheme on the UK economy over the 2010 to 2020 period to be between £1.7 and £2.3 billion in 2020 prices/values. Compared to a total scheme cost of £411 million in 2020 prices/values (including beneficiary contributions to project costs), this is equivalent to a £4.20 to £5.50 of net additional GVA for every £1 spent on KTPs.

11.13 We assessed the VfM of the KTP scheme by quantifying and monetising the net impact on businesses and associates who were no longer employed at the KTP business. The impact on associates still employed at the KTP business was excluded (to avoid double counting), because this was already assumed to be included in the impacts on businesses.

11.14 The VfM assessment on the business side was underpinned by the findings from the econometric analysis of net impacts of KTPs on beneficiary companies (as reported on in section 9). For the associates, the VfM assessment was based on findings from our survey of associates. Finally, the costs of the KTP scheme were calculated using data on grants, scheme management costs and business contributions. The cost information was provided by Innovate UK.

11.15 Our approach to estimating the net impact of KTPs is summarised in Figure 11-1 below:

Figure 11-1: Approach to estimating the net impact of KTPs



Source: SQW

KTP net impact – businesses

11.16 To calculate the net impact of the KTP scheme on supported businesses, we used the estimated cumulative net additional real turnover from the econometric analysis in Table E-2. For the purposes of VfM we used the estimates we obtained when differentiating by business size to reflect that small businesses, on average, grew faster than medium and large businesses.

11.17 Using the data on employment and turnover in the Business Structure Database (BSD), we calculated the average business size of both small and medium/large KTP businesses[48] in the year before the KTP. These data are shown in Table 11-1 below:

Table 11-1: Average business size in year before KTP

Pre KTP size:	Micro or small businesses (0 - 99 employees)[49]	Medium or large businesses (100+ employees)
Mean employment	25	763
Median employment	15	253
Mean real turnover	£3,845,000	£211,845,000
Median real turnover	£1,634,000	£38,519,000

Source: SQW analysis

11.18 Due to a tail of larger companies in the sample, the median represented a better estimate of the average business size and we used median turnover to calculate the GVA impacts shown below.

11.19 Not all KTP projects lasted the same length, and we needed to estimate the impacts during KTPs for between one and three years. Projects were attributed impacts according to their length. Project that lasted up to 18 months were attributed 1 year of impacts, between 18 and 30 months 2 years of impacts, and projects that lasted over 30 months were attributed the full 3 years of "ongoing" impacts from Table E-2.

11.20 The net additional impact of KTPs on real turnover was calculated for each year in 2010 to 2020 using the number of KTP projects that started in that year (F1 and W3 only). Cumulative ongoing effects were only attributed to the KTP scheme as long as they were statistically significant and at most for 6 years (i.e. for 3 year long KTPs, if 3 years post KTP they were statistically significant).

[48] As in the econometric analysis, large outlier companies with 5000+ employees were excluded from the analysis.
[49] The number small/ large distinction at 100 employees was chosen to maintain significant sample sizes in both groups for the econometric analysis.

11.21 We translated the net additional turnover impact of the KTP scheme by using annual GVA to turnover ratios[50] for the main sectors of KTP businesses and the sector profile of KTP beneficiaries observed in the BSD.[51]

11.22 Finally, we accounted for other additionality considerations as follows to translate the net additional GVA impact into a net impact attributable to the KTP scheme:

- **Displacement:** A portion of the additional growth experienced by KTP businesses may replace activity in non-KTP businesses as the companies were active in competitive markets. In accordance with the HCA Additionality Guidance, we set displacement to 29.3%[52].
- **Leakage:** As we used BSD data on UK economic activity to measure the impact of KTPs, and we are interested in the UK wide economic benefits of the KTP scheme, leakage was set to zero.
- **Substitution:** KTP supported businesses may undertake a KTP in lieu of other growth projects which would have also generated economic benefits. However, the comparison businesses in our DiD models would still be able to undertake these other projects so our estimated impacts were assumed to be net-additional to the benefits of them. Hence substitution was set to zero.
- **Deadweight:** Our DiD estimation estimated only the additional growth of supported businesses relative to the comparison group, and so the DiD was assumed to capture any deadweight effects.
- **Attribution:** Our qualitative research suggested that for many supported businesses, the KTP coincided with other activities as part of business development, i.e. a period where businesses undertook significant efforts to grow their size. If this is true about supported businesses but not the comparison group, a portion of the estimated impact may be attributable to these other activities, which could include other public interventions. We have set two different conservative estimates of this non-attributable effects in our analysis: 20% and 40%. These were derived from responses to the business survey on the extent to which reported benefits were due to the KTP as a factor alone or in combination with other factors. The results presented below reflect this range of uncertainty.

11.23 Attributing our estimated gross impacts to the KTP scheme in this way, we estimate that on the business side, between 2010 and 2020, KTPs have increased UK GVA by between £1.7 and £2.2 billion GVA.

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[50] Using data from the Annual Business Survey: https://www.ons.gov.uk/businessindustryandtrade/business/businessservices/datasets/uknonfinancialbusinesseconomyannualbusinesssurveysectionsas

[51] 37% manufacturing, 12% Information and Communication, 20% Professional and Scientific Research Services, 9% Wholesale and Retail, 22% Other (UK average).

[52] HCA additionality guidance, 4th edition, for business development & competitiveness interventions indicates 29.3%

KTP net impact – associates

11.24 To estimate the net impact of the KTP scheme we also estimated the impact on associates. However, to avoid double counting benefits, we only considered those associates who were no longer at the KTP business.[53]

11.25 In our survey of associates, we included a question on the salary uplift at the end of the KTP and at the time of the survey due to the KTP project. Using these two estimates, and assuming a linear growth path in between, we estimated the cumulative gross salary impact of the KTP scheme across the associates in our survey. Note, the first value, their salary uplift at the time of completing their first KTP, was converted into 2020 prices using GDP deflators.[54]

11.26 This salary impact was translated into a gross GVA impact based on assumptions and ONS data. First, salary was converted to employment costs using a fixed rate of 15%. This assumes that the employer's National Insurance and pensions contributions were around 15% of salaries. Employment costs were converted into GVA using a ratio derived the ONS's Annual Business Survey sectoral data on employment costs and approximate GVA.[55] The ratio of these two, for the relevant sector, converted the cumulative employment costs into an approximate GVA figure for the period since the associate finished their first KTP.

11.27 The final stage in calculating this impact was the gross-to-net conversion. This reduced the gross benefits, retaining only those benefits that were additional due to the KTP. In our associate survey we asked if they felt that the same benefits would have occurred, to a lesser extent, at a lower quality, or over a longer timeframe, if they did not take part in the KTP. We then reduced the gross cumulative benefits calculated above to match the survey responses on each question to calculate our net impact.

11.28 Finally, we scaled up the calculated impact to the KTP population. This was informed by the analysis in section 6 that showed that our survey of associates was representative of the overall associate population in terms of KTP timing and proportion of W3 and F1. **Our estimates suggest that the total net additional impact of KTPs on GVA through associates who were no longer at the KTP business was £38.4m.** This is the equivalent of £20.6k net cumulative GVA per associate that was no longer at the KTP business.

Benefits to cost comparison for the KTP scheme

11.29 To calculate the benefit to cost ratio for the KTP scheme we used the ratio of the net impact of the KTP scheme over the total scheme costs for the period 2010 to 2020.

[53] It is worth noting that in this way we are not estimating the overall impact of KTP associates but just a fraction of it.
[54] https://www.gov.uk/government/collections/gdp-deflators-at-market-prices-and-money-gdp
[55] Sector was included in our survey of associates and matched to ABS definitions. When no data was available we used economy wide averages.

11.30 To calculate the overall net impact, we add the estimated net impacts on businesses (£1.7 to £2.2 billion) to the net impact on associates no longer at the KTP business (£41 million). This gives us an estimated net impact of the scheme of £1,707 million to £2,263 million.

11.31 To calculate the net present value of the total KTP costs between 2010 and 2020, including the business contribution, we used ONS data on the GDP deflator data[56] to express the scheme costs in 2020 prices/values. This inflation data matched the data used in the SRS to transform turnover into real turnover data and the data used to transform associate impacts. The total costs of the KTP scheme between 2010 and 2020 were estimated to be £411m in 2020 prices/values (£264m excluding the business contribution).

11.32 Taking the ratio of scheme impacts over scheme costs, we estimate that the return on investment of the KTP scheme is between £4.20 to £5.50 of net additional GVA for every £1 spent on KTPs in the period.[57]

Table 11-2: Costs and benefits of the KTP scheme

	High case attribution (80%)	Low case attribution (60%)
Costs: grants and operating	£263.7m	£263.7m
Costs: business contribution	£147.0m	£147.0m
Total costs	£410.7m	£410.7m
Associate impacts	£38.4m	£38.4m
Business impacts	£2,224.3m	£1,668.2m
Total impacts	£2,262.7m	£1,706.6m
BCR	5.5	4.2
BCR (excluding business contribution)	8.6	6.5

Source: SQW analysis

[56] https://www.gov.uk/government/collections/gdp-deflators-at-market-prices-and-money-gdp
[57] Counting only costs to UKRI and excluding business contributions, the estimated BCR is 6.5 to 8.6.

12. Conclusions

Key findings

Overall performance

12.1 **Overall, the KTP scheme has achieved its core objective of helping businesses in the UK to innovate and grow, and has made a substantial contribution to the UK economy:**

- KTPs between 2010 and 2020 have generated an estimated £1.7 and £2.2 billion in net GVA for the UK economy. These impacts are based on the estimated effects on business growth and on the earnings of associates, and are Green Book/Magenta Book compliant in their methodologies.
- The scheme has delivered strong value for money over this period: for every pound of public and private investment, the scheme has generated a return of £4.20 to £5.40 in net economic benefits.

Design and implementation

12.2 **The scheme aligns well with Government priorities for innovation** and with strategic priorities of KB institutions, which have become more closely aligned with KTPs over the evaluation period with an increasing requirement to demonstrate impact, including through knowledge exchange. KTPs are viewed as important in the innovation ecosystem and **do not appear to duplicate other forms of support**. However, the scheme could be better aligned and integrated with the wider innovation support landscape in practice, and this could help to maximise the benefits of KTPs further and attract new types of applicant that may not have collaborated with the KB previously. **Overall levels of satisfaction with KTP processes and project implementation were high**, although feedback on the associate recruitment processes and marketing/promotion of the scheme were mixed.

Business benefits

12.3 The KTP scheme has helped businesses to mitigate the risk of investing in innovation, addressing resource constraints and, to some extent, information failures for both businesses and academics that hindered collaboration. KTP resources have been focused on projects that were strategically important to most of the businesses participating.

12.4 KTPs have helped businesses to undertake **both product and process innovation** . This has led to business performance improvements. According to the econometric analysis, **impacts on the growth rate of employment and turnover were statistically significant**, and were sustained throughout the KTP and for three years following completion. Wider feedback suggested that KTPs have led to high quality jobs and helped businesses to generate additional turnover from exports. Whilst some businesses reported benefits to productivity,

the econometric analysis found that impacts on productivity were not statistically significant. That said, KTPs have **helped to strengthen the underpinning drivers of productivity**, such as skills, R&D investment and process innovation. Outcomes were still being attributed to the KTP, even where the project finished a number of years ago, demonstrating the **sustainability of outcomes**. KTPs have influenced businesses' perceptions of, and capability to undertake, R&D, thereby making future innovation activities more likely. The evidence indicated that many of the relationships between businesses and KB partners were pre-existing, and these have often been strengthened and have continued since the project ended.

Academic benefits

12.5 KTPs have enabled academic partners to strengthen their knowledge of industry challenges, leading to **more industry-relevant research and teaching materials,** academic publications, and helping them to **lever further funding**. KTPs have helped to strengthen the ability of academics to engage with businesses and transfer knowledge. KTPs have also helped to progress academic careers, and a small number have generated IP and/or spinout businesses. **KTPs have had a legacy effect for academics**: almost all academics surveyed said the benefits gained from the KTP were sustained after it was completed and the majority of those academics continued to reap the benefits.

12.6 KTPs have generated **wider benefits for the KB institution**, including improved profile and credibility, providing material on impact for REF/KEF case studies, and widening and strengthening business networks. There was evidence that demonstrated how KTPs have influenced attitudes towards business engagement and innovation at an institutional level. The cross-disciplinary nature of some KTP projects has also helped to strengthen relationships within institutions.

Associate benefits

12.7 There was strong evidence to show that associates have increased **their knowledge, skills and capabilities** from KTPs, which included technical, commercialisation and business related skills. For the majority, the KTP has **raised career ambitions and accelerated career progression** (particularly for those within industry). KTPs have positively impacted upon associates' **employment opportunities and their earnings** over the course of their career. Many associates secured a job at the KTP business partner after the project ended, and almost all associates surveyed are now in employment in industry or academia. Knowledge gained through KTPs has been disseminated more widely, with examples from both industry and academia, although the subsequent effects on third parties could not be confirmed in this study.

Additionality and contribution of KTPs

12.8 **The majority of outcomes described above were partially or (to a lesser extent) fully additional,** and there was strong evidence to suggest that KTPs have made a key difference

in bringing about outcomes, often alongside other factors. For all partners surveyed, full deadweight was very low, indicating that very few would have achieved all the outcomes anyway without that support. Evidence on the relative contribution of KTPs suggested that **the scheme did play an important – and in some cases critical – role in generating the outcomes observed**. It is important to recognise that these outcomes have often been achieved in combination with other factors. KTPs often formed part of wider business development plans and the businesses often had prior experience of innovation and working with academia. The academics involved often had a track record of working with and/or in industry.

Success factors

12.9 The evidence demonstrates how the KTP model is effective in facilitating knowledge transfer between partners. The **three-way, industry-led partnership** and **dedicated resource for an associate that is embedded in the business** has been key to this. Other key factors that influenced the success of KTPs included: having a strong and realistic plan at the outset, with alignment of goals and buy-in from all partners; close alignment between expertise and need; and having a well-structured project. Within the business, strategic fit and prioritisation of the KTP by the leadership team was important, alongside buy-in across other relevant teams. The fit, motivation, capability and calibre of the associate was "instrumental" to the success. Proximity between partners can be helpful, but was not always necessary. The location, sector of the business, and the size of the KTP grant were not significant determinants of the effects on business growth as a result of the KTP. This highlights their potential role across different types of business, and all places and sectors.

Wider benefits

12.10 The evaluation found examples that demonstrated that KTPs can contribute to equality, diversity and inclusion. However, the evidence also suggested that there is more to be done in contributing to widening participation, for instance with the large majority of associates and academics being male.

12.11 Above and beyond the direct benefits for those involved in the KTP scheme, there was some evidence for potential spillovers. This included academics sharing the knowledge gained through KTPs with other academics and businesses, and associates taking the skills and knowledge gained with them as they progressed their careers in other organisations.

12.12 The KTP scheme has had a wide reach across the UK. With the benefits not affected by region/ nation, we can conclude that the scheme has had a positive impact on business innovation and growth across the UK. The scheme was not designed to deliver wider local benefits, though there were some examples of such effects. These examples included local employment creation, KTP businesses contributing to local cluster development, and KTPs being used (alongside other interventions) to strengthen an area's innovation ecosystem. The

potential for more of these benefits would require deliberate instigation and we return to this under the recommendations and lessons.

Recommendations and lessons

12.13 Overall, as set out above, the KTP scheme achieved significant impact over the 2010-2020 period, with strong evidence of outcomes for the three partners involved in line with the underlying programme logic. The recommendations and lessons to consider are made in this context.

Demand and reach of the scheme

12.14 The evidence in the report has demonstrated that the demand for, and reach of, the scheme is broad. A few areas have been identified where this could be developed further to increase access to the scheme by businesses who are less active in relation to innovation and/or engagement with the knowledge base, and for projects that may be less commercially-focused. This may require additional resources for the scheme.

- The application process/forms and criteria were thought to be potential barriers to projects that have a focus on social/environmental rather than commercial aims. These should be revisited to ensure that they are aligned with potential projects in these fields.
- The majority of businesses were innovation-active and/or had prior experience working with the knowledge base before their KTP. The evidence also indicated that KTPs have often been used as part of a business's wider package of development activities to support growth. Two options for expanding reach to businesses that are newer to innovation and/or collaboration with the knowledge base could be to: tap into the wider business support landscape to attract new applicants, including those within UKRI (e.g. EDGE) and those outside (e.g. linking to export support or schemes such as Help to Grow); and consider shorter KTPs, thereby reducing the investment required for those businesses new to innovation. Actions here may require additional resource for programme delivery.
- Supporting the two previous points, communications on the potential business benefits and on projects with social or environmental objectives may help to broaden access.
- A key lesson from the evaluation was the need for senior buy-in within KB institutions to KTPs and the existence of individuals within relevant technology transfer/enterprise offices with the drive to promote them and make them happen. KB institutions should therefore engage and periodically re-engage with senior leaders, highlighting the benefits that KTPs can bring.

Implementation

12.15 The evaluation found a number of key facets that were important in supporting the impact of KTP projects, particularly around the partnership and the three parties involved in

this. These provide lessons for those that are involved in instigating, developing and supporting projects so that impact can be maximised. Key areas of good practice for dissemination are as follows:

- Associate recruitment is important to ensure a suitable candidate is found. Processes that can support this include speed of action upon project approval and ensuring the post is seen as attractive. The range of benefits to associates found in this evaluation, including for those wishing to pursue careers in industry, academia or at the interface of the two can help to promote these posts.
- A KTP plan that is developed post-award, including with clear goals and shared and well-understood ways of working, was found to be key to success. This could be a useful check for KTAs, and provides an important first milestone for the parties involved.
- Capacity and buy-in within business was a key factor in success. A senior representative of the business with ownership of the KTP project helps to ensure that this is in place.
- The institutional capacity of the knowledge base partner to support the project during delivery was found to be an important factor in success. KB representatives should note this, particularly if academic partners have less previous experience in working with industry, and so may require additional support. The support role provided by KB representatives includes taking on administrative tasks such as meeting minutes and claims processes.

12.16 Finally on implementation, monitoring data to help facilitate the evaluation could have been better, in particular in relation to close out data and contact information. This may reflect that the period subject to the study went back to 2010. That said, it is critical for monitoring information to be captured and maintained to enable future evaluation. A useful action would be to check, update and add secondary details for key contacts at the end of the KTP.

Wider aspects

12.17 KTPs were seen as distinctive in the innovation landscape. However, it was not clear how they fit or complemented other support in practice, and there was a perception that some in UKRI had a lack of understanding of the role of KTPs. As well as the potential for tapping into schemes such as EDGE (see above), two other key issues should be considered:

- Communications and profile-raising within UKRI on the role of KTPs in their existing form could help encourage better integration with other existing activities, e.g. with those of Research Councils. This could highlight the various routes to impacts that KTPs can have, and so prompt more consideration on how they could align with other schemes. Key relevant routes include: increasing the application of research into industry and wider contexts; as a means of developing human capital for innovation, including at the

important interface between research and industry; and to support innovation and growth in businesses.

- There was some ad hoc evidence on the role of KTPs in contributing to place-based aspects. Whilst not part of KTP design, a key question is whether there is scope to maximise place-based impacts further in future. This would need to be actively instigated by Innovate UK and/or by local partners, likely on a case-by-case basis.

Annex A: Key findings and notes on the evidence

A.1 This Annex section sets out some of the key findings from the report, the sources of evidence that have been used and any notes or caveats.

Table A-1: Key findings, sources and notes

Finding	Source	Notes/caveats
The majority of businesses were already innovation active and had experience of engaging with academics	Business survey, e.g.: • 81% of respondents had invested in R&D activities prior to KTP • 64% had previously engaged with academics through a range of mechanisms	Business survey was representative of the population on observable characteristics, though was small in sample (86), meaning a margin of error on the %s of around 8-10 percentage points
The majority (88%) of business respondents had faced challenges that hindered their engagement with academics prior to their KTP	The main issues were: not knowing about academic experience available (62%), not knowing how to access academics (58%), a lack of resources/capacity within the business, including finance, to engage with academics (54%)	Business survey was representative of the population on observable characteristics, though was small in sample (86), meaning a margin of error on the %s of around 7-10 percentage points
The majority of the academics had prior experience of working with businesses and in industry	Academic survey, e.g.: • 95% had worked with businesses before • 39% had collaborated with the KTP business before, and 25% knew the business but had not collaborated • 65% of academics had direct experience of working in industry	Academic survey was representative of the population on observable characteristics, though was small in sample (93), meaning a margin of error on the %s of around 4-9 percentage points
Activity additionality was reasonably high, with the majority of businesses and academics saying that projects would probably or definitely not have gone ahead anyway if a KTP grant had not been available.	67% of businesses said the project would definitely or probably not have happened without the KTP grant. This was similar to the 65% reporting a similar type of additionality in close-out forms. This figure was 75% for academics. Where it would have gone ahead, timing, scale, quality may have been compromised. See Table 4-3 for more info.	As above, data were from business and academic surveys, with potential margins of error. That said, the close out forms provide corroboration. Note there could be some attribution bias.

Finding	Source	Notes/caveats
There is good evidence that the KTP scheme has led to the intended intermediate outcomes set out in the underlying logic – for businesses, academics and associates.	This is based on the survey responses – with Figures 5-1 (businesses), 6-1 (associates) and 7-1 (academics) setting out the proportions of respondents observing different benefits to date, or expecting it in the future.	As above, there are margins of error associated with the surveys. For the business and academic surveys, the margins are higher (around 6-10 percentage points); for the associate survey, which had 406 responses, the margins are lower (3-5 percentage points). Note that there may also be some attribution bias.
KTPs have had a positive statistically significant impact on the employment and turnover growth of beneficiary companies. This positive impact was significant both during and following the KTP. The effects started in the first year of KTPs, and were sustained until three years after the KTP has finished.	Difference-in-differences analysis supports this finding, with Table 9- setting out the coefficients and statistical significance. The reported coefficient can be interpreted approximately as the net additional growth rate associated with treatment.	This may reflect the effects of KTPs in combination with other complementary factors. For instance, the fact that the effect starts in the first year of the KTP may be partly explained by KTPs being part of a broader set of business development actions.
KTPs were found to have no statistically significant effect on productivity as estimated using the ratio between turnover and employment.	Difference-in-differences analysis supports this finding, with Table 9- setting out the absence of statistical significance.	This is intuitive given that we have seen similar levels of positive effect on turnover and employment. This does not mean that KTPs do not help productivity for some companies, and some businesses reported an effect on productivity in the survey.
There was limited evidence to suggest that KTP characteristics or business characteristics affected the findings in relation to employment and turnover. Three exceptions were: smaller companies and high growth potential companies benefited more; those KTPs finishing early had a lower effect than those completing. This suggests that an open and broad approach is appropriate.	Difference-in-differences analysis – see Annex E.	There were some other factors in individual years or tests where a differential effect was seen, but these were inconsistently found. The two points made here were the key examples.
The estimated net impact on GVA through businesses was £1.7bn to £2.2bn between 2010 and 2020.	Section 11 sets out the analysis undertaken to reach these figures – drawing on the econometric analysis, in	The approach used conservative assumptions. We have sought to take account of the attribution of the effects to

Finding	Source	Notes/caveats
	particular the evidenced effects on turnover, which have been converted to GVA.	KTPs (versus other factors) by using the survey responses on 'contribution', though this is not an exact science and could be prone to attribution bias. We therefore applied a high (80%) and low (60%) attribution to indicate a potential range.
The overall estimate net impact on GVA was £1.7bn to £2.3bn between 2010 and 2020.	Section 11 sets out the analysis undertaken to reach these figures. This is based on the estimated business impacts (row above) and impacts through the salaries of associates that were no longer employed at the KTP business. The associate impacts have been estimated using the survey of associates, in particular their perceptions of how the KTP has helped with their earnings potential and the additionality associated with the KTP.	Note that the associate impacts presented in Section 11 do not reflect the total associate impacts as they have excluded those associates still employed at the KTP business. Note also that the associate impacts are based on self-reported perceptions and so could be subject to some attribution bias. That said, these impacts make up a very small proportion of the total estimated impacts (2%).
The overall benefit cost ratio was estimated to be 4.2:1 to 5.5:1	Section 11 sets out the analysis undertaken. These BCRs were based on the overall net impact set out in the row above against the costs to the public purse and the costs to businesses (in terms of matched contributions).	The BCRs are not directly comparable to previous studies on KTPs, because we have incorporated the matched contributions by businesses on the costs side (excluded in previous studies), and the methodology for estimating business impacts has used the difference-in-differences approach (previous studies used self-reported feedback from businesses). There may be some costs that are excluded, e.g. additional costs to businesses of implementing a KTP, and additional costs to KB institutions (such as employment of KTP specialists). Conversely, we have not attempted to value the benefits to the knowledge base.

Source: SQW

Annex B: List of consultees

Table B-1: List of internal consultees

Name	Role	Organisation
Narpal Sihra	KTP lead	Knowledge Transfer Network
Jan Stringer; Ian Blakemore; Joel Ferguson; Philippa Ryan; Gerry O'Hagan; Rob Rolley; Gerry Black; Susan Suttle	Regional KTAs (x8)	Knowledge Transfer Network
Natalie Crawley	KTP Manager	Welsh Government
Scott Quinn	KTP Manager	Invest Northern Ireland
James Box	Senior Programme Manager	NERC
Huw Vasey	Strategic Lead for Innovation, Business Engagement and Commercialisation	ESRC
Adam Luqmani	Joint Head of Business Engagement	EPSRC

Table B-2: List of external consultees *(*views gathered from membership)*

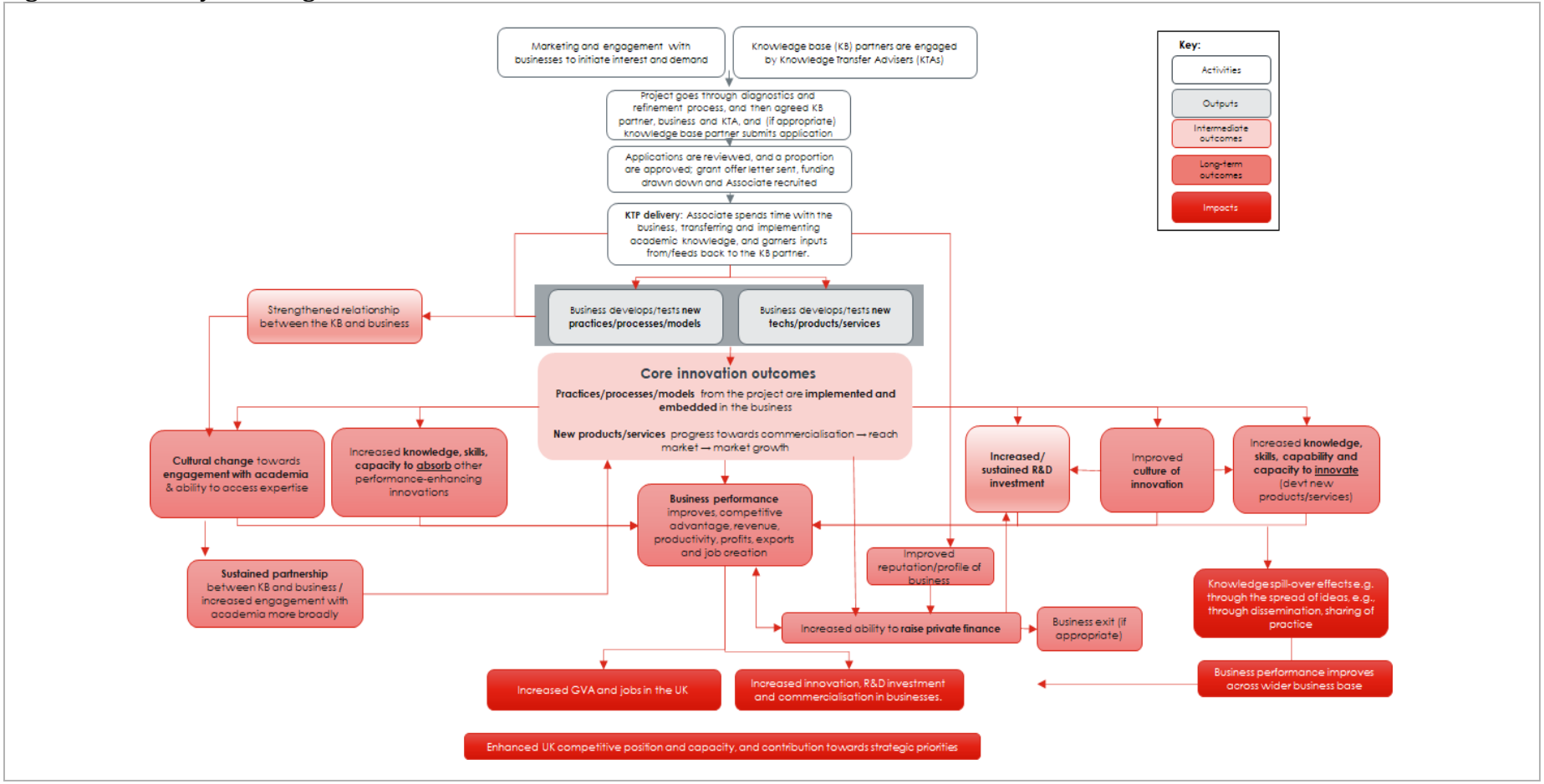
Name	Role	Organisation
Hazel Juggins	KTP Manager (University of Northumberland) and KT Manager National Forum Chair	KT Manager National Forum
Jovan Luzajic; Ed Castell	Policy Manager; Policy Analyst	Universities UK
Annette Bramley	Director	N8 Research Partnership
Douglas Dowell*	Policy Manager	Russell Group
Joe Marshall; Anna Dent-Davies	CEO; Universities Partnerships Manager	National Centre for Universities and Business
Rachel Persad	Policy Manager	GuildHE
John Robins; Alexandra Leadley	Business Development Manager; Skills Academy Manager	Compound Semiconductor Applications Catapult
Mike Holmes	KTP Manager	Centre for Process Innovation
Jack Semple*	Alliance Secretary	Manufacturing Technologies Association

Table B-3: List of Knowledge Base consultees

Name	Role	Organisation
Lorraine Marks	Head of KTP and Business Engagement Programmes	Queen's University Belfast
Alasdair Cameron	Director - West of Scotland KTP Centre	University of Strathclyde
Paul Yeomans	KTP Manager	The University of Nottingham
Sarah Durkin	KTP Development Manager	Sheffield Hallam University
Janet Morana	Associate Director of Research and Enterprise	University of Salford
Holly Leonard	Innovation Partnerships Manager	University of Essex
Anna Bullen	Partner Development Associate	University of Loughborough
Alexis J. Holden	Director, Research and Enterprise Service	UCLAN
Louisa Evans	KTP Officer	University of Warwick
Stuart McKay	Senior KTP Manager	University of the West of Scotland
Chris Woods	Research & Impact Support Officer	University of Bangor
Ellen Parkes	KTP Manager; KTP Development Coordinator	University of the West of England (x2)
Kamran Harandy	External Funding Manager	Falmouth University
Arnaud Drapier	Research Development Officer (Business Led)	University of Leicester
Paul Thomas	Business Manager	Cardiff University (feedback received via email not consultation)

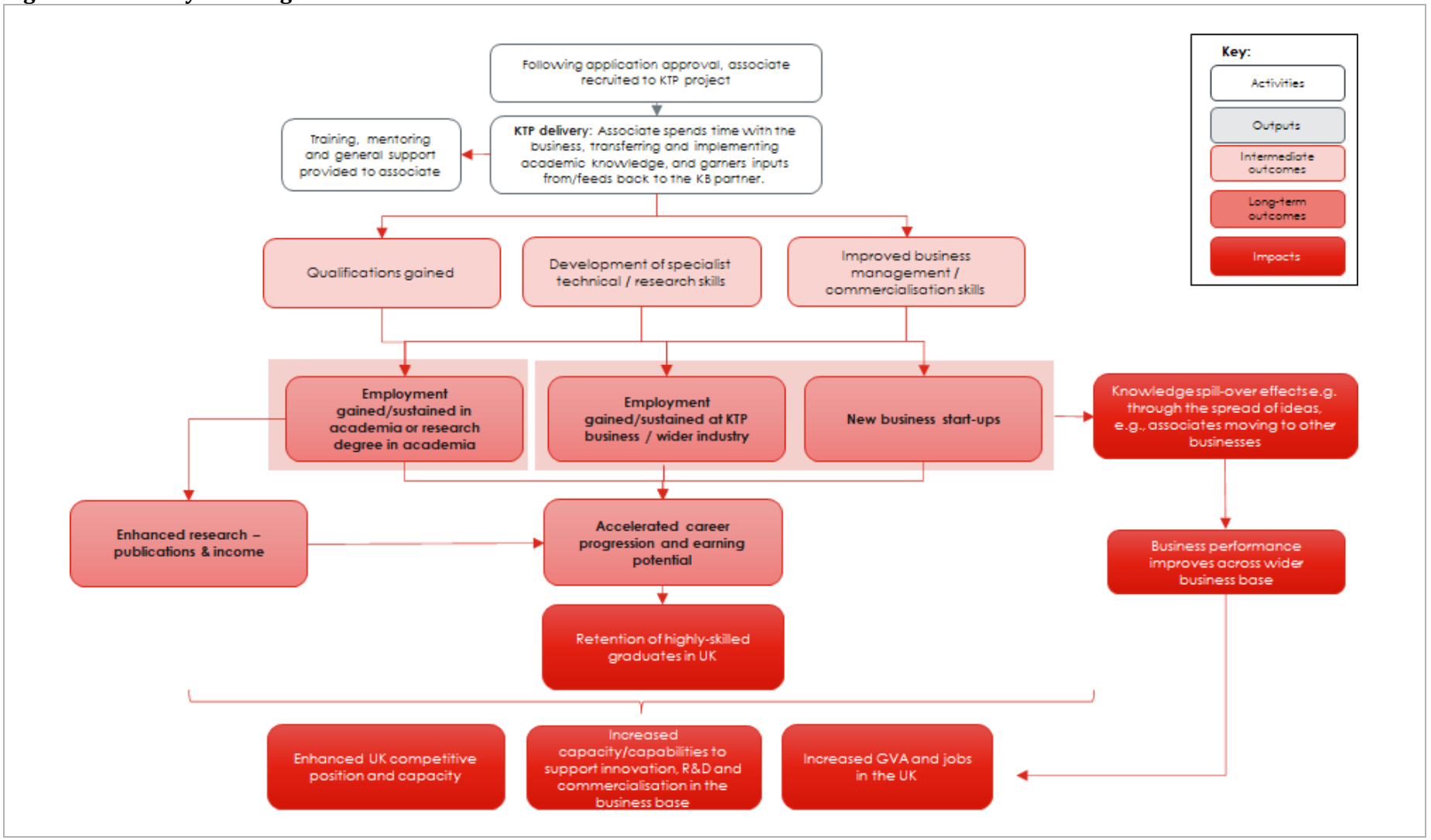
Annex C: Theories of Change and underpinning assumptions

Figure C-1: Theory of Change - Businesses



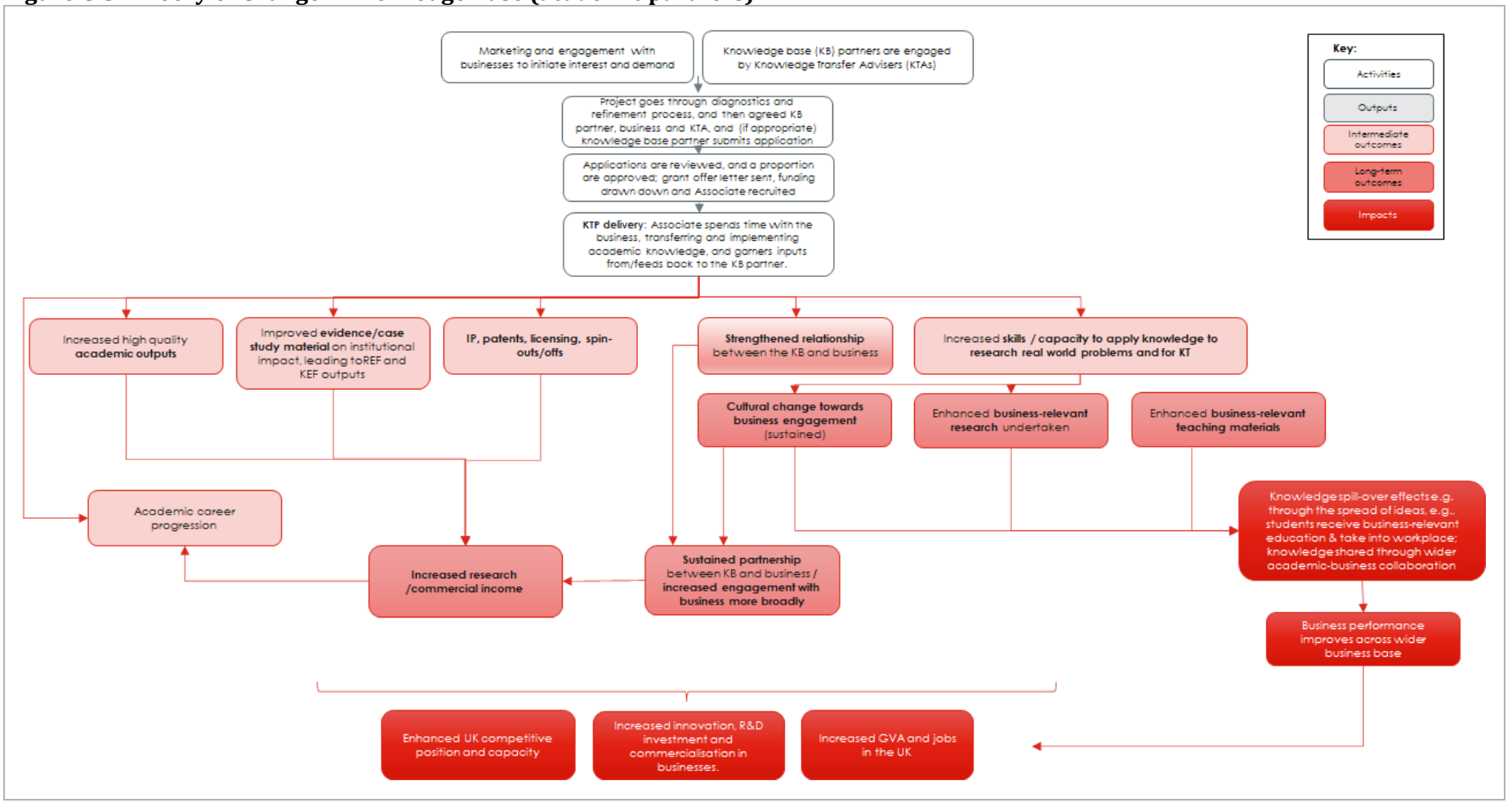
Source: SQW

Figure C-2: Theory of Change – Associates



Source: SQW

Figure C-3: Theory of Change – Knowledge Base (academic partners)



Source: SQW

Table C-1: Underpinning assumptions and factors that may enable or hinder KTP performance

	Strategy / rationale	Delivery	Effects
Businesses	• Businesses would not have accessed university expertise or alternative support without KTP • KTP projects are innovative/focused where they can make a strategic difference	• Business accepts/values knowledge • Business has resource/skills/capacity to absorb knowledge and implement change • Business receives complementary support where necessary	• Benefits are tangible and sustained • Business accesses finance where necessary • Wider external factors, e.g. demand for products/services, regulatory barriers
Associates	• KTP aligns with skills and aspirations of would-be associates	• KTP recruitment process is effective • Associate is actively embedded in business, and focus on KTP project • Associate receives effective coaching, mentoring and personal development, and wider support from business/KB	• The new skills/qualifications gained help associates to secure employment
Knowledge Base	• At an institutional level, KTPs align with strategic priorities, and effective processes and sufficient capacity in place to generate demand, recruit and administer KTPs • Academics incentivised to engage with /develop partnerships with businesses	• Academic provides regular and appropriate supervision • Academic expertise relevant to business challenge, and adapted/localised to meet specific needs of business	• KTP leads to further collaborative or consultancy projects, and/or new ways of engaging with businesses • KTP experience used to inform teaching and further research, which is more business-relevant as a result, i.e. learning can be applied/generalised
Cross-cutting	• Clear rationale to engage with KTPs • Clear business case for project • KTP offer is attractive, with sufficient demand from eligible/relevant partners • Application process is proportionate/appropriate • Employing high-calibre graduates to work with business/KB is effective knowledge transfer mechanism	• All partners fully committed to project, and have resource/time required to engage effectively • KTP interacts effectively with other interventions in practice (e.g. EEN/Edge or Catapults) • IP agreement clear between partners and facilitates commercialisation	• Partnership is strengthened and sustained, and becomes strategic (not transactional) • Dissemination/knowledge exchange/ spillover mechanisms are present and effective (e.g. Associate movement, academics apply learning in other industry relationships, leading to the uptake of ideas by other businesses)

	Strategy / rationale	Delivery	Effects
	• KTPs complement/do not duplicate other support available • KTP project does not replace what could be achieved by using other sources of knowledge/advice, nor replace solutions that are available 'off the shelf' • Outcomes/benefits for all three partners will not/are most unlikely to occur to the same extent without a KTP (i.e. there is additionality)	• Frequent communications and trust between partners, with a common technical/organisational 'language' (or ability to develop/learn it) • Shared vision between partners, and well-structured project plan	• Transferability/relevance of knowledge, openness/capabilities to disseminate by business/KB • Local impacts – alignment between KTP and local specialisms/clusters/other local interventions

Source: SQW

Annex D: Further data on surveys

D.1 The following sections present comparisons between the characteristics of partners surveyed against the total populations supported. It also includes survey respondent's satisfaction scores.

Representativeness checks

Business partners

Table D-1: Size of survey sample and entire population

	Count	%
Total no. of survey respondents	86	5% of total population
Total no. of beneficiary businesses	**1,868**	

Table D-2: Total and average grant size

	Survey (n=103 awards as 1 has no figure)		Total population (n=2,285 awards)	
Total grant amount	£	9,467,843	£	209,071,858
Average grant amount	£	91,921	£	91,498

Table D-3: Region

	Survey	%	Total population	%
South East	10	12%	223	12%
Scotland	10	12%	221	12%
North West	10	12%	209	11%
Yorkshire and the Humber	6	7%	177	9%
West Midlands	11	13%	153	8%
London	5	6%	137	7%
Northern Ireland	4	5%	136	7%
East Midlands	8	9%	133	7%
South West	5	6%	132	7%
North East	6	7%	124	7%
East of England	6	7%	112	6%
Wales	5	6%	111	6%
Total number of businesses	**86**		**1,868**	

Table D-4: Business size

	Survey	%	Total population	%
Micro	264	14%	14	16%
Small	687	37%	29	34%
Medium	459	25%	24	28%
Large	457	24%	19	22%
Unknown	1	0%	0	0%
Total number of businesses	**1,868**		**86**	

Table D-5: Start year of KTP

	Survey (n=103 awards as 1 has no figure)	%	Total population (n=2285 awards)	%
2010	466	20%	16	19%
2011	198	9%	6	7%
2012	202	9%	7	8%
2013	299	13%	18	21%
2014	321	14%	16	19%
2015	291	13%	5	6%
2016	218	10%	7	8%
2017	191	8%	10	12%
2018	86	4%	1	1%
2019	13	1%	0	0%
Total number of awards	**2,285**		**86**	

Table D-6: Standard Industrial Classification (SIC) Codes

	Survey	%	Total population	%
Unknown	18	21%	694	37%
Service	11	13%	219	12%
Instrument/electrical man	8	9%	138	7%
IT/multimedia	7	8%	103	6%
Metal goods	4	5%	99	5%
Metal manufacturing	4	5%	82	4%
Medical	4	5%	69	4%
Chemical manufacturing	4	5%	57	3%
R&D	1	1%	47	3%

	Survey	%	Total population	%
Plastics/paper	3	3%	46	2%
Education/administration	2	2%	41	2%
Energy/water	4	5%	35	2%
Furniture/jewellery/games	2	2%	29	2%
Food/drink	1	1%	29	2%
Membership/Professional Orgs	0	0%	26	1%
Construction	4	5%	25	1%
Publishing/media/sport	1	1%	24	1%
Agriculture/fish	1	1%	20	1%
Sustainability	3	3%	19	1%
Footwear/textiles	1	1%	18	1%
Bricks/glass	1	1%	16	1%
Transport	1	1%	15	1%
Finance	0	0%	11	1%
Wood	1	1%	5	0%
Aerospace	0	0%	1	0%
Total number of businesses	**86**		**1,868**	

Associates

Table D-7: Size of survey sample and total population

	Count	%
Total no. of associate survey respondents	400	17% of entire population
Total no. of associates with completed projects	2,422	

Table D-8: Number of project completed

Number of projects completed	Associate survey respondents (n: 400)	%	Total population of associates (n: 2422)	%
1	397	99%	2,402	99%
2	3	1%	19	1%
3	0	0%	1	0%
Total	**400**		**2,422**	

Table D-9: Start year of first project completed

Start year of first completed project	Associate survey respondents (n: 400)	%	Total population of associates (n: 2422)	%
2010	521	22%	68	17%
2011	212	9%	32	8%
2012	213	9%	38	10%
2013	305	13%	47	12%
2014	336	14%	50	13%
2015	320	13%	63	16%
2016	234	10%	45	11%
2017	191	8%	36	9%
2018	81	3%	19	5%
2019	9	0%	2	1%
Total	**2,422**		**400**	

Table D-10: Duration of completed projects

Duration of completed project	Associate survey respondents (n: 400)	%	Total population of associates (n: 2422)	%
Less than 1 year	2	1%	11	0.5%
1 to 2 years	43	11%	319	13%
2 to 3 years	249	62%	1459	60%
3 to 4 years	94	24%	541	22%
4 to 5 years	11	3%	81	3%
More than 5 years	1	0.3%	11	0.5%
Total	**400**		**2422**	

Knowledge base partners

Table D-11: Size of survey sample and entire population

	Count	%
Total no. of academic survey respondents	93	6% of entire population
Total no. of academics associated with completed projects	1,597	

Table D-12: KB organisations covered

	Count	%
Total no. of KB organisations surveyed academics worked within	55	40% of entire population
Total no. of KB organisations	136	

Table D-13: Location of KB organisation

	Total no. of academics surveyed (n: 93)	%	Total population of Knowledge Base organisations (n: 136)	%
Scotland	14	15%	18	13%
South East	16	17%	17	13%
London	4	4%	15	11%
Wales	3	3%	13	10%
North West	13	14%	12	9%
South West	7	8%	11	8%
West Midlands	5	5%	11	8%
East Midlands	8	9%	10	7%
East of England	5	5%	9	7%
Yorkshire and Humber	7	8%	8	6%
Northern Ireland	6	6%	6	4%
North East	5	5%	6	4%
Total no.	**93**		**136**	

Table D-14: Average number of KTP projects completed

	Academic survey respondents (n: 93)	Total population of academics (n: 1597)
Average no. of KTP projects completed	1.5	1.3

Table D-15: Start year of first completed KTP project

Start year of first project	Academic survey respondents (n: 93)	%	Total population of academics (n: 1,597)	%
2010	17	18%	402	25%
2011	9	10%	162	10%
2012	11	12%	142	9%
2013	18	19%	210	13%
2014	10	11%	192	12%

Start year of first project	Academic survey respondents (n: 93)	%	Total population of academics (n: 1,597)	%
2015	11	12%	187	12%
2016	9	10%	129	8%
2017	8	9%	124	8%
2018	0	0%	41	3%
2019	0	0%	8	1%
Total no.	**93**		**1,597**	

Satisfaction scores

Business partners

Table D-16: Business survey (n: 86): How effective do you think the following aspects of the set up of the KTP project(s) were on a scale of 1 (very ineffective) to 5 (very effective)?

	1	%	2	%	3	%	4	%	5	%	DK	%
Support from your KTP Advisor/KTA	2	2	4	5	8	9	25	29	45	52	2	2
Interaction with knowledge base during the development of the project	2	2	6	7	15	17	23	27	38	44	2	2
Forming the KTP partnership(s)	0	0	2	2	6	7	42	49	34	40	2	2
Finding and recruiting an appropriate Associate(s)	5	6	6	7	16	19	27	32	30	35	6	1
Developing the KTP project(s)	2	2	4	5	13	15	40	47	26	30	1	1

Table D-17: Business survey (n: 86): How effective do you think the following aspects of project implementation were on a scale of 1 (very ineffective), and 5 (very effective)?

	1	%	2	%	3	%	4	%	5	%	DK	%
Clear IP agreement between business and the knowledge base	2	2	2	2	9	11	23	27	44	52	5	6
Value of academic team's knowledge in relation to the project	2	2	9	10	5	6	27	31	43	50	0	0

	1	%	2	%	3	%	4	%	5	%	DK	%
Shared vision for the project amongst partners	1	1	3	3	14	16	27	31	41	48	0	0
Capabilities of the associate	7	8	1	1	12	14	27	31	39	45	0	0%
Interaction with the knowledge base post award	5	6	3	3	21	24	23	27	31	36	3	3
Delivery of activities in line with a project plan	4	5	6	7	14	16	37	43	25	29	0	0
Support from non-academic staff from the knowledge base organisation	5	6	7	8	17	20	24	28	23	27	10	11

Associates

Table D-18: Associate survey (n: 400): How satisfied were you on a scale of 1 (very unsatisfied) to 5 (very satisfied) with the following aspects of the KTP programme?

	1	%	2	%	3	%	4	%	5	%	DK	%
Training provided from Ashorne Hill	9	2	13	3	26	7	83	21	251	63	18	5
Support from the KTP Advisor/KTA	8	2	24	6	46	12	109	27	210	53	3	1
The recruitment and induction process for you onto the KTP	4	1	8	2	43	11	130	33	209	52	6	2
Monitoring requirements for the KTP	11	3	19	5	70	18	142	36	152	38	6	2

Table D-19: Associate survey (n: 400): How effective do you think the following aspects of project implementation were on a scale from 1 (very ineffective) to 5 (very effective)

	1	%	2	%	3	%	4	%	5	%	DK	%
Support from academic staff from the knowledge base organisation	9	2	30	8	54	14	109	27	196	49	2	1
Support from the business	23	6	31	8	67	17	107	27	171	43	1	0

	1	%	2	%	3	%	4	%	5	%	DK	%
Value of academic team's knowledge in relation to the project	15	4	27	7	57	14	131	33	168	42	2	1
Interaction with the knowledge base post award	38	10	30	8	79	20	86	22	136	34	30	8
Support from non-academic staff from the knowledge base organisation	14	4	26	7	76	19	122	31	129	32	31	8
Delivery of activities in line with a project plan	13	3	33	8	87	22	147	37	117	29	3	1
Shared vision for the project amongst partners	26	7	41	10	80	20	136	34	113	28	4	1

Knowledge base partners

Table D-20: Academic survey (n: 93): How satisfied are you with the following aspects of the KTP programme from a scale of 1 (very unsatisfied) to 5 (very satisfied)?

	1	%	2	%	3	%	4	%	5	%	DK	%
Support from your KTP Advisor/KTA	1	1	2	2	6	6	19	20	65	70	0	0
Approval process	0	0	1	1	8	9	35	38	42	45	7	8
Ease of forming the KTP partnership	0	0	3	3	9	10	43	46	35	38	3	3
Monitoring requirements	0	0	5	5	10	11	42	45	35	38	1	1
Application processes	0	0	3	3	13	14	38	41	34	37	5	5
Associate recruitment process	0	0	5	5	17	18	40	43	28	30	3	30
Marketing and promotion of KTPs	1	1	10	11	29	31	32	34	12	13	9	10

Table D-21: Academic survey (n: 93): How satisfied are you with the following aspects of project implementation on a scale of 1 (very unsatisfied) to 5 (very satisfied)?

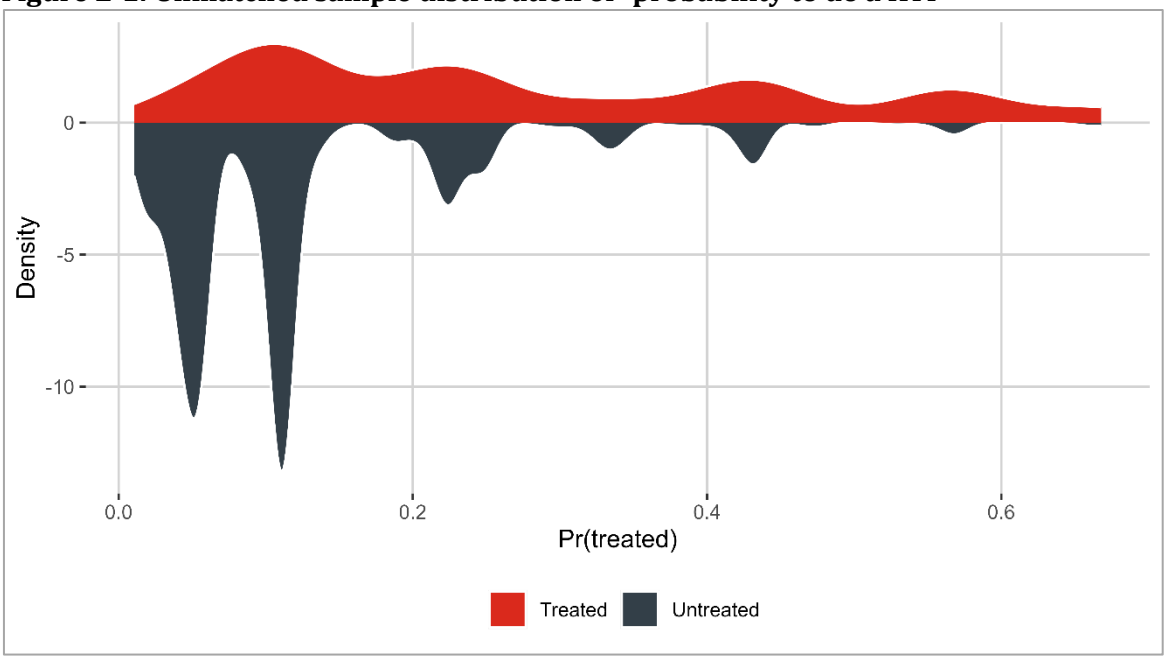
	1	%	2	%	3	%	4	%	5	%	DK	%
Partner commitment to the project	2	2	2	2	10	24	22	24	57	61	0	0
Shared vision for the project amongst partners	1	1	3	3	10	33	31	33	47	51	1	1
Well-structured project plan	1	1	2	2	8	42	39	42	43	46	0	0
Clear IP agreement	1	1	2	2	15	32	30	32	41	44	4	4

Annex E: Detailed methodology

Detail on Propensity Score Matching

E.1 Figure E-1 shows the estimated "propensity scores", i.e. the estimated probability for a business to be a KTP beneficiary based on their observable characteristics before the KTP was undertaken. The portion in red at the top shows the distribution of actual KTP businesses and the portion in dark grey below shows the distribution of the unmatched sample of potential comparison businesses. The graph clearly shows that the unmatched group of businesses has a much higher concentration around low propensity scores and that the overall distribution looks very dissimilar to the distribution of KTP businesses.

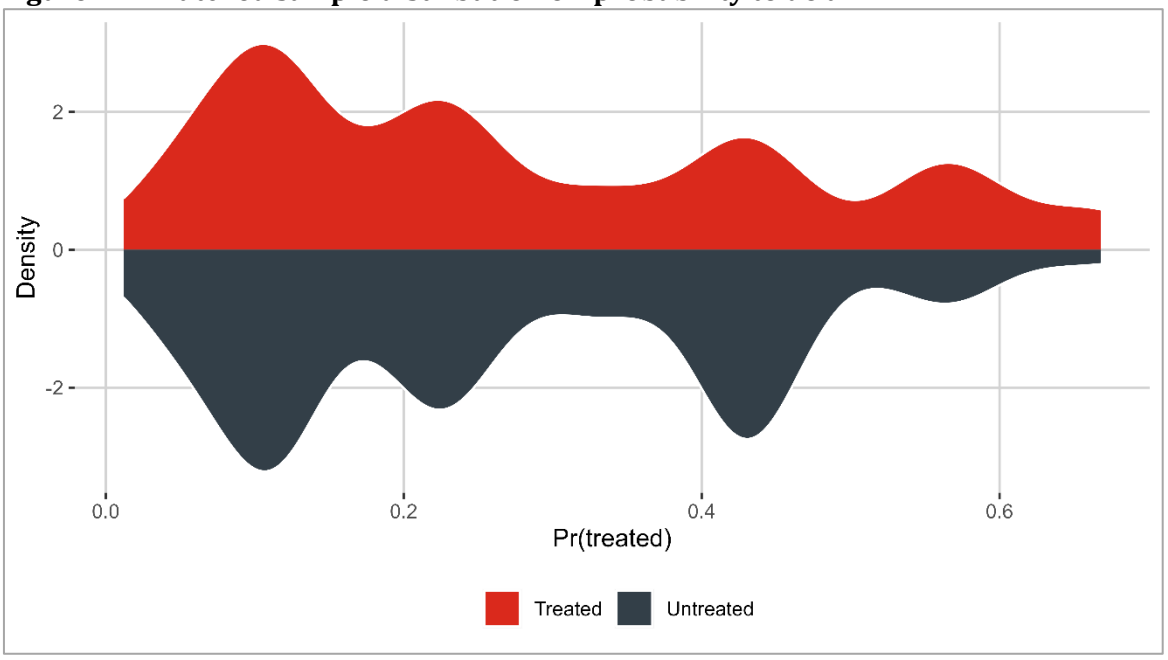
Figure E-1: Unmatched sample distribution of "probability to do a KTP"



Source: SQW analysis

E.2 Using the estimated propensity scores, we matched each KTP beneficiary to the non-beneficiary with the closest propensity score. Figure E-2 shows the distribution of propensity scores for KTP beneficiaries and the matched sample of non-beneficiaries.

Figure E-2: Matched sample distribution of "probability to do a KTP"



Source: SQW analysis

E.3 The graph shows that the matching was successful in reducing bias in observable characteristics of the distribution of KTP businesses against the wider business population. This was reaffirmed through tests of sampling bias between the treatment and comparison group presented in Table E-1 below:

Table E-1: Results from matched and unmatched sample tests

Variable	**Unmatched sample**	**Mean** Treated	**Mean** Control	**% bias** Treated v Control		**T test** Treated v Control	
	Matched	Treated	Control	**% bias**	**|%↓ bias|**	**t**	**p>|t|**
Credit rating	U	65.251	55.551	31.3		12.41	.000***
	M	65.251	64.189	3.4	89.1	.93	.352
Status company	U	.938	.973	-16.6		-7.22	.000***
	M	.938	.935	1.5	91.2	0.36	.721
Business age							
Young	U	.089	.292	-53.5		-17.56	.000***
	M	.089	.087	0.5	99.1	.18	.854
Old	U	.634	.358	57.4		21.53	.000***
	M	.634	.638	-0.8	98.7	-.22	.829
Pre KTP size							
Micro	U	.251	.369	-25.7		-9.27	.000***
	M	.251	.250	0.1	99.5	.04	.968
Medium	U	.192	.053	43.2		20.07	.000***
	M	.192	.160	9.8	77.3	2.37	.018**

Variable	Unmatched sample	Mean Treated	Mean Control	% bias Treated v Control		T test Treated v Control	
	Matched	Treated	Control	% bias	|%↓ bias|	t	p>|t|
Large	U	.107	.023	34.7		17.19	.000***
	M	.107	.096	4.5	87.1	1.04	.300
BH tracking							
Not tracked	U	.754	.755	-0.3		-.11	.916
	M	.754	.737	3.9	-1299	1.12	.264
Tracked	U	.180	.174	1.5		.57	.571
	M	.180	.195	-4.1	-172.5	-1.16	.248
Sector							
Construction	U	.033	.118	-32.7		-10.47	.000***
	M	.033	.034	-0.7	97.9	-0.29	0.772
Financial, insurance, or real estate	U	.028	.094	-27.7		-8.9	.000***
	M	.028	.024	2.0	92.7	0.87	.382
Manufacturing	U	.370	.113	62.8		27.6	.000***
	M	.370	.324	11.2	82.1	2.78	.006***
Transport & storage	U	.007	.024	-14.0		-4.45	.000***
	M	.007	.007	0.0	100.0	-0.00	1.000

Source: SQW analysis of ONS data

Table E-2: DiD analysis of impacts of KTP support by business size

	(1) Ln(employment)	(2) Ln(real turnover)	(3) Productivity
Medium and large companies only (100+ employees)			
KTP 1st year	0.0783*** (4.20)	0.0768** (2.46)	-49.05** (-2.04)
KTP 2nd year	0.103*** (4.57)	0.0893** (2.41)	-67.66* (-1.95)
KTP 3rd year	0.121*** (4.68)	0.152*** (3.71)	-52.08* (-1.76)
Post KTP 1st year	0.102*** (3.91)	0.108*** (2.82)	-28.86 (-1.48)
Post KTP 2nd year	0.102*** (3.28)	0.0960** (2.06)	-35.44 (-1.41)
Post KTP 3rd year	0.0610* (1.75)	0.0631 (1.31)	-33.27 (-1.20)
Micro and small companies (<100 employees) - *additional growth*			
KTP 1st year	0.00596 (0.23)	0.0287 (0.66)	14.18 (0.34)

	(1) Ln(employment)	(2) Ln(real turnover)	(3) Productivity
KTP 2nd year	0.0737** (2.40)	0.0861* (1.75)	355.4 (1.14)
KTP 3rd year	0.0989*** (2.92)	0.0697 (1.29)	401.6 (1.07)
Post KTP 1st year	0.105*** (3.18)	0.0782 (1.57)	-164.3 (-0.92)
Post KTP 2nd year	0.0371 (0.98)	0.0395 (0.71)	-197.6 (-0.92)
Post KTP 3rd year	0.0268 (0.67)	0.00995 (0.17)	-246.2 (-0.96)
Group trends			
Medium & large companies	-0.0434*** (-6.80)	-0.0366*** (-4.21)	16.57 (0.85)
Micro & small companies	0.0420*** (8.76)	0.0331*** (5.19)	-19.63 (-1.05)

t statistics in parentheses
** p < 0.1, ** p < 0.05, *** p < 0.01*
All regressions include time and business fixed effects and cluster-robust standard errors

Source: SQW analysis

Table E-3: Within sample regressions

	Ln(employment)			Ln(turnover)		
	1st Year post – year before	2nd Year post – year before	3rd Year post – year before	1st Year post – year before	2nd Year post – year before	3rd Year post – year before
KTP characteristics						
Second or Third KTP	0.0285 (0.66)	0.0511 (1.05)	0.0627 (1.15)	0.133** (2.00)	0.0842 (1.08)	0.126 (1.48)
KTP finished early (W3)	-0.0912** (-2.15)	-0.130** (-2.26)	-0.154** (-2.38)	0.117 (1.51)	-0.0411 (-0.45)	-0.0480 (-0.48)
Ln(grant value)	0.0256 (0.53)	0.0331 (0.46)	0.0745 (0.92)	-0.0136 (-0.14)	-0.0399 (-0.35)	0.0780 (0.62)
Length of project (months)	-0.00211 (-1.02)	-0.00106 (-0.33)	-0.00193 (-0.54)	0.0128*** (3.01)	0.00878* (1.73)	0.00631 (1.13)
Ln(distance between KB and business)	-0.0184* (-1.69)	-0.0181 (-1.51)	-0.0145 (-1.08)	-0.00444 (-0.27)	-0.00940 (-0.49)	-0.0215 (-1.03)
KB partner institution characteristics						
Russell group	0.0500 (1.17)	0.0180 (0.39)	0.00513 (0.10)	-0.0907 (-1.45)	-0.0522 (-0.71)	-0.0573 (-0.73)

	Ln(employment)			Ln(turnover)		
	1st Year post – year before	2nd Year post – year before	3rd Year post – year before	1st Year post – year before	2nd Year post – year before	3rd Year post – year before
University Alliance	-0.00273 (-0.06)	0.0126 (0.22)	-0.0669 (-1.05)	0.0671 (0.86)	0.0960 (1.05)	0.0950 (0.96)
Million Plus	-0.0362 (-0.72)	-0.00664 (-0.10)	-0.0635 (-0.87)	0.0493 (0.55)	0.0850 (0.81)	0.108 (0.95)
Guild HE	0.0342 (0.32)	-0.0212 (-0.11)	0.0498 (0.23)	0.165 (0.62)	0.0850 (0.27)	0.145 (0.44)
Post 92 Poly	0.000358 (0.01)	-0.0301 (-0.58)	0.000600 (0.01)	0.00605 (0.09)	0.0190 (0.23)	-0.0172 (-0.19)
Business characteristics						
Status is company	0.0706 (1.34)	0.0920 (1.10)	0.0966 (1.04)	0.0811 (0.71)	0.121 (0.91)	0.137 (0.95)
Beahurst tracked	-0.123 (-1.64)	-0.157** (-2.14)	-0.221*** (-2.70)	-0.108 (-1.09)	-0.113 (-0.98)	-0.195 (-1.53)
Beauhurst not tracked	-0.149** (-2.19)	-0.216*** (-3.21)	-0.296*** (-3.95)	-0.101 (-1.10)	-0.237** (-2.22)	-0.251** (-2.16)
Business age in 2020	-0.00346** (-2.50)	-0.00416* (-1.68)	-0.00340 (-1.25)	-0.00220 (-0.65)	-0.00282 (-0.71)	-0.00236 (-0.56)
Business age in 2020 is young	0.278* (1.88)	0.402*** (3.49)	0.317** (2.41)	-0.0841 (-0.54)	0.194 (1.06)	-0.132 (-0.65)
Business age in 2020 is middle	0.0368 (0.82)	0.0491 (0.86)	0.103 (1.62)	0.0555 (0.71)	0.0890 (0.97)	0.142 (1.44)
Number of grants received	-0.000961 (-0.40)	0.000153 (0.05)	0.00274 (0.85)	-0.00114 (-0.29)	0.0000399 (0.01)	0.000693 (0.14)
Business size before KTP						
Micro	0.0104 (0.09)	0.00982 (0.12)	-0.118 (-1.25)	-0.0749 (-0.67)	-0.0667 (-0.51)	-0.381*** (-2.62)
Small	-0.0913 (-0.83)	-0.118 (-1.35)	-0.283*** (-2.84)	-0.165 (-1.39)	-0.160 (-1.15)	-0.470*** (-3.04)
Medium	-0.153 (-1.40)	-0.184* (-1.93)	-0.362*** (-3.33)	-0.219* (-1.69)	-0.196 (-1.30)	-0.513*** (-3.04)
Large	-0.0963 (-0.87)	-0.113 (-1.04)	-0.245** (-1.99)	-0.137 (-0.94)	-0.0976 (-0.57)	-0.437** (-2.29)
Region						
East of England	-0.0171 (-0.34)	-0.0113 (-0.13)	-0.0302 (-0.32)	0.000258 (0.00)	0.0361 (0.27)	0.160 (1.09)
London	0.110 (1.50)	0.133 (1.64)	0.0952 (1.07)	0.0517 (0.47)	0.0770 (0.60)	0.126 (0.91)

	Ln(employment)			Ln(turnover)		
	1st Year post – year before	2nd Year post – year before	3rd Year post – year before	1st Year post – year before	2nd Year post – year before	3rd Year post – year before
North East England	-0.0218 (-0.24)	0.0411 (0.43)	0.0511 (0.48)	-0.0540 (-0.42)	-0.0327 (-0.22)	0.0988 (0.60)
North West England	0.0418 (0.71)	0.0186 (0.24)	-0.0374 (-0.43)	0.0626 (0.58)	0.0963 (0.77)	0.167 (1.24)
Scotland	0.118* (1.85)	0.131* (1.71)	0.181** (2.14)	0.00947 (0.09)	-0.0810 (-0.67)	-0.0164 (-0.12)
South East England	0.0502 (0.93)	0.0822 (1.10)	0.0823 (1.00)	0.0425 (0.42)	0.0544 (0.46)	0.181 (1.42)
South West England	0.0589 (0.96)	0.0555 (0.66)	0.0498 (0.53)	0.0604 (0.52)	-0.0202 (-0.15)	0.106 (0.72)
Wales	0.0599 (0.58)	0.0605 (0.64)	0.105 (1.00)	0.136 (1.05)	0.198 (1.31)	0.248 (1.53)
West Midlands	0.0356 (0.67)	0.0420 (0.50)	0.0961 (1.04)	-0.0526 (-0.46)	0.0516 (0.39)	0.152 (1.05)
Yorkshire and the Humber	-0.0106 (-0.17)	-0.0335 (-0.39)	-0.0448 (-0.48)	-0.0395 (-0.34)	-0.0919 (-0.68)	-0.00991 (-0.07)
KTP department code						
BIO	-0.0270 (-0.34)	-0.0335 (-0.39)	-0.0448 (-0.48)	-0.268* (-1.89)	-0.455*** (-2.69)	-0.808*** (-4.44)
CEM	0.0629 (0.72)	-0.0375 (-0.36)	-0.0833 (-0.72)	0.213 (1.28)	0.158 (0.81)	0.0692 (0.33)
CHE	0.110 (1.13)	0.214** (2.03)	0.202* (1.75)	0.118 (0.83)	-0.00759 (-0.05)	0.00939 (0.05)
COS	0.0821 (1.37)	0.131** (2.00)	0.135* (1.84)	0.0849 (0.96)	0.170 (1.63)	0.136 (1.19)
CVE	0.00120 (0.01)	0.0236 (0.25)	-0.0661 (-0.62)	-0.105 (-0.80)	-0.0465 (-0.30)	-0.150 (-0.91)
DES	0.00368 (0.04)	0.0330 (0.32)	0.0119 (0.10)	0.135 (0.94)	0.197 (1.18)	0.220 (1.23)
ELE	0.0378 (0.50)	0.0545 (0.62)	0.00929 (0.10)	0.178 (1.49)	0.137 (0.98)	0.0699 (0.47)
ENG	0.0639 (1.13)	0.100 (1.54)	0.0451 (0.62)	0.0875 (0.99)	0.0975 (0.95)	-0.0417 (-0.37)
MAF	0.177 (1.12)	0.125 (0.89)	0.0144 (0.09)	-0.0309 (-0.16)	-0.0346 (-0.15)	-0.196 (-0.79)
MAN	-0.00281 (-0.04)	0.0375 (0.47)	-0.0554 (-0.63)	-0.0335 (-0.31)	-0.110 (-0.87)	-0.228* (-1.66)
MAT	0.0594	0.164	0.109	-0.156	0.0697	-0.00845

	Ln(employment)			Ln(turnover)		
	1st Year post – year before	2nd Year post – year before	3rd Year post – year before	1st Year post – year before	2nd Year post – year before	3rd Year post – year before
	(0.41)	(1.64)	(0.99)	(-1.15)	(0.44)	(-0.05)
MED	0.0653 (0.93)	0.0750 (0.79)	0.0733 (0.70)	0.209 (1.62)	0.139 (0.92)	0.0949 (0.59)
MHS	0.0410 (0.40)	0.0995 (0.81)	0.00521 (0.04)	0.135 (0.81)	0.113 (0.58)	-0.128 (-0.61)
MPE	0.0579 (0.83)	0.0867 (1.04)	0.0585 (0.62)	0.107 (0.94)	0.0880 (0.66)	0.0399 (0.27)
PHY	0.0480 (0.39)	0.0999 (0.69)	-0.0881 (-0.54)	0.440** (2.24)	0.506** (2.21)	0.203 (0.81)
Observations	1075	1068	1019	1069	1062	1013
Degrees of freedom	46	46	46	46	46	46

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Source: SQW analysis

SQW

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