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Evaluation of ICURe

Final Report

Ipsos MORI

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Executive Summary

Ipsos MORI was commissioned to undertake an evaluation of the Innovation to Commercialisation of University Research (ICURe) programme by Innovate UK in October 2018. This report sets out the findings of the evaluation.

ICURe

The ICURe programme was established in 2013 and aims to address a set of system failures that inhibits the commercialisation of academic research. It provides funding and commercialisation training to teams of University researchers (comprising a Principal Investigator (PI), Early Career Researcher (ECR), a Technology Transfer Officer (TTO) and a Business Advisor) with research outputs that are potentially commercially viable, enabling them to conduct focused market validation activities. The findings from these activities are then presented to a panel of relevant experts that advise on the most appropriate commercialisation strategy. The scheme has also provided grants for some teams that were advised to establish a commercial vehicle (a spin-out) to exploit the underlying intellectual property, in effect providing seed capital to accelerate the development and growth of the company.

Initially, the ICURe programme was delivered by the SETSquared partnership of academic institutions, with funding from the Innovate UK, Higher Education Investment Fund (HEIF) and from the Aid for Start-Ups Programme. The programme was extended in 2017 with BEIS funding, and expanded in 2018 to include two new delivery partners, Warwick University delivering the Midlands cohorts, and Queen's University Belfast delivering the North and North-West cohorts.

Effectiveness of delivery

- Participation in the ICURe programme by academic institutions has widened significantly over the 15 cohorts. Demand for the programme has proven robust to the extension and expansion of the programme, and there have been no apparent adverse effects on the quality of applications received. There may be opportunities to secure deeper engagement with institutions that are comparatively new to the programme.
- There are no obvious weaknesses in the design of the programme, and the quality of delivery has been maintained through its extension and expansion. The evaluation did raise some questions as to how far the level of technical enterprise education received by ECRs ahead of their involvement in the programme enabled them to tackle some elements of the process of developing business models and optimal commercialisation strategy. It is unlikely that adjustments to the ICURe programme could meet the appetite for this type of training.

Recommendation: Although the training provided through the Bootcamp was viewed positively by participating teams, it does not act as a substitute for comprehensive enterprise education. UKRI may wish to consider whether there may be are broader levers at its disposal that could raise the level of commercialisation skills amongst ECRs (for example, encouraging PhD students to complete enterprise education modules during their programmes). UKRI could also consider some form of supplementary post-ICURe commercialisation training for ECRs (where appropriate) focused on more technical business skills to maximise the quality of the outcomes attained.

- The findings of the study reproduce the positive findings from the evaluation of the first six cohorts and indicates that participation in the programme stimulated substantial efforts to validate the value proposition for the underpinning the

technology that would not have been possible otherwise. These efforts were viewed as instrumental in shaping the later commercialisation of projects.

- There has been a shift in the advice made to teams since the last evaluation, with a fall in the share of teams advised to spin-out, and a significant increase in the proportion of teams advised to pursue a licensing pathway or to conduct further or sponsored research. Teams did not always react positively to advice to license the technology – partly because they typically viewed a spin-out as the optimal pathway, but also because they were conscious of the comparatively limited availability of post-programme support available to achieve such an outcome.
- The extension of the programme led to a regionalisation of the delivery that reportedly brought benefits by enabling its delivery to be customised to meet local needs. This was, however, accompanied by a fragmentation of certain aspects of the programme delivery, and there may be benefits in strengthening central co-ordination functions to deal with those aspects better handled from the centre.

Recommendation: The regionalisation of the ICURe programme has also created some challenges that might best be addressed by a central co-ordinating partner. UKRI should consider where there may be benefits in strengthening the role of a central delivery partner in relation to both co-ordination and maintenance of networks (e.g. of investors and business advisors) where may be increasing returns to scale.

Commercialisation impacts

- The evidence reinforces the findings of the evaluation of the first six cohorts and suggests that the programme has motivated significant levels of commercialisation activity within participating HEIs and its effectiveness in this regard has proven robust to its extension and expansion. Teams participating in the programme were substantially more likely to pursue all different routes to commercialisation as well as seek further public or private funding to develop the technology further. Participating teams also made greater progress in resolving key issues involved in defining the optimal business or commercialisation model.
- Teams participating in the programme outperform non-participating teams in types of outcomes considered in this study. Spin-outs were the most frequent outcome from the programme – with 35 percent of all participating teams going on to found a spin-out, relative to 12 percent of non-participating teams. Licensing outcomes were, by contrast, comparatively infrequent and the success rate was comparatively low given the share of teams advised or moving on to pursue a licensing pathway. Participating teams also outperformed non-participating teams in terms of securing further private or public funding to progress the development of the technology underpinning their application to the programme.
- The programme had a significant impact on the number of spin-outs established by participating teams, and it was estimated that between 49 and 55 spin-outs were incorporated that would not have been in the absence of ICURe by January 2019. Participation in the programme also appeared to have substantial impacts on the quality of spin-outs established - those established by participating teams grew more rapidly, were more likely to have attracted external equity funding, and attained higher valuations than those established by teams declined a place on the programme. The increase in the market valuation of spin-outs attributed to ICURe is estimated at between £62.5m and £69.9m).
- The availability of grant funding through the Aid for Start-Ups and Follow-On Funding appeared (on an indicative basis) to play a significant role in accelerating the growth and development of spin-outs.

Recommendation: Public support to help capitalise spin-outs appears to have a substantial impact in accelerating their growth. It is recommended that UKRI retains this element of the programme in any national roll-out, recognising that some adjustments to the model may be needed to reach a design that maximises value for money.

There are unanswered questions as to the long-term impact of the transition from Aid for Start-Ups to Follow-On Funding. While the requirement to find match funding up front appears to have slowed the progression of spin-outs, it does not appear to have led to a reduction in the overall number of spin-outs incorporated. However, it is too early to judge how far reduced speed has had a long-term impact on the growth or development of the spin-out companies established.

Recommendation: UKRI should closely monitor the on-going growth of firms receiving Follow-On Funding before reaching a judgement as to whether the optimal model of financial support has been found. UKRI should also consider whether alternative financial instruments could be considered – given the market failure rationale for supporting spin-outs with early stage financing (i.e. missing markets), a natural remedy would be to supply some form of patient equity funding directly – which could, in the long-term, provide some form of revolving fund with future investments funded by future profitable exits. Convertible loans could be another option to consider.

- The impact of ICURe programme on licensing agreements was less significant. While the programme appeared to motivate participating teams to begin the process of engaging licensees in larger numbers, the outcomes of these efforts were less significant and no more licensing agreements were reached than would have been achieved in the absence of the programme.

Recommendation: The issues encountered by teams in progressing licensing outcomes are complex and it is clearly difficult to disentangle those technologies that did not commercialise because they were not sufficiently commercially valuable and those that had commercial potential. However, issues relating to the availability of post-ICURe funding and the maturity of technologies appear to be a constraining factor, raising questions of how teams can best be supported once their involvement in the programme comes to an end. The Knowledge Transfer Partnership programme appears to offer one possible 'off-the-shelf' instrument through which this might be achieved – though this does rely on the ECR making contact with potential licensees through the market validation process.

The issues involved are complex and may have broader relevance in the context of wider research and other funding made available to support the commercialisation of academic research (e.g. Impact Accelerator Accounts). UKRI may find value in commissioning specific research into the broader challenges faced by academic institutions in licensing technologies and understanding the common factors underpinning successful and unsuccessful attempts to reach licensing agreements with commercial partners.

It is also recommended that UKRI consider how the Options Roundabout forms its advice for licensing and whether it may be helpful for the panel to consider in more depth further stages of technological development that could aid the team increase their chances of securing a licensing agreement or maximise the commercial values attained.

- The ICURe programme has offered good value for money, with an estimated benefit to cost ratio of between £3.43 to £3.84 per £1 spent. This reproduces the findings of the prior evaluation focusing on the first six cohorts based on a more robust set of data, giving greater confidence in the judgement reached in the preceding study that the programme is a viable candidate for a national roll-out. However, it should be noted that there are some uncertainties with these results. Firstly, it was not possible to control for possible differences between successful and unsuccessful applicants that could bias results, and it is possible that the underpinning statistical analysis has overstated the impact of the programme.

Secondly, the results assume that investors can effectively price the risks and potential returns associated with the future commercialisation of the technology (which may not be the case).

Wider benefits

- Participating ECRs rated their post-ICURe skill capability index to be 10 points higher than those who did not participate in the programme. The most highly rated skills included idea identification, awareness of commercial capabilities and customer relationship building. Qualitative evidence suggests that ECRs with little commercial experience prior to ICURe were able to significantly improve a range of skills including the understanding of the market, confidence, and the ability to expand networks.
- Career prospects: evidence is mixed around participants' career prospects. Most participants (77 percent) are still working within the same academic institution as when they made their application. However, 11 percent of participants are now employed within the created spin out. Stakeholder interviews and case studies suggested that ECRs experienced broadened career opportunities whilst PIs were less likely to leave their role at universities.
- Both PIs and ECRs benefited from the skills gained through ICURe, specifically in terms of broadening the scope of their research and becoming more commercially oriented about future research programmes.
- ICURe contributed to reshape TTOs (with 58 percent of respondents noticed some form of change). This alleviated previous resource constraints on TTOs during the application stage and allowed TTOs to improve both their project management and networking skills.
- ICURe's impact on changing academic culture was perceived as moderate. Changes in processes to commercialise research were reported more often by those who had participated in the first six cohorts which suggests that changes in academic culture might take some time to materialise. Qualitative evidence suggested that the reputational effects of the institution were considered one of the main incentives to participate, and interviewees perceived an increase in commercial awareness within universities. However, this was not considered to be purely attributable to ICURe, as the REF also contributed to the increased importance placed upon research impact.

1 Introduction

Ipsos MORI was commissioned to undertake an evaluation of the Innovation to Commercialisation of University Research (ICURe) programme by Innovate UK in October 2018. This report sets out the findings of the evaluation.

1.1 ICURe

The ICURe programme was established in 2013 and aims to address a set of system failures that inhibits the commercialisation of academic research. It provides funding and commercialisation training to teams of University researchers with research outputs that are potentially commercially viable, enabling them to conduct focused market validation activities. The findings from these activities are then presented to a panel of relevant experts that advise on the most appropriate commercialisation strategy. The scheme has also provided grants for some teams that were advised to establish a commercial vehicle (a spin-out) to exploit the underlying intellectual property, in effect providing seed capital to accelerate the development and growth of the company.

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1.2 Evaluation aims and objectives

As described in the invitation, the evaluation aims to assess the implementation of ICURe pilot and provide evidence as to the suitability of the pilot for expansion and national roll-out. The following key questions were set for the evaluation (adapted from the Invitation to Tender):

- Has the programme acted as an accelerator speeding up commercialisation processes?
- Has the programme enabled or created a cultural behavioural change in creating entrepreneurial intent in the academic sector? What is the behavioural additionality?
- Has the programme improved the entrepreneurial skills or the intent to commercialise amongst those involved in the programme? What has been the impact on the perception of commercialisation in different universities involved?
- Success of the programme in turning research output into the marketplace or further research (including new ventures, product licensing, and development of new products and services)?
- What is the programme's impact on the UK economy?

1.3 Evaluation scope

The programme is delivered in sequential cohorts, and all cohorts that were finished at the time of commissioning were included in the scope of this evaluation. That is:

- Cohorts 1 to 13 that were delivered by the SETSquared Partnership;

- The first cohort delivered by Warwick University in the Midlands region, Midlands-A (Mid-A); and,
- The first cohort delivered by Queen’s University Belfast in the North and North-West regions (including Scotland and Northern Ireland), North-and-North-West-A (NxNW-A).

The evaluation began at an early stage of the process of involving additional delivery partners. While some evidence was gathered on the issues encountered in extending the ICURe programme to new delivery partners, it was arguably too early in this process to make a comprehensive judgement on the robustness of the expansion process as insufficient time had elapsed to allow participating teams to achieve their commercialisation objectives.

1.4 Method

An evaluation of the first 6 cohorts of the programme was conducted in 2016/17. Tools and methodology for this evaluation build on those of the previous evaluation, though they have been updated to ensure they remain fit for purpose, and comparisons are made between the first six and later cohorts throughout to explore both how far the quality of the delivery model has been maintained over time and evidence of longer terms impacts. Evidence to support the evaluation was collected using the following methods:

- **Analysis of monitoring information:** An analysis of the available application and monitoring data was undertaken to provide an understanding of the teams that applied to participate and the outcomes achieved by teams awarded places on the programme.
- **Stakeholder consultations:** Consultations with a group of ten stakeholders in the programme were completed to obtain views on the effectiveness of ICURe. These focused on testing the programme rationale, understanding the issues academic institutions face when commercialising University research, and effects of the programme. The consultations also aimed to gather views and feedback on the recent extension of the programme to two new delivery partners. The three partners involved in the delivery of the programme were consulted as part of the study, as well as a range of TTOs that have participated in the ICURe programme. It should be noted that some stakeholder groups, such as the Options Roundabout panellists, could not be covered as part of this research.
- **Case studies:** Eight in-depth case studies of individual projects were completed to provide qualitative insight into the benefits of participating in the programme. These involved a review of application and monitoring information associated with the project and detailed interviews with all team members (where feasible). The case studies were selected to cover a range of advice given by the Options Roundabout and outcomes achieved to facilitate comparative analysis and explore the role of the programme in producing its intended effects under different conditions. It should be noted that the participation of the teams in the programme was comparatively recent in many cases, and as such, commercialisation outcomes were often nascent.
- **Applicant survey:** A telephone survey was conducted with applicants to the ICURe programme to provide quantitative evidence on the impact of ICURe. The sample included a group of applicants that were not awarded places on the programme (henceforth referred to as ‘non-participants’) that served as a counterfactual to support the identification of the causal effects of the programme. Those surveyed in the preceding evaluation conducted in 2016/17 were also included in the sampling frame to provide evidence of the long-term impact of the scheme. The sampling frame comprised 607 valid contacts. The final sample achieved was 383 (a response rate of 50 percent), with 283 participants and 100 non-participants responding to the survey.

- **Analysis of secondary data:** Records of teams applying for a place on the ICURe programme were linked to administrative records of new company registrations held by Companies House to validate details of the number of spin-outs established and explore their subsequent growth (as far as practicable based on the limited information set out in annual accounts for small companies). Records of the spin-outs established were also linked to Pitchbook, which provides tracks equity investments made in innovative firms and associated exits.
- **Econometric analysis:** An econometric analysis exploring the causal effects of the programme was completed using difference-in-difference methods (using non-participants as a comparison group). It should be noted that while this analysis controls (as far as possible) for observed and some unobserved differences between teams and the innovations forming the focus of their applications, participating teams may have taken part in other local programmes that have also contributed to the results achieved. While the findings control for the effects of some support available to participating teams, the impacts reported may not be attributable to ICURe alone where teams participating in other commercialisation support programmes.

1.5 Structure of this report

The remainder of this report is structured as follows:

- **Section 2** provides an overview of ICURe and its intended effects.
- **Section 3** focuses on the short terms effects of the individual components of the programme.
- **Section 4** examines the commercialisation effects of ICURe.
- **Section 5** considers the potential wider benefits associated with the programme.
- **Section 6** concludes and identifies a set of lessons from the delivery of the programme.

Annex A provides details of the econometric analysis supporting this report and Annex B provides details of the case studies completed as part of the study.

2 ICURe

This section provides an overview of the ICURe programme. This includes an overview of the rationale for the programme, and an outline of the mechanisms by which the ICURe programme was expected to deliver its intended outputs, outcomes and subsequent impacts. The analysis below provides an overall framework for the evaluation of the programme and the interpretation of the evidence collected, drawing on the academic research base and ICURe programme documentation and monitoring records.

2.1 Overview of the programme

The Innovation to Commercialisation of University Research (ICURe) programme was launched in 2014 in response to the issues identified with the commercialisation of UK academic research in the House of Commons Science and Technology Committee investigation, 'Bridging the Valley of Death'¹. The ICURe programme has the following objectives:

- To increase the probability of the successful commercialisation of academic research, options signposting and the spinning out of high potential new companies.
- To develop entrepreneurial skills and market knowledge in a new cadre of Early Career Researchers.
- As a programme, the initiative also aims to provide lessons on how a national rollout could be optimally implemented.

The programme involves a programme of training and the implementation of a hypothesis driven business model discovery process. It draws on lean start-up principles, whereby start-up companies develop their businesses through experimentation and testing of market opportunities, collection of customer feedback and quick, iterative design and development (loosely based on the US I-Corps initiative)². Participation in the programme culminates in a presentation of the findings of a market validation exercise to an expert panel who provide advice on the optimal commercialisation strategy. At this point, some project teams may be invited to apply for Follow-On Funding (Aid for Start-Ups before April 2018). Under these new arrangements, Innovate UK provides up to £0.3m in grant aid provided the project team raises 30 percent in match funding.

The intervention is delivered to project teams that include an Early Career Researcher (ECR, who leads the market validation exercise and forms commercialisation plans and was usually involved in the research group led by the PI prior to ICURe), a Principal Investigator (PI, responsible for developing the knowledge underpinning commercialisation efforts, usually with the support of the ECR), a business advisor to the team, and an officer from the relevant Technology Transfer Office (to assist the team and oversee the commercialisation process). A total of 188 teams across had participated in the programme over 15 cohorts by mid-2018, and 47 academic institutions had been engaged.

2.2 Rationale

The UK has an internationally competitive scientific research base, accounting for 16 percent of the world's most highly cited articles. Some studies also suggest that the UK performs relatively well to international comparators in commercialising University research outputs via spin-outs and licensing. However, given the social and economic benefits associated with commercialisation of research, many initiatives have been introduced to address relevant barriers:

¹ UK Government (2013). Bridging the Valley of Death-Improving Commercialisation to Research.

² https://www.nsf.gov/news/special_reports/i-corps/index.jsp. Date accessed: 28/10/16.

- **Commercial awareness and capability of academic personnel:** There is evidence that the skills of academics are important in achieving optimal commercialisation outcomes. Several papers link early stage firm survival and economic success with the quality of both academic and commercially oriented human capital available for management roles in early stage ventures, indicating academics often lack either technical expertise or entrepreneurial skills.³ The variety and frequency of interactions between researchers and industry are also influenced more by individual characteristics than the characteristics of their host departments or universities, with researchers holding previous industry collaboration experience more likely to engage in future industry collaborations.⁴
- **Bounded networks in academic research:** The links and overlaps between academic networks within institutions or research fields and business communities may be fragmented. Weaknesses in these networks are likely to introduce delays into the commercialisation process or introduce lock-in effects for sub-optimal technologies, resulting in the slow realisation of economic benefits.⁵
- **Incentives:** The set of rules and conventions that govern academic institutions as well as reward systems may impede innovation and commercialisation activity. Several studies exploring barriers to commercialisation have identified insufficient rewards from engaging in such activity as an obstacle. Dowling highlighted that pressures to publish can create tensions with business engagement for universities⁶ and one paper suggests that academic founders of spin-outs dedicate relatively little of their time to the development of spin-outs and may explain why many do not grow or become sustainable.⁷ However, a 2016 survey examining how criteria influencing promotions have changed suggests that while the importance of research and publications remains critical, more now see working with business and industry as an important factor compared with 2008/09.⁸ This may reflect wider changes in incentives in the UK landscape over the past decade with the introduction of pathways to impact in grant award decisions, consideration of impact in research quality assessments driving the allocation of block grant funding, and the growing efforts to affect culture change that make this type of activity be seen as more legitimate (underpinned by programmes such as HEIF and Research Councils Impact Acceleration Accounts).
- **Financial market imperfections:** The commercialisation of research outputs can carry a high degree of risk. Several financial market failures have been identified that constrain availability of capital for start-ups and potentially justify public intervention. These include issues of adverse selection if investors cannot observe the true risk of a project or company, or accurately value their intangible assets. Moral hazard issues also arise as it is costly to monitor activity after an investment is made, deterring small investments. There is also a set of broader market failures and barriers which pervade this area such as knowledge spill-overs from innovations that are not valued by investors.⁹
- **Other complementarity failures:** National, regional and local innovation systems may also fail to provide the complementary assets required to commercialise academic research in an optimal manner. For example, complementary technologies may fail to emerge in a timely fashion (and may exhibit public good qualities themselves). Additionally,

³ See Criaco et al. (2014), Shane and Stuart (2002) and Colombo and Piva (2012).

⁴ D'Este, P. & Patel, P. (2007). University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy*. 36(9): 1295–1313

⁵ Department for Business, Innovation, and Skills (2014) *The Case for Public Support for Innovation*.

⁶ Dowling, A., 2015. *The Dowling Review of Business-University Research Collaborations*.

⁷ Hewitt-Dundas, N., 2015. *Profiling UK university spin-outs*. Enterprise Research Centre, Warwick, UK

⁸ Hughes, A., Lawson, C., Kitson, M., Salter, A., 2016. *The Changing State of Knowledge Exchange: UK Academic Interactions with External Organisations 2005-2015*. National Centre for Universities and Business, London, UK.

⁹ Bravo-Biosca (2014). *Access to finance for innovation: Rationales and risks of public intervention*.

weaknesses in local factor markets may inhibit exploitation attempts (e.g. the extent to which an appropriate commercial team can be appointed will be linked to the strength and depth of local labour markets).

The ICURe programme was introduced to help overcome some of these barriers and market failures. The table below maps the mechanisms involved in the programme to the barriers identified above and identifies the potential residual constraints and dependencies that are not directly addressed by the scheme.

Table 2.1: Mapping of ICURe mechanisms to market failures and barriers to commercialisation

Market failure or barrier	ICURe mechanisms	Constraints and dependencies
Commercial awareness and capabilities of academic personnel	The core focus of the ICURe is to raise the commercial awareness and capabilities of participating teams. The programme involves a market validation exercise in which the teams involved make contacts with potential customers to establish levels of demand for the innovation and adjustments that could be made to increase its value. The Business Model Canvas aims to give teams understanding of the considerations involved in developing an optimal business model and commercialisation strategy.	While the scheme aims to directly address issues associated with the commercial skills of academic staff, it does not seek to give teams the full breadth of skills required to successfully commercialise technologies. Wider support from the University and its Technology Transfer Office – either in appointing a commercial team or seeking and securing licensing agreements, are likely to be critical in supporting the anticipated outcomes from the programme.
Bounded networks	The market validation exercise and the process of developing a business plan forces the acquisition of new relationships outside of the networks teams are accustomed to. New links may also have benefits in enabling team members to more rapidly evaluate the commercial potential of future innovations and engage more effectively with industry.	The market validation exercise is focused on understanding the needs of potential customers. Teams also will need to build relationships with a wide range of other organisations (such as manufacturers, distributors, or competitors). This may not be directly supported by ICURe, though it is anticipated that the skills acquired may ease this process.
Incentives	Changes in commercial awareness and capabilities of academic personnel will increase the value they attach to commercialisation of research and their associated research agenda when they return to academic research. It is hoped that this will begin a process of cultural change, ultimately increasing incentives to engage in research with commercial applications.	ICURe does not directly alter institutional incentives, and it can be anticipated that any process of cultural change mediated by the programme will be take time to embed. It is likely that external factors may be equally – if not more important – in mediating changes in incentives involved. Again, there may substantial inter-institutional variability in how far cultural norms are amenable to change.
Financial market imperfections	The provision of seed funding through Follow-On Funding (previously Aid for Start-Ups) for some teams directly addresses issues of imperfections in financial markets. The availability of this funding enables those involved to focus on progressing commercialisation rather than seeking venture finance in the early stages of the spin-out. The capitalisation of spin-outs may also make it more straightforward to attract an appropriate management team or follow-on finance from business angel investors or venture capital funds.	Local availability of venture capital act as constraint on commercialisation. These challenges will be more acute where the costs involved are high and long-term, potentially forcing teams to pursue licensing pathways and suboptimal realisation of value for universities and the UK. Where teams have accessed Follow-On Funding or Aid for Start-Ups or other finance to begin the commercialisation process, challenges may be encountered in accessing follow-on finance (resulting in abandonment of technologies or slow progress).
Other complementarity failures	ICURe does not involve a mechanism to address local weaknesses in capital, labour and technology markets that may inhibit the commercialisation of research, but it may address these weaknesses indirectly. For example, the creation of a pipeline of potential investable technologies or commercial vehicles may work to attract the required assets to local areas.	While ICURe may attract complementary assets to local economies, it is unlikely that these effects will always be sufficiently strong to overcome the prevailing forces of agglomeration that attract capital and labour to those areas with significant economic mass. As such, the impacts of ICURe could be expected to vary in line with the character and strengths of local innovation systems.

2.3 Evaluation framework

2.3.1 Inputs

Delivery of the ICURe programme to date has involved the following inputs:

- **Core programme delivery costs:** A total of £5.2m in funding had been spent in terms of core programme delivery costs for cohorts one to thirteen, Mid-A and NxNW-A by December 2018. The bulk of these resources have been used to cover the costs incurred by participating teams (who received grants of up to £35,000, largely to cover the salary and travel costs of the ECR and travel costs of other team members).
- **Aid for Start-Ups:** Eighteen teams were awarded Aid for Start-Ups funding were awarded by the end of 2017/18. The total grant offered was £7.8m.
- **Follow-On Funding:** Nineteen awards for Follow-On Funding were since April 2018 when this scheme replaced Aid for Start-Ups Funding. The value of these awards totalled £4.0m.

In addition to these expenditures, complementary in-kind resources, valued at £719,000, were brought to the programme in the form of the time inputs of Technology Transfer Offices (TTOs) associated with participating academic institutions¹⁰. TTOs were tasked with managing their institutions' involvement in the programme, promoting the programme to academic staff, and supplying individual Technology Transfer Officers to support project teams. In addition, PIs and business advisors involved in each selected project team have supplied their services and time on a pro-bono advisory basis (though in some cases universities have paid a day rate to cover the costs of their involvement).

2.3.2 Activities

The inputs described above have supported the following programme delivery activities:

- **Application and assessment process:** An application is made by project teams in which they describe their technology, its commercial potential, the proposed team, and their motivations for applying. A total of 412 applications were received, 188 teams awarded places on the programme, with 185 successfully completing. Queens University Belfast have moved the entire team formation and application process online to support application management. They deployed an online platform "crowdicity", allowing co-creation of applications as well as early interactions between project teams and business advisors in advance of the initial application.
- **Orientation and start-up training (Bootcamp):** Project teams participate in an initial residential training programme over several days. This focuses on developing selected applicants' understanding of lean start-up principles, a hypothesis driven validation and business model identification process. The 'Bootcamp' is initially delivered to the ECR with the other team members contributing after the first day to support the strategy and planning for the market engagement period. This staging of the exercise was designed to create a level of professional distance between the PI and the ECR, to help ensure that the time of the latter was not diverted to other activities (e.g. delivering on-going research projects). Some discretion has been given around the structure of the Bootcamp across the different cohorts and certain areas to allow more focus on different aspects. For example, the northern delivery partner, Queens University Belfast, has placed more emphasis on networking, adding a specific training on online professional networking tools like LinkedIn. New delivery partners have also condensed some topic areas to give more focus on technical areas of business planning, upfront

¹⁰ This was taken from monitoring data, received from Innovate UK in January 2019.

learning and theories of entrepreneurship rather than some of the softer elements, and liaised with external consultancies for support and guidance.

- **Market validation exercise:** The ECR leads a focused assessment of the commercial potential of the underlying intellectual property with support from the programme team, PI, and business advisor. Tasks include creating contacts with potential customers, suppliers, collaborators and/or competitors, and the expectation from Innovate UK is that the ECR would undertake around 100 face-to-face meetings as part of this exercise. The aim of these interactions is to collect the information needed to validate the level of market demand for the technology under development; understand adjustments that may increase its value to consumers; the price point that could potentially be obtained; how the product or service could be sold into the market; and the practicalities that may be involved in commercialising the technology (aided with a CRM tool to keep records for future engagement). In cohorts three and four, the three-month period was extended to six-months and the option was given to ECRs to conduct this exercise on a part-time basis, though this adjustment was rescinded in later rounds in response to concerns that a longer market validation period increased the likelihood that the ECR would be diverted from the programme, weakening their engagement.
- **Business advisors:** Each project team includes a business advisor to support the business model discovery process (predominantly found by the team and its associated institution). Advisors are required to take part in a subset of the 'Bootcamp' training, provide the team guidance during the market validation exercise and support the final refinement and presentation of the market validation at the Options Roundabout. This differs from the concept of a business mentor that acts in a similar manner to a business angel, offering support in exchange for an equity stake or executive role in a company. The increased number of delivery partners in 2018 has opened-up a pool of new businesses advisors. In some areas, it was noted that there was willingness to volunteer for this advisory role but for others, where there was a limited number of volunteers, monetary incentives were trialled.
- **Options roundabout presentations:** After the market engagement period, project teams draw on what they have learnt and attend a one day training to further develop their respective business models. The results of this refinement process are then presented to an independent panel of sector and business experts at an event named the 'Options Roundabout'. The panel seeks to advise on the optimal commercialisation strategy based on the market validation exercise which is presented to them. Projects were examined against a range of criteria, including the quality of the market validation exercise completed, business model development, the size of the commercial opportunity, team strength and consideration of the next steps for the project. These considerations also included the extent to which the team could secure funding in the absence of financial aid (i.e. an additionality test).
- **Aid for Start-Ups and Follow-on Funding:** Some teams were also recommended to apply to apply Aid for Start-Ups or Follow-On Funding when this instrument was available (and some teams were offered up to £15,000 to cover the salary costs of the ECR to help prepare their application, though this was not a core component of the programme). Aid for Start-Ups offered grants of up to £0.5m to support the development of spin-outs. Aid for Start-Ups was discontinued and replaced since the tenth cohort of the ICURe programme by a new funding scheme, Follow-on Funding. It is still provided by Innovate UK and offers up to a maximum of £300k, conditional on the project team matching 30 percent of this with private funds. Instalments are now paid in quarterly arrears in comparison to a monthly payment in advance under the Aid for Start-Ups programme. Applications for both Aid for Start-Ups and Follow-on Funding required project teams to submit a full business plan for review which is assessed using business as usual Innovate UK processes (with adaptations in the ten criteria for assessment), with members of the Options Roundabout panel and independent technical assessors involved in the independent assessment. There has been substantial variability in the availability of

this financial support over the course of the programme – for example, while no AFSU funding was available for cohorts six to eight, Innovate UK did make further funding available in June 2017 that needed to be spent by March 2018.

2.3.3 Outputs

These activities could be expected to be associated with the following outputs:

- **Increased contacts:** As part of their market engagement, project teams are expected to investigate the commercial potential of their research outputs through making connections with likely customers, suppliers and competitors.
- **Market validity assessments:** Teams selected for ICURe produce a market validity assessment which is largely comprised of a business model canvas¹¹ which is subject to continual refinements over the course of, and after, the programme. It should be noted that a full business plan is not an expected output at this stage.
- **Options Roundabout advice:** Commercialisation advice is provided to selected project teams by independent assessors with relevant expertise and experience in the commercialisation of academic research outputs.
- **Business plan:** Some teams will also produce a business plan following the Options Roundabout although this is not a requirement of the programme.

2.3.4 Outcomes

This section provides an indication of the expected outcomes at the project, individual and institution levels.

Individual

- **Commercial awareness:** At an individual level, the programme is expected to raise commercial awareness amongst participating ECRs and PIs. It aims to foster understanding of how lean start-up principles could focus their technologies around various sets of different customer needs. This, alongside with experience in designing and implementing a business development strategy, is expected to raise the capabilities of ECRs and PIs to effectively engage with businesses.
- **Commercial intent:** Participation in the programme may also produce other attitudinal changes relating to intentions or motivation to commercialise amongst the project team, and increases in belief in their ability to do so (i.e. self-efficacy).
- **Commercial skills:** Participation in the programme may also help build the overall capabilities of the individuals participating in the programme to start-up a new venture successfully. However, there is some acknowledgement that the commercial skills of participating individuals may not be sufficiently developed to lead the commercialisation of the innovation if spinning out is chosen as the optimal route to market (and it may be that the teams choose to appoint a commercial team to do so with support from their institutions).
- **Research agenda:** One anticipated effect of participation in the programme is that it will orient the direction of the research pursued by the ECR or PI towards more commercial activities. These effects may arise if academics are encouraged to give more consideration to the impact and potential uses of the research outputs they produce. Improved understanding of the demands of the market may guide future research plans and questions to generate solutions to business problems as opposed to exploring research opportunities driven by academic interest alone.

¹¹ Osterwalder & Pigneur (2010) Business Model Generation. URL: <https://strategyzer.com/canvas/business-model-canvas>. Date accessed: 24/10/16.

- **Ongoing engagement with new contacts:** Network theory suggests that those more central to networks are exposed to more opportunities to benefit from those networks (e.g. as a conduit for the transmission of knowledge or ideas or creating more opportunities to collaborate). The establishment of new contacts (internally and externally) through the market validation process may produce on-going benefits by enabling sustained links with industry and creating further opportunities for researchers to pursue the commercialisation of their research.
- **Reputational effects:** The experience gained through participation in ICURe could also produce important outcomes for individual in raising reputations for their capabilities to engage with industry and the commercialisation process more generally. In turn, this may encourage internal colleagues and others to seek out relationships with those individuals, further increasing the density and potential value of networks. Past involvement in ICURe may also be looked on favourably by other organisations (e.g. Research Councils).

Project

- **Resolution of business model issues:** The intention of the programme is that the intellectual property that form the focus of project goes through a validation process whereby the optimal commercialisation strategy is discovered and/or developed. In practice, this will involve consideration of the value proposition at the heart of the business model, the resources and partners required to implement the business model (and associated cost structures), core customer segments, relationships and channels to market, and anticipated revenues.
- **Decision to commercialise:** The Options Roundabout and other aspects of the programme are expected to influence both the decision to commercialise and the route to market which is taken by project teams. Some project teams may decide not to commercialise when they would have otherwise sought to do so unsuccessfully, potentially avoiding wasted resources.
- **Leverage of private or public finance:** ICURe may also help lever additional public or private investment to further the development of the underlying technology. Project teams will be more in tune with the commercial potential of their research and may be more effective in communicating these when applying for further funding.
- **New spin-outs:** The ICURe programme is expected to encourage some teams to establish an external commercial vehicle to exploit the underlying intellectual property (with or without HEI support). Typically, the PI and ECR will support the initial technical and commercial development of the spin-out. As a management structure and commercial team is introduced they will withdraw from the commercial development of the business. An ECR may take a Chief Technology Officer role, though this is not usually a direct objective for team members.
- **R&D spending:** Both participating teams and those not awarded places on the programme may seek to undertake further R&D to complete further validation of their technology to reduce their technology risk moving forward.
- **Technological progress:** While the activities of ICURe are focused on the commercial validation of research, further technological progression is possible where teams have leveraged further funding to continue R&D.

Institutional

- **Benefits and improvements for TTOs:** There are several ways in which TTOs are expected to benefit from ICURe.
 - **Approach to commercialisation:** TTOs may adapt their approach to the commercialisation of academic research as a result of participating in ICURe. This could result from increased knowledge of the distribution of academic research

being conducted in their institutions, superior understanding of different commercialisation channels, or strengthened business and financial networks.

- **New or improved access to TTO support:** The remit and organisation of TTOs varies considerable among UK institutions. While some have clear processes to place projects on a trajectory to market, others do not seek to go this far. TTOs are also sometimes divided by research field or sector and have little interaction with those outside of their specialisms. The signposting from ICURe and the inclusion of a TTO lead in ICURe project teams may result in an improved understanding and ability to work more collaboratively, cohesively and efficiently within their institutions.
- **Greater university-industry collaboration:** The ICURe programme is also likely to generate knowledge of the most effective means for academic communities to engage with industry. This could be visible in greater levels of collaboration with industry and changes in the research agendas of the individuals concerned. Learning-by-imitation processes may also be present, whereby the knowledge gained through the programme is transferred to adjacent colleagues (helping promote wider cultural change within the institutions concerned).
- **Improved reputation for impact:** The reputation of academic institutions for commercialising technologies may also be enhanced by the participation of project teams in ICURe. A proven record of commercialisation may result in the improved fund-raising ability (e.g. via Impact Case studies included in the Research Excellence Framework).

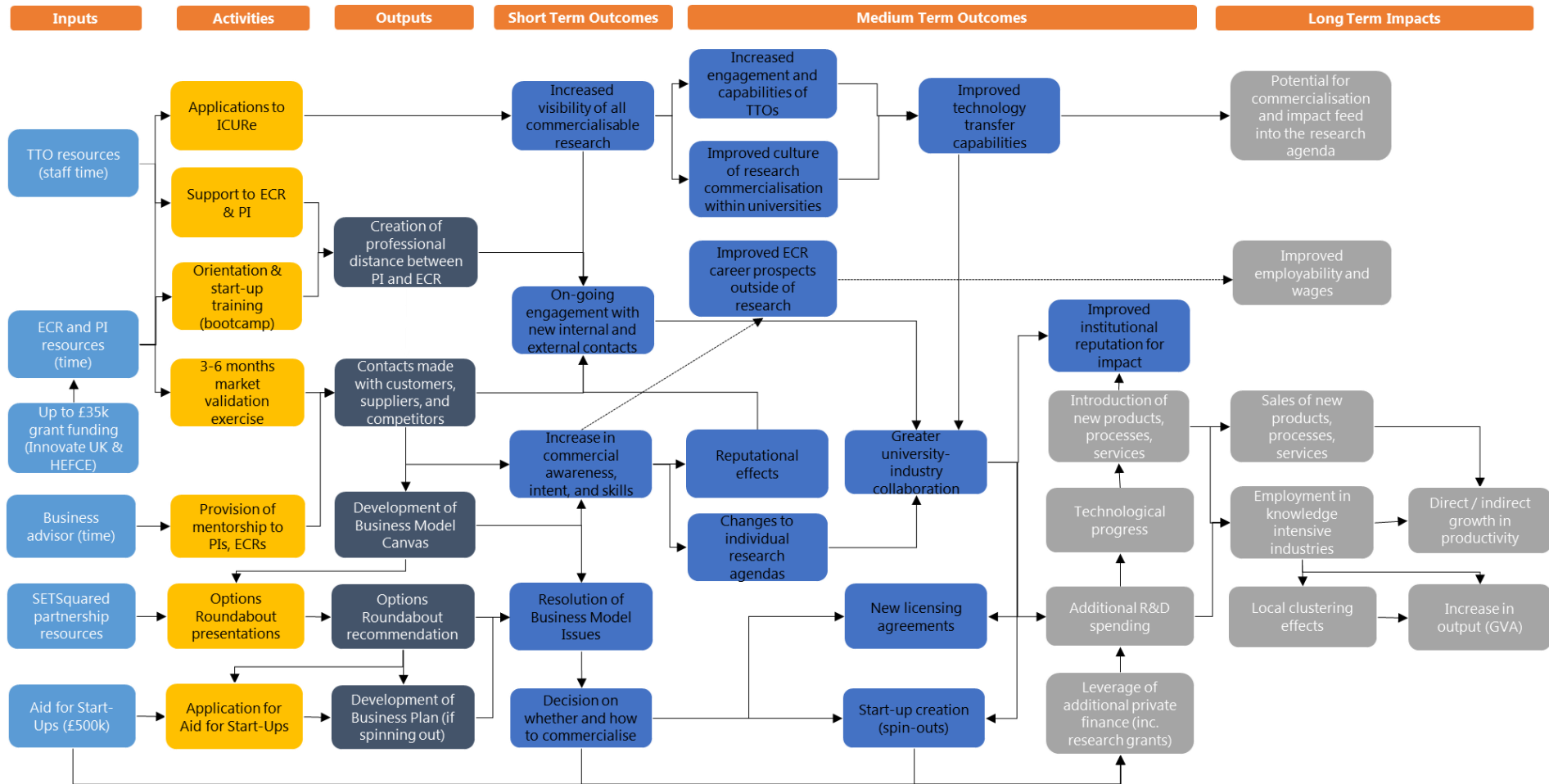
2.3.5 Impacts

As a result, the programme is expected to result in the following economic impacts:

- **Employment:** Where the programme has led to the creation of spin-out, much of the early activity of the business may be focused on the appointment of a commercial leadership team (resulting in short-term employment effects).
- **Turnover and GVA:** In the longer term, spin-outs incorporated may launch new and/or improved products or services to market. Where successful, this will result in an increase in turnover for the spin-outs concerned (and an associated increase in output and jobs to satisfy demand). The products or services introduced could displace the sales of products or services supplied by competitors (leading to offsetting effects to the extent that they are based in the UK). However, this will still lead to social welfare improvements if they involve a transfer of output from less to more productive producers. Given the areas of technology being developed by participating teams, these types of outcomes will have long time horizons. Other metrics, such as firm valuations, may offer better indications of future profitability expectations.
- **Licensing:** Where a licensing route has been pursued, the effects of the programme may be visible both in income for the universities concerned, and in comparable effects to the above amongst licensees. However, some firms may use licensing of intellectual property as a blocking mechanism to prevent the emergence of competitor products,
- **ECR career prospects:** The programme provides time and resources for ECRs to develop their own commercial experience, a reputation for conducting commercialisation activity, and increase the size of their professional networks. This may produce labour market effects by enhancing the career prospects and/or productivity for the ECR. These types of effect would be visible both in increased employment probabilities for the ECRs, and in their wages.
- **Local cluster development:** Finally, the increased commercial capacity and capability of TTOs and academic researchers may trigger local economic development effects. For example, improved reputation for commercialisation may attract additional investments or talent to the area which could result in clusters of high growth companies to the area.

2.4 Logic model

The logic model below visually illustrates the theory of change presented above, identifying the key causal links that occur as part of the programme.



2.5 Context

This section provides evidence on the ways in which HEIs identify and support commercial opportunities within their institutions. Evidence provided in this section draws from the case study and stakeholder research.

2.5.1 Identification of research with commercial potential

TTOs and delivery partners typically reported that projects with market potential are identified through both informal processes (such as by talking to academics or receiving ideas from them) and more formal channels (such as grant application support, awareness and information sessions, and from innovation disclosure forms). TTOs also attend conferences and meet companies to identify what types of commercial research is needed, and attempt to match this back with researchers at their university.

In one case study, it was reported that when an academic makes a disclosure to the TTO, an officer is typically assigned to support with operating tests, and to provide information on funding sources and contact sharing. When encouraging teams to participate in the ICURe programme specifically, TTOs indicated that they do not apply specific selection criteria, but usually account for individual factors (such as motivation of the researchers), and project-level factors (the status of Intellectual Property and ensuring that the technology is sufficiently mature). Some TTOs also mentioned their institutions were running other programmes for commercialisation or proof of concept in parallel to ICURe, which they used to identify teams for the ICURe programme, or to help to make teams ready to apply for ICURe.

2.5.2 Selecting commercial opportunities for further support

Qualitative evidence suggested that commercialisation opportunities identified through the channels above are screened by TTOs to identify projects with market potential that need further support to progress. This involves organising meetings with the academics involved, a review of the data generated to support their invention, an exercise to assess what further development is needed, a review of the patentability of the innovation and of the funding opportunities available to support progression. A set of questions to identify commercial opportunities emerged from stakeholder consultations:

- Who would use it and what do they need?
- Does the problem still exist?
- Who do we need to speak to in the supply chain?
- What commercialisation route is most suitable?

HEI-specific culture or expertise might play a role in the type of research that is selected by the TTO for further support. It also shapes preferences for certain routes to market. Indeed, some TTOs described the processes in place in their university as mainly oriented towards specific outcomes. In one case, a TTO reported that in the process of commercialising research, projects aiming to spin out are generally preferred, to help them access further funding beyond the university. In two other cases, TTOs mentioned that their universities typically focus on licensing opportunities rather than other commercial outcomes, as they consider it an easier model in terms of efforts from the TTO's and academics' perspective. Others give priority to those with specific funding opportunities available to further progress the intervention. Only two TTOs consulted indicated that the main aim of the commercialisation process was getting research to be used and making a difference, regardless of the specific outcome.

2.5.3 Enablers and barriers associated with commercialising academic research

Research with stakeholders largely confirmed the presence of the hypothesised barriers to commercialisation of academic research set out in section 2.2. Several barriers were identified during the qualitative research that limited the overall ability of HEIs to commercialise academic research. These barriers feature at the individual, project and institutional level. They are summarised in the Table 2.2 below, along with ICURe's contribution in addressing them.

Table 2.2: Key barriers associated with commercialising academic research

Challenges	How ICURe addresses them
Access to funding has been highlighted as one of the main challenges in the commercialisation process. The difficulty in raising funds in the North of England and in Northern Ireland was highlighted by delivery partners, who focus on investment networks and support both before and after the application stage.	As most of the teams are at early stages, ICURe does not encourage engagement with investors. However, it was highlighted that the ICURe brand awareness has become significant among some investors, who value the teams first hand market evidence following the market validation exercise
Capacity and time amongst TTOs and academic staff is often limited. Offices usually deal with a large portfolio of projects and are often unable to provide the right support to project teams.	ICURe participation helps TTOs dedicate their attention and time to a project, establishing closer relationships with academics.
Reaching a balance between the academics' commitment to research/teaching and their contribution to the commercialisation of technologies was identified as a barrier.	Switching the focus towards the ECR helps reduce the burden on the PI. ECRs who do not have clear career paths and have sufficient time, expertise and the trust of their senior researchers can lead most of the process.
Lack of interest towards commercialisation among senior researchers who do not see it as a priority was highlighted as a barrier. Resistance in academic culture and the perception of commercialisation as a distraction from research could hinder the progress of innovations with market potential.	The case studies indicated that senior researchers' involvement in has been fundamental for commercialisation outcomes. Support from the PI in bringing the project forward to the market was highlighted as a critical component.
When pursuing the commercialisation of an output, some universities try to find the best fit for the technology into an existing industry, instead of developing the technology based on market needs.	The market validation exercise was thought of as crucial in exploring different market sectors, customer categories, and identify potentially viable routes. In case studies, this phase was defined as critical in influencing the development of projects.

2.6 Other relevant schemes

Several other public schemes and support programmes have been developed to support ECRs in various aspects of their careers, addressing some of the key barriers and failures, as identified above. A description of their aims and objectives and activities is provided below:

- **Enterprise fellowships** are provided by several institutions, including the Royal Academy of Engineering (RAEng Enterprise Fellowships) and the Royal Society of Edinburgh (BBSRC Enterprise Fellowships). These train applicants in relevant business skills and advance commercialisation of a technology whilst each imposing their own restrictions. In the case of the RAEng Enterprise Fellowship, the technology must be in an engineering related area and a decision to spin-out already made. For BBSRC Enterprise Fellowships, the technology must have originated from BBSRC funded research. In addition, several academic institutions offer incubation facilities.
- **A Pre-Cure programme** was initiated in 2017 by SETSquared and was made available in selected universities (University of Warwick, Queens University Belfast, Ulster University, and Sensor City¹² in Manchester and Liverpool). While Pre-Cure

¹² Sensor City is a global innovation hub for the development of sensor technologies. It emerged from a joint-venture between Liverpool John Moores University and The University of Liverpool, and is backed by BEIS and the European Regional Development Fund.

was suspended, its model was a condensed version to that of the current ICURe programme, and selected teams participated in a Bootcamp, market engagement activities and an Option Roundabout appraisal. According to the monitoring data, 28 project teams successfully participated in the Pre-Cure programme.

- Consultations offered anecdotal evidence that universities are developing programmes with similar objectives to ICURe. For instance, the **Midlands Innovation Commercialisation of Research Accelerator (MICRA)** programme was highlighted as a potential substitute for ICURe. The programme is to be launched by the Midlands Innovation University Partnership following a £5 million award from Research England, with objectives to drive jobs and economic growth across the Midlands region. Conceived as a connected system of Technology Transfer Offices, the MICRA programme is intended to act as a single gateway to the collective intellectual property (IP) resources from the eight Midlands Innovation universities – Aston, Birmingham, Cranfield, Keele, Leicester, Loughborough, Nottingham and Warwick. Collaborating with industry and organisations from all sectors, the programme will provide support and access for enterprise development, investment and investor relationships to help entrepreneurs drive their ideas forward, meet a wider community of like-minded people and find the most appropriate, targeted incubation support within the partnership.
- **Innovation to Impact (i2i) programme** is a programme delivered by the University of Warwick with funding from the Research Council Impact's Accelerator Accounts. Its activities and objectives are similar to ICURe: participants go through an initial phase of training before investigating the commercialisation potential of their innovation by engaging with companies. Targeted at master and PhD students, it was considered by the TTO at the University of Warwick as a programme feeding into the ICURe programme which is targeted at PhD completers and ECRs. Overlap with ICURe was thus considered minimal.
- The presence of **commercialisation funds within HEIs** can play a significant role in supporting the creation or accelerating the scale-up of a spin-out company. But a high degree of variability can be observed across different universities in the scale of seed and VC capital that can be committed to debuting start-ups. For instance, the commercialisation arm of Cambridge University - Cambridge Enterprise - can commit up to a £1m per start-up, though few institutions have access to this depth of resource – for example, the entire capitalisation of the Nottingham Invention Fund is £5m, and many cannot call on any resource of this nature.

3 Participation in ICURe

This section provides an overview of how the different components of the ICURe programme - from the application process to the Options Roundabout - supported participants in discovering the optimal commercialisation pathway for their technology and helped them to plan and progress in their chosen commercialisation route. This analysis was completed using evidence from the survey of applicants, an assessment of monitoring information and analysis of qualitative evidence.

3.1 Applications to ICURe

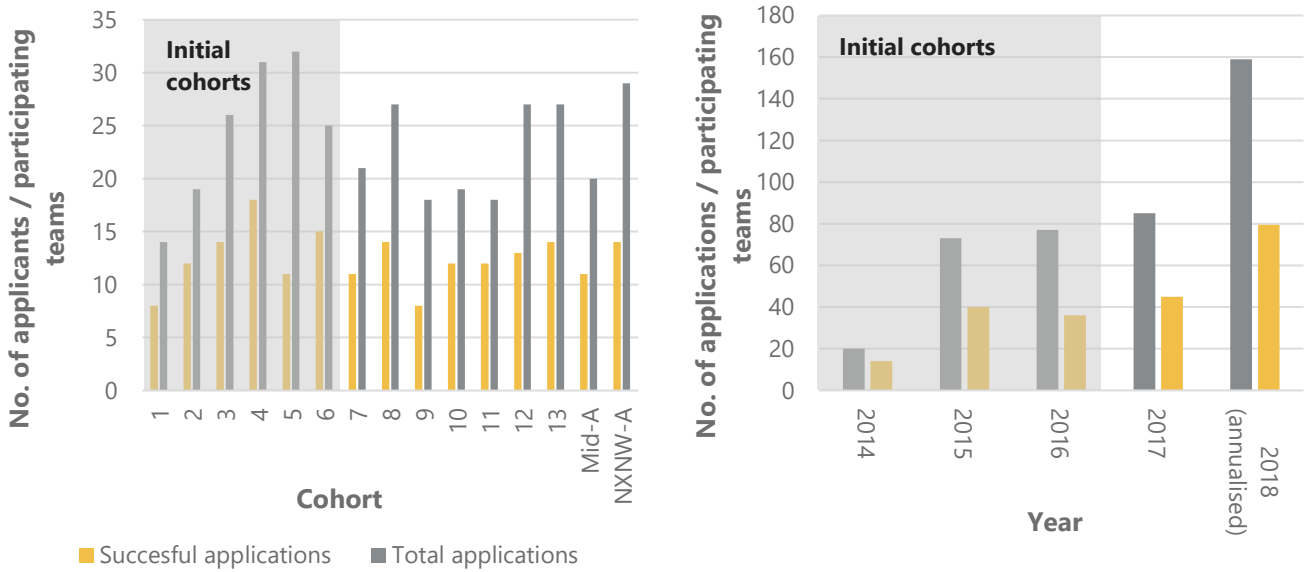
The application form, process and criteria have remained the broadly the same throughout the programme, aside from some minor tweaks to the application form to better understand funding streams prior to ICURe and to avoid administrative bottlenecks (e.g. visa issues). The template set by SETSquared was also used by other delivery partners, with two main differences:

- **Online application system:** The entire team formation and application process for the NxNW cohorts delivered by Queen's University Belfast is online, on their "crowdicity" platform. It allows for co-creation of applications and early interactions between project teams and business advisors in advance of the initial application.
- **Support in recruiting business advisors:** The prior evaluation focused on the first six cohorts showed that the business advisor facilitated the outcomes of the programme. A key concern for the possible scale-up of the programme was in the feasibility of recruiting and maintaining sufficient numbers of business advisors. The new delivery partners were aware of this issue, and indicated that their local area did not benefit from strong investor networks (making the involvement of a business advisor especially important to guide teams during the programme). To ensure that all teams participating in their cohorts would benefit from the involvement of a business advisor, Warwick University and QUB have matched teams with a relevant business advisor from their networks, trying to align the commercial background of the business advisor with the technological field of projects. To do so, they have put significant effort into developing relationships with local consultants and have reached into their alumni network to densify and diversify the networks of business advisors they could offer to participants. Queen's University Belfast has used its online platform "Crowdicity" to support team formation, and particularly the finding of a business advisor. A specific section on the platform is dedicated to potential applicants who need to find a Business Adviser, where they can pass (non-confidential) information about their project and engage with the online community of advisers and entrepreneurs. Feedback from case studies of teams in these cohorts indicated this support had been critical in securing a business advisor, and they were unsure if they would have managed to recruit one otherwise.

3.1.1 Demand for the programme

Monitoring information indicates that the volume of applications to the ICURe programme has remained stable since the programme was extended (see figure 3.1). The number of applications for places on the programme averaged 24.5 over the first six cohorts and 22.9 for subsequent cohorts. The number of participating teams has doubled in 2018 relative to 2016. There was no evidence that demand for the programme was exhausted by the initial six cohorts, and the decision to scale up the programme appears justified from this perspective. Assuming the application of the scoring criteria has remained stable over time (i.e. assessors do not adjust scores in light of the average quality of proposals received), there was also no evidence that the expansion of the programme had adverse effects in terms of the quality of applications coming forward - to the extent that there is a trend, it is towards higher quality applications.

Figure 3.1: Number of ICURe applications and successful applications by cohort and year

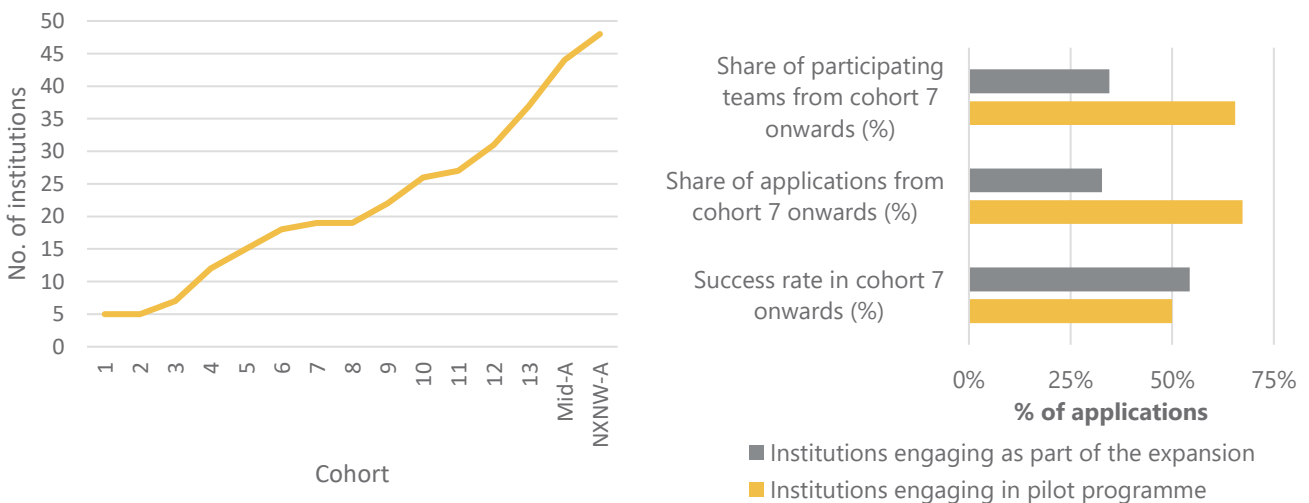


Source: SETSquared monitoring information (2019)

3.1.2 Participation of HEIs in the programme

Participation in the ICURe programme has widened, as shown in Figure 3.2. Eighteen institutions had engaged in the programme by the end of the sixth cohort, rising to 47 by mid-2018. Teams from institutions participating in the initial six cohorts did not have any advantage in the application process. However, given the number of institutions that were new to the programme, the depth of their engagement might be considered less extensive than expected, accounting for 33 percent of applications but more than half the institutions involved. Delivery partners suggested institutions involved from the start of ICURe have developed a refined understanding of its objectives, requirements and delivery processes, and are more confident in putting forward teams. Newer institutions may be more cautious and put a limited number of teams forward as they are still in the process of refining their understanding of the ICURe programme.

Figure 3.2: New academic institutions engaging with ICURe, and success rates at the application stage



Source: SETSquared monitoring information (2019)

3.1.3 Motivation to apply

The underlying motivation to apply for the ICURe programme varied across teams, and was often influenced by the stage of development of the technology:

- **Opportunity to focus on commercial potential:** The programme offered the opportunity to solely focus on commercialisation and developing the technology to be market ready. To the interviewees' knowledge, the programme considered unique in this respect, providing research teams with direct support to identify the path to commercialisation. Teams that had not yet identified the market segment for their innovation particularly valued the opportunity to complete the market validation exercise.
- **Further funding and progression:** The ICURe programme was also seen as offering an opportunity to leverage further funding and identify market segments, both fundamental steps in progressing the commercialisation of projects. Teams that had clearly identified the commercial potential of the innovation and were ready to take it to the market reported they expected participation in the programme to enable them to take their projects to the next stage. In two cases, teams reported to have already engaged with potential customers and investors prior to applying (without success), believed that the programme could contribute to raise the profile of their innovation.
- **Confirm the value of the innovation:** Teams were also seeking to confirm the uniqueness of the innovation and further investigate its commercial potential through a market validation exercise in a structured framework. In one case study, it was reported that one of the key motivations to apply for the programme was to explore the level of global competition, and if so, what standards needed to be achieved.

3.1.4 Awareness of the programme and application channels

In line with the findings of the previous evaluation, applications to ICURe programme tended to be brokered by Technology Transfer Offices within participating academic institutions. The survey showed that TTOs were the primary method for introducing the ICURe programme to both successful and unsuccessful applicants (66 and 49 percent) from cohorts seven onwards. Reliance on TTOs to promote the programme and identify relevant applicants appears to have increased since the previous evaluation (from 55 percent for the first six cohorts to 60 percent from cohort seven onwards).

Dependence on TTOs to stimulate demand for the programme does not seem to be a cause for concern. The survey evidence suggested that TTOs tend to be more effective at conveying the key objectives and requirements of the programme and identifying those best suited for the programme. Teams that did not secure a place on the programme were more likely than participating teams to have first heard of ICURe through a colleague or word of mouth rather than their TTOs (20 percent compared to eight percent). However, reliance on TTOs has resource implications should the programme further expand and the number of applications continue to rise.

There was evidence from four of the nine consultations with TTOs that some PIs and ECRs have applied without notifying their TTO. They highlighted that this could create capacity issues on the side of TTOs, as they would only find out about their imminent engagement in an ICURe project when notified by the delivery partner a few days ahead of the Bootcamp. As such, they did not necessarily have the time set aside to ensure their attendance at the Bootcamp or to conduct the necessary research to familiarise themselves with the project to provide the quality of support needed.

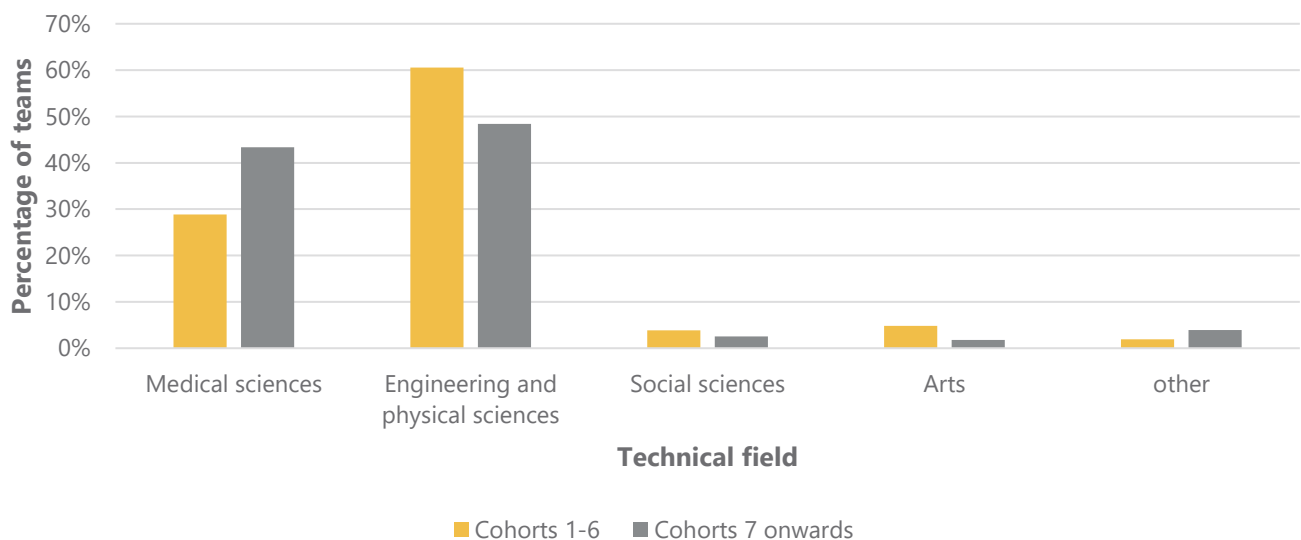
Recommendation: UKRI and ICURe delivery partners may wish to consider ways in which applications could be restricted to those teams that have engaged with their TTO to avoid planning issues.

3.1.5 Characteristics of applicants

In terms of the characteristics of applicants:

- Technical field, development and focus:** The technical field of applicants' experience and the focus of project proposals remained dominated by STEM subjects (93 percent). As illustrated in Figure 3.3 below, the distribution of teams within different STEM subjects has altered. Projects focusing on medical and biological sciences now account for a similar proportion of the participating teams (43 percent) as those in the field of engineering and physical sciences (48 percent). Feedback from delivery partners suggest that this may reflect efforts to recalibrate the portfolio of participating teams. It should also be noted that concerted efforts have been made to engage non-STEM research groups in more recent cohorts not covered by this study (e.g. cohort 15 had more than 50 percent non-STEM teams).

Figure 3.3: Proportion of applicants by technical field over time



Source: Ipsos MORI Applicant Survey (February 2019)

- Proximity to market:** Participating teams did not differ from non-participating teams in terms of the proximity of the underlying technology to market (on average, teams reported they had developed the technology to TRL4, implying that they had generally moved beyond the proof-of-concept stage to early prototype development). They had also invested a similar level of resource to develop the technology (an average of £236,000 for participating teams and £253,000 for non-participating teams).
- Publication and patenting activity:** Participating teams were more likely than non-participating teams to have registered a patent relating to the technology forming the basis of their proposal to ICURe (59 versus 42 percent). This could indicate that their technology may have been considered to hold greater commercial potential than those of non-participating teams (as the costs incurred in prosecuting the patent are incurred by the university).
- Commercialisation experience:** The commercial experience of different members of the team appeared to have increased relative to the first six cohorts, though it remains limited for ECRs. All ECRs reported a low level of experience in commercialisation activity (an average of two years). Business advisors and TTOs reported an average of 25 and 11 years (compared to 13 and nine in the first 6 cohorts) of commercialisation experience. The reasons for these differences amongst TTOs are unclear. However, stakeholders reported that new delivery partners reported have made significant

investments in building up networks of business advisors – notably through reaching out to their universities' alumni networks - and providing support to teams in matching them with a relevant business advisor. The provision of financial incentives by new delivery partners might also have helped to attract more experienced business advisors.

- **Previous commercialisation activity:** Participating and non-participating teams did not differ in terms of the level of their engagement in commercialisation activity prior to ICURe. Twenty-eight percent of participating teams had made a previous attempt to commercialise their project prior to their application compared to 24 percent of non-participants. Nine percent had previously attempted to incorporate a spin-out and 19 percent had sought a licensing agreement. Eighteen percent had engaged with customers to validate the market for the product, while 20 percent of applicants had held discussions with TTOs.
- **Business model issues:** Respondents were asked to comment on the progress of resolving a set of business model issues (using the dimensions of the Business Model Canvas as a framework, explained in more detail in Section 4), giving a score on each between one and ten (with ten signifying the issue was completely resolved)¹³. Prior to ICURe, non-participating teams considered themselves further ahead in these teams. Both groups, reported that the least progress had been made in clarifying the value and source of anticipated revenues, and in establishing of the customer relationships required to progress their project.

3.1.6 Benefits of the application process

Overall, experiences of the application process were positive. Costs associated with the application were considered proportionate to the funding and added value provided by the ICURe programme. Most teams had some experience of other public grant application processes and were in possession of relevant existing documents to include. Challenges around dates and timelines for the application process were raised: key dates were reportedly released at very short notice though this was partly intentional to put applicants in a more commercial mindset.

Recommendation: UKRI and ICURe delivery partners may wish to consider if it is possible to provide greater notice regarding the timing of future cohorts to encourage greater participation, facilitate planning, and/or stimulate higher quality proposals.

The qualitative research revealed that the application process had numerous benefits for team members. A key benefit was the opportunity for the team to think through and articulate their value proposition and commercial objectives for the programme. The application process benefitted team members in different ways:

- **ECR/PI:** The application process encouraged the ECRs and PIs to reflect on the commercial potential of the technologies and how to convey their benefits to a non-technical audience. This allowed ECRs to better present their innovations to a range of stakeholders during the market validation exercise.
- **TTO:** This phase contributed enabled relationships to develop between the members of the team and work together to clarify their ideas on the projects' purpose, commercial potential and overall vision. Teams that developed a relationship with the TTO at the application stage were also reported to have received more regular support during the exercise (highlighting possible issues attached to the independent submission of applications by PIs and ECRs).

¹³ These responses were aggregated to construct an index to provide an approximation of how far teams had resolved the core issues associated with their business models, though it should be noted that participants are likely to be more familiar with these issues given that they received instruction on the development of a business model canvas and business plan during the course of the programme. As a result, non-participating teams may have been more likely to misinterpret the issues or understand them differently to participating teams

- **Business advisors:** The application process gave business advisors the opportunity to get to know the project and other members of the team. This was especially important in teams where the business advisor had been allocated to the project by the delivery partner (Warwick University or Queen's University Belfast) and was external to the team or the University and associated networks. Early intervention from the business advisor was beneficial as it gave more time for the team to receive, and to start to address advice, guidance and feedback on their commercialisation plans.

3.2 Participation in ICURe

3.2.1 Bootcamp

As with the previous evaluation, the Bootcamp was perceived positively by programme participants. Survey findings indicate that it was still widely attended by team members, with 89 percent of survey respondents confirming their attendance. Most attendants also reported that the Bootcamp was effective in preparing teams for the market validation exercise, and 90 percent of survey respondents described it as to be very or fairly effective (in line with findings for the first six cohorts). This indicates that quality standards have been maintained as the programme has been extended and expanded.

The qualitative evidence supports these findings:

- **Improving ECR confidence to complete the programme:** Case studies suggested the Bootcamp helped increase the ECR's confidence in the commercial potential of their project and their ability to progress its commercialisation. By talking to people about the project and stepping outside of their comfort zone, ECRs improved their ability to communicate using different strategies to suit different audiences. Stakeholders also reported that practicing how to present the innovation was crucial in increasing ECRs' confidence for the market validation phase.
- **Increasing commercial awareness:** The Bootcamp stage exposed the ECR and the PI to activities and processes associated with commercialisation that they were previously not familiar with. By forcing researchers to concentrate only on the project's commercial potential, the Bootcamp allowed them to better understand motivations, the focus of the project and practical commercial opportunities. Stakeholders also reported that this phase gave an opportunity to collect a large amount of data about potential markets and customers, which was beneficial for the market validation exercise.
- **Knowledge sharing and peer networking:** The opportunity to network with peers at the Bootcamp was identified as a benefit both in case studies and stakeholder interviews. The development of networks and contacts has been particularly beneficial to ECRs for the market validation stage, while for TTOs, the Bootcamp represented an opportunity to network with institutions they do not normally speak to and gain knowledge about what other universities are doing.
- **Business Model Canvas:** The simplified version of the BMC was thought to be a helpful tool in terms of allowing the ECR to think about the technology from the perspective of business problems and possible solutions. Some teams reported that the canvas helped create a comprehensive hybrid of everyone's thinking that added clarity to the potential technology application, and the input of the TTO was emphasised as important in achieving this clarity.
- **Action Plan:** This was perceived as a useful tool to plan the market validation exercise and identify different target markets. Sessions on planning and budgeting accelerated the development of plans for the exercise and were useful in setting expectations about what was required from the team, outlining activities, roles, and responsibilities of team members, assigning resources and establishing key milestones. It was also mentioned that this phase was used to create a topic guide to be used in interviews with potential business partners or customers.

Team members benefitted from the Bootcamp in different ways. Table 3.1 below illustrates the main benefits associated with the Bootcamp that were reported by team members and TTOs consulted. As evidenced in the table, the ECRs were reported as benefitting the most from the Bootcamp experience.

Table 3.1: Overview of main benefits of the Bootcamp for different team members

ECR	PI
<ul style="list-style-type: none"> ▪ Increased confidence to bring the project forward and the ability tailor communication to suit different audiences. ▪ Exposure to key commercialisation activities and processes they were previously not familiar with. ▪ Opportunity to practice how to present the innovation, talk to people about the project, and step outside of their comfort zone. ▪ Acquisition of helpful information through pre-reading and presentations and observing first-hand the tools and techniques learnt. 	<ul style="list-style-type: none"> ▪ Critical opportunity to grasp the requirements, milestones and objectives of ICURe. ▪ Forced focus on the project's commercial potential. ▪ Understanding the role of the ECRs in leading the exercise and learning how to support them. ▪ Opportunity to network with peers.
Business advisor	TTO
<ul style="list-style-type: none"> ▪ It provided the opportunity to support the team with training. 	<ul style="list-style-type: none"> ▪ Learning best practice from previous cohorts on how to support the ECR and the team. ▪ Close collaboration with the ECR aided a better understanding of the value proposition underpinning the technology. ▪ Opportunity to network, gain knowledge about what other universities are doing and speak to institution they do not normally speak to

However, stakeholders suggested that some aspects of the Bootcamp could be refined:

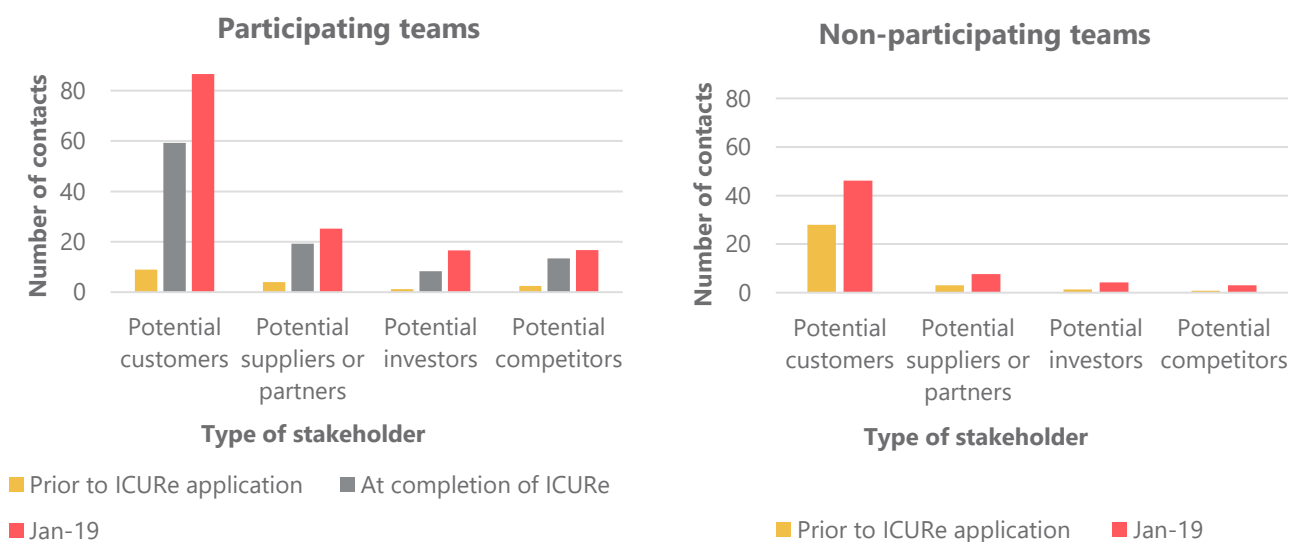
- **Commercial training:** TTOs and Business Advisors reported that the Bootcamp would benefit from providing ECRs with additional commercial training, specifically around the making of a business plan. It was suggested that a longer or more comprehensive training on business models, value proposition analysis and networking skills would have been helpful for the ECRs to make the most out of the market validation exercise. Some PIs and TTOs suggested that the usefulness of the Bootcamp often depends on the team's previous exposure to commercialisation.
- **Business Model Canvas:** PIs and ECRs regarded the complete version of the Business Model Canvas as less useful than its simplified version. It was thought to be a more complex task as key terminology remained unclear for those with little commercial exposure and it was not always perceived as contributing to clarify value propositions.
- **Subject-specific expertise:** TTOs suggested that the current format of the Bootcamp, where it caters for a multitude of technical fields simultaneously, could not be expected to support teams with niche value propositions to maximise the effectiveness of their validation exercise. It was reported that these types of projects may have completed validation exercises of a higher quality by completing the ICURe programme with other project teams from a similar technical field or who intended to approach similar customer segments. More targeted support was suggested, in the form of guest speakers and programme support staff with field specific expertise, potentially resulting in more effective resolution of business model issues during the market validation exercise. However, it was acknowledged that this would reduce opportunities for ECRs to network with individuals outside of their technical field which was considered a key benefit of the Bootcamp process.

Recommendation: Although the training provided through the Bootcamp was viewed positively by participating teams, it does not act as a substitute for comprehensive enterprise education. It may be a challenge to meet the appetite for technical business education within ICURe as it is currently designed. UKRI may wish to consider whether there may be are broader levers at its disposal that could raise the level of commercialisation skills amongst ECRs (for example, encouraging PhD students to complete enterprise education modules during their programmes).

3.2.2 Market Validation

The market validation exercise required the ECR to make commercial contacts to validate or develop the value proposition defined during the Bootcamp phase of the programme (a notional target of 100 was set though this varied depending on the nature of the market and the number of participants). The survey indicated that participating teams made substantial numbers of contacts during the programme while non-participants appeared to make little progress (as illustrated in the figure below). The effect was sustained for participating teams as they continued to engage additional contacts across all stakeholder types beyond their participation in the programme.

Figure 3.4: Average contacts made with potential customers, suppliers, investors and competitors



Source: Ipsos MORI Applicant Survey (February 2019)

Qualitative research highlighted that engagement with potential customers during the exercise was critical in validating the potential of the innovation and confirm its unique selling points. It also aided to understand of the characteristics of different market sectors and customer categories, and helped teams identify viable commercialisation routes. An improved knowledge of the barriers to entry, existing market players and regulatory frameworks was also instrumental for teams in resolving business model issues and refining their approaches to commercialisation.

The data and information collected during the three-month period generated evidence to inform next steps. It was highlighted that a valuable feature of the exercise was the identification of specific industry contacts to approach. The information collected during this stage enabled teams to build tangible business plans and securing additional funding. The exercise also challenged assumptions about the potential applications of their technology, its value to customers, and understanding of the characteristics of markets into which the product or service might be introduced. In some case studies, teams pivoted to more promising market segments following conversations with potential customers and investors.

However, a range of issues were identified in the case studies that hindered the progress of project teams:

- **Imbalance in the type of stakeholders engaged:** Maintaining a good balance between the different types of stakeholders engaged was challenging and some teams reported a preference for engaging with customers and technical experts, which was thought useful in gauging the value of their technology against the needs of the market and refine their product applications to better meet those needs. This came at the risk of insufficient engagement with partners and suppliers that would be crucial in sustaining business development efforts post-ICURe.
- **Commercialisation attempts prior to ICURe:** Previous attempts by the PIs to commercialise the technology were not necessarily an advantage for ECRs as they sought to establish themselves as leaders of the market validation exercise. Where PIs had already had conversations with customers or investors, the ECRs' ability to pick up and lead those conversations was undermined, as they found limited engagement as they were already in talks with the PIs of the project (a possible co-ordination failure).

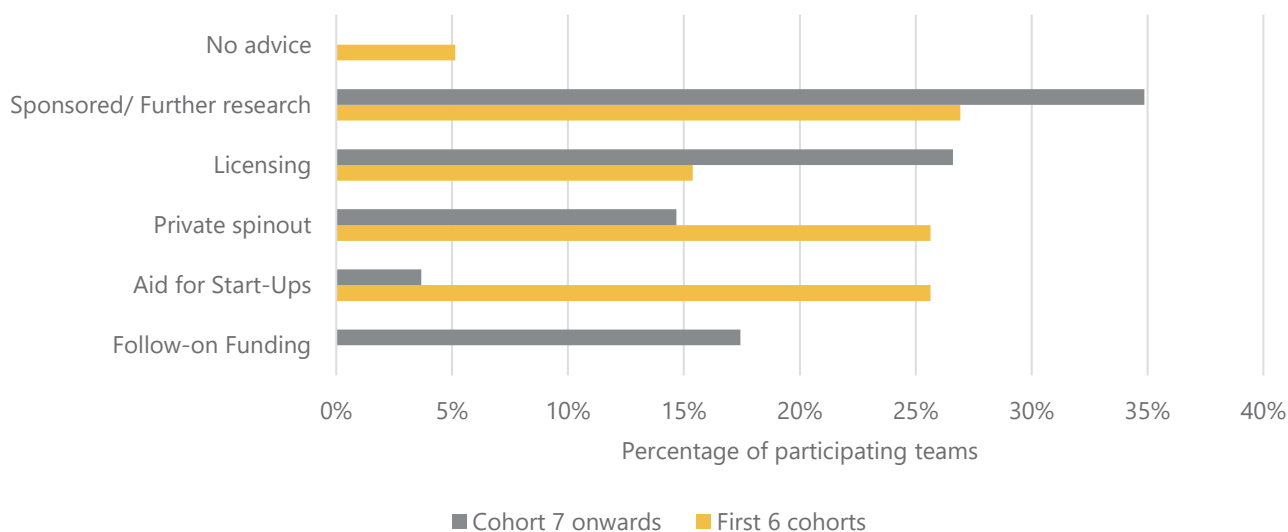
Recommendation: It may be helpful to require teams to disclose the details and outcome of previous and current commercialisation attempts during the application process. This may flag potential 'dead-ends' as well as projects that may encounter co-ordination difficulties.

- **Length of market validation exercise:** As with the previous evaluation, some have suggested that the programme would benefit from being extended, as the current period of 3 months was thought to be relatively short to acquire the contacts of a variety of stakeholders and engage them effectively. This was a concern for teams who had to pivot during their market validation exercise or had many potential customer segments that required further investigation. However, as highlighted in Section 2, SETsquared tested a potential extension the duration of the market validation exercise for two cohorts, but this did not produce satisfactory results and was discontinued. In those cases, there was a tendency for the ECR to be drawn away from the project.

3.2.3 Options Roundabout

Prior to the Options Roundabout, teams reconvened to undertake a final analysis and discussion of the evidence gathered through the market validation exercise. This was described as a useful opportunity to meet each other face-to-face again and agree on their key messages and proposed route to market to present at the Options Roundabout. Preparations for the Options Roundabout and the presentation on the day was led by the ECR. Once teams had presented their 'story' and proposed their commercial exploitation plan, feedback was provided by the Options Roundabout Panel to the teams, and the panel provided a score (for the benefits of the delivery partners and OR panel only) giving a basic measure of the quality and completeness of the content teams were seeking to communicate. The panel also provided suggestions and advice on what it perceived as the optimal commercialisation pathway (or pathways). Generally, the Options Roundabout process was reported to boost the confidence of the team to further develop the project, helping to validate their ideas and propositions and confirming projects' potential.

Analysis of the monitoring information revealed that there has been a change in the advice given by the Options Roundabout panel relative to the first 6 cohorts (as recorded in the monitoring data), as illustrated in figure 3.4.

Figure 3.5: Advice of the Options Roundabout panel, first 6 cohorts and cohort 7 onwards

Source: SETSquared monitoring information (2019)

A comparison between the recorded advice of the Options Roundabout for first six and later cohorts shows:

- Changes in advice offered:** There was a fall in the share of teams advised to spin-out with public or private funding (from 51 percent of teams to 36 percent). At the same time, the share of teams that have been advised to pursue a licensing pathway has increased from 15 percent to 27 percent, and the share of teams advised to undertake sponsored or further research has risen from 27 percent to 35 percent. It is not entirely clear from the evidence available as to what has driven this change, as Options Roundabout panellists have not been engaged as part of this study. Consultations with delivery partners suggested that this might stem from a desire to diversify the advice given and encourage participants to engage in a broader range of commercialisation pathways.
- Reaction to Options Roundabout's advice:** As with the previous evaluation, case study findings indicated that teams continued to approach the programme with the objective of establishing a company. The reaction to the advice given tended to be negative when advised to pursue a licensing pathway or to seek further research funding, with teams more likely to challenge the make-up of the Options Roundabout's panel members, the relevance of their backgrounds and the quality of guidance given. Although TTOs interviewed considered the advice from the panel was usually well-founded and reflective of the realities of the market, survey findings indicate that higher shares of teams chose to seek to establish a company (47 percent) than were advised to do so by the Options Roundabout (27 percent). Part of this explanation may lie in some of the gaps in post-ICURe support for commercialisation routes that do not involve a spin-out (as explained further in Section 4). These gaps are known to project teams, who perceive licensing as a sub-optimal pathway with a less clearly delineated route to commercialisation.

3.2.4 Team support

Overall, ECRs reported a comparatively high level of satisfaction with the support offered the different team members. On a 10-point scale, PIs and business advisors were rated seven on average compared to TTOs who were rated eight overall. Case studies highlighted high degrees of variation in the type of support provided by the different members of the team. Table 3.4 below provides a summary of the type and strength of support provided by each team member, with low medium and high support indicated through light to dark red.

- Role of the TTO:** Case study evidence highlighted that TTOs usually provided initial logistics support, as well as regular support to the ECR. During the exercise, this took the form of weekly meetings and regular communication, and support at the end to plan for the Options Roundabout. TTOs also supported ECRs in identifying potential market sectors., and it was mentioned that the TTO generally managed the patent registration process. Ordinarily, the TTO would also support the project in finding industry contacts, assisting in setting up collaboration agreements with industry partnerships. Other than managing the team’s commercialisation path, TTOs themselves reported that their role was also to manage the relationship with the Business Advisors (including keeping them on board after the ICURe programme if needed). Stakeholders have in fact indicated as crucial the presence of a business advisor and a TTO at the same time in a team, as TTOs do not always have the same level commercial experience.
- Role of the business advisor:** Support from the Business Advisor was seen as particularly important for the ECR throughout the programme, as they were usually the team member with proper business experience. Input from the Business Advisor was thought to be especially helpful in developing the Business Model Canvas, targeting the most relevant customer segments, providing useful market contacts, and advising on how to best approach meetings with external organisations and companies. The case studies also suggested that support from the Business Advisor varied significantly across project teams. In some cases, the Business Advisor stayed in regular contact with the ECR, providing advice, guidance and feedback throughout with a focus on practical steps and industry guidance. But in some cases, the teams indicated that the business advisor’s involvement was limited to high-level advisory and guidance, which was not deemed insufficient. It is acknowledged the business advisor typically provided their time on a voluntary basis.
- Role of the PI:** PIs were less engaged than the business advisors and the TTOs in the day-to-day activities to progress the project. Their role was primarily that of a mentor to the ECR – discussing progress regularly, providing quality assurance, and offering a sounding board for their decisions. It was also reported that PIs typically had an extensive network which they could draw upon for contacts. Support from the PI in bringing the project forward to the market was highlighted as a critical element without which progress could be inhibited. For example, without motivation from PIs to follow the commercialisation route, many high-quality proposals may not get submitted, reinforcing the importance of addressing cultural factors and incentives to engage in commercialisation.

Table 3.2: Type and strength of support offered by team members during the programme

Type of support	PI	TTO	Business advisor
Strategic guidance			
Contact creation			
Interpersonal skills development			
Personal encouragement motivation			
Development of a business plan			
Administrative and logistic support			

3.2.5 Views on potential changes to the programme's design

As part of this evaluation, we have explored appetite for two potential refinements for future cohorts of the programme suggested as part of initial scoping conversations:

- **Creating subject-specific cohorts:** The rationale for this approach was to focus TTOs' attention, knowledge sharing and peer-networking on a technological field for the duration of a cohort. It was suggested this could concentrate networking opportunities amongst participants with similar technological field or target markets, and potentially facilitate or accelerate their commercialisation process. There were mixed views amongst TTOs on the value of creating subject-specific cohorts. As noted above, this format was perceived as best suited to support teams with niche value propositions. Running subject-specific cohorts was also seen as an opportunity to calibrate the Options Roundabout panel to better align with the technological field of projects. However, mixed cohorts were valued highly owing to their ability support interdisciplinary networking (reflective of wider trends in academia). TTOs highlighted that the mixed nature of the programme enables peer-learning throughout the programme, giving an opportunity to learn from people working across different sectors. Sector specific cohorts would limit these potential benefits.
- **Providing financial incentives to business advisors:** The two new delivery partners have introduced financial incentives which ranged between £200-250 per day for two and a half days, supposed to secure business advisor's participation at the Bootcamp. This created a natural difference between cohorts, and consultations explored the potential need for more general support for financial incentives for business advisors. Views were again split amongst stakeholders on the need to incentivise business advisors to participate in the programme. On the one hand, evidence from interviews with business advisors themselves suggested that many worked as consultants, and the main motivation to participate in ICURe for them was to establish networks and about potential opportunities to find future collaborators or clients. However, TTOs and delivery partners suggested that the relatively small incentives provided to business advisors allowed them to attract people who were genuinely interested in commercialisation projects instead of being there only for networking purposes and tended to be more engaged with the project. Additionally, TTOs reported that without an incentive, it was more difficult to engage business advisors at the application stage.

3.2.6 Views on the extension of the programme

Overall, the extension of the programme to two new delivery partners was perceived positively by the range of stakeholders' interviews (although the overall evidence was limited as the new delivery partners have only delivered relatively small numbers of cohorts). The following two main themes tended to frame discussions on this issue (and many of the issues flagged are being actively considered by delivery partners):

- **Regionalisation of the programme:** Consultations with participating teams in the Mid-A and NxNW-A cohorts, TTOs and delivery partners indicated that the regionalisation of the programme was beneficial in tailoring the programme to local needs, gaps and challenges. For instance, the Queens University Belfast organised Investor Panels following the Options Roundabouts for the NxNW cohorts, and was considered a step in the right direction given the weak density of investor networks in the relevant regions. Interviewees also suggested the expansion of the programme had a positive influence on the creation of networks at the local levels (including between TTOs). Delivery partners highlighted that they had met – sometimes for the first time – TTOs in other universities to discuss applications, exchange views on the commercialisation options for certain teams after their participation in the ICURe programme, or to create and connect the networks of business advisors of the different universities in the region to put at the disposal of the ICURe applicants.

- **Fragmentation of the programme:** Delivery partners highlighted that adopting a regional approach also caused fragmentation to occur at the front end of the programme. It was thought that the current balance between regional and national delivery of the programme could be refined, and noted that certain aspects of the programme would be better delivered or monitored on a national scale. This call for a more consistent approach and centralised management was especially acute at both ends of the programme (pre- and post ICURe), and crystallised around the following issues:
 - **Streamlining sources of information on programme promotion and application:** Public facing aspects of the programme appear fragmented. For instance, each delivery partner deals with the promotion, awareness raising and provision of application information on the ICURe programme via its own website. This fragmentation was considered confusing for potential applicants. A single information and application website was suggested to address this issue. The regional approach to the assessment of applications was, however, not challenged.
 - **Gathering monitoring information on previous cohorts:** Delivery partners mentioned that the ICURe programme had now ran enough cohorts to start collecting and analysing consistent monitoring data on the performance of the various teams and cohorts over time. SETSquared is currently collecting and centralising this monitoring information, but this did not seem to be known to the other two delivery partners. They called for this data to be shared with delivery partners and ideally published on a shared website, as they believe it could also be useful to highlight the success of previous participating teams, which could in turn help to promote the programme and attract potential applicants for future cohorts of the programme.
 - **Creating a national pool of Business Advisors:** As the new delivery partners have received good feedback from participating teams on the support they provided to link teams with potential business advisors for the programme, it was suggested that this approach is taken at the national level. As business advisors were considered quite mobile and willing to travel, it was thought that this aspect of the programme did not need to be regionalised. A proposition to create a national pool of business advisors was raised, and it was highlighted that this would be facilitated if centralised monitoring information were collected on previous cohorts (see point above), as keeping track of previous projects would help to identify potential advisors for future cohorts.

Recommendation: The regionalisation of the ICURe programme in its expansion has brought perceived benefits, though has also created some challenges that might best be addressed by a central co-ordinating partner. UKRI should consider where there may be benefits in strengthening the role of a central delivery partner in relation to both co-ordination and maintenance of networks (e.g. of investors and business advisors) where may be increasing returns to scale.

3.3 Summary

- **Demand for ICURe:** Participation in the ICURe programme by academic institutions has widened significantly over the 15 cohorts. Demand for the programme has proven robust to the extension and expansion of the programme, and there have been no apparent adverse effects on the quality of applications received. There may be opportunities to secure deeper engagement with institutions that are comparatively new to the programme.
- **Quality of programme delivery:** There are no obvious weaknesses in the design of the programme, and the quality of delivery has maintained through its extension and expansion. The evaluation did raise some questions as to how far the level of technical enterprise education received by ECRs ahead of their involvement in the programme enabled them to tackle some elements of the process of developing business models and optimal commercialisation strategy. It is unlikely

that adjustments to the ICURe programme could meet the appetite for this type of training, and it is recommended that UKRI considers other levers at its disposal that could help address these types of issue.

- **Behavioural change:** The findings of the study reproduces the positive findings from the evaluation of the first six cohorts and indicates that participation in the programme stimulated substantial efforts to validate the value proposition for the underpinning the technology that would not have been possible otherwise. These efforts were viewed as instrumental in shaping the later commercialisation of projects.
- **Options roundabout:** There has been a shift in the advice made to teams since the last evaluation, with a fall in the share of teams advised to spin-out, and a significant increase in the proportion of teams advised to pursue a licensing pathway or to conduct further or sponsored research. As shown in the prior evaluation, teams did not always react positively to advice to license the technology – partly because they typically viewed a spin-out as the optimal pathway, but also because they were conscious of the comparatively limited availability of post-programme support available to achieve such an outcome.
- **Expansion of the programme:** The extension of the programme led to a regionalisation of the delivery that reportedly brought benefits by enabling its delivery to be customised to meet local needs. This was, however, accompanied by a fragmentation of certain aspects of the programme delivery, and there may be benefits in strengthening central co-ordination functions to deal with those aspects better handled from the centre.

4 Commercialisation Outcomes

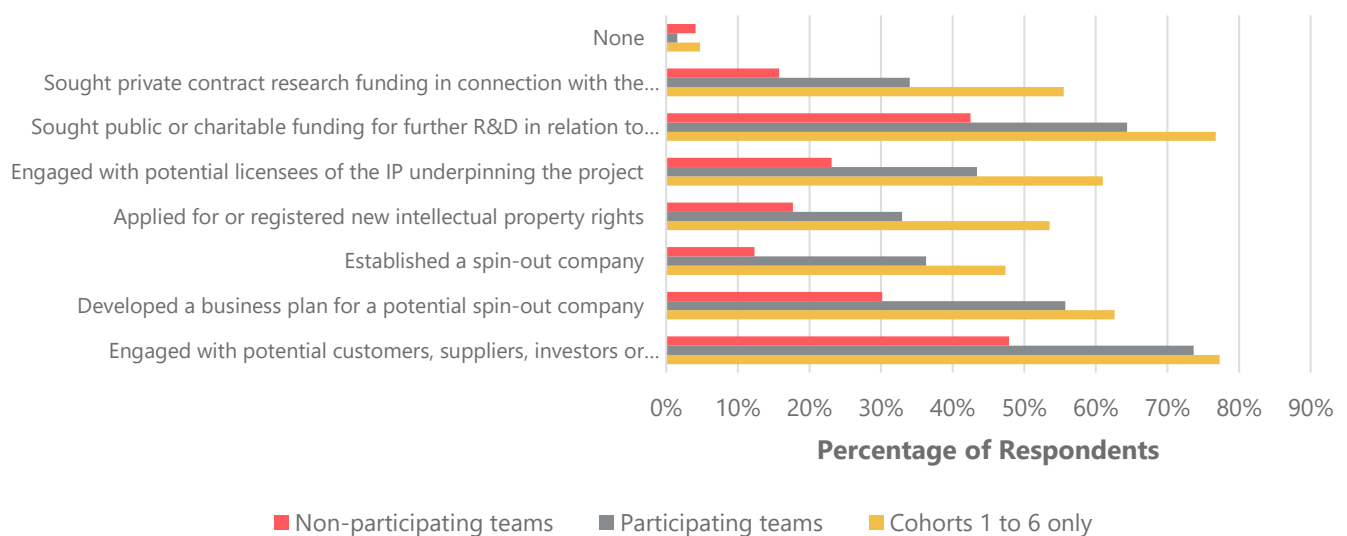
This section provides an analysis of the commercialisation outcomes resulting from the ICURe programme. This section considers the impact of the programme in supporting the development of business models, commercialisation effects via spin-outs and licensing agreements, and other effects in terms of the development of the technologies underpinning the participation of teams in the programme. This section draws on both the survey of applicants for places on the ICURe programme, analysis of administrative data, qualitative research with stakeholders in the programme and participating teams, and a set of econometric analysis aiming to explore the causal effects of ICURe on the outcomes of interest (set out in more detail in Annex A).

4.1 Actions taken following the Options Roundabout

The figure below shows the actions that were taken to commercialise the underlying technology by teams following the Options Roundabout (or following their application being declined in the case of non-participating teams). As illustrated, few teams took no actions to commercialise their underlying technologies. However, teams participating in the programme were both more likely to pursue different routes to commercialisation as well as seek further public or private funding to develop the technology further. For example, 36 percent of participating teams went onto found a spin-out (versus 12 percent that were declined a place on the programme) and 43 percent had engaged with potential licensees (23 percent amongst non-participating teams).

These findings broadly align with the results of the prior evaluation of the programme, suggesting that its effectiveness in motivating commercialisation activity amongst PIs, ECRs and TTOs has been robust to the extension and expansion of the programme. The figure also illustrates that these actions may take time to arise: those participating in the first six of cohorts of the programme were more likely to have established a spin-out, registered foreground intellectual property, engaged with potential licensees or sought further funding to develop the technology.

Figure 4.1: Actions taken to take the project forward following the Options Roundabout



Source: Ipsos MORI Applicant Survey (February 2019)

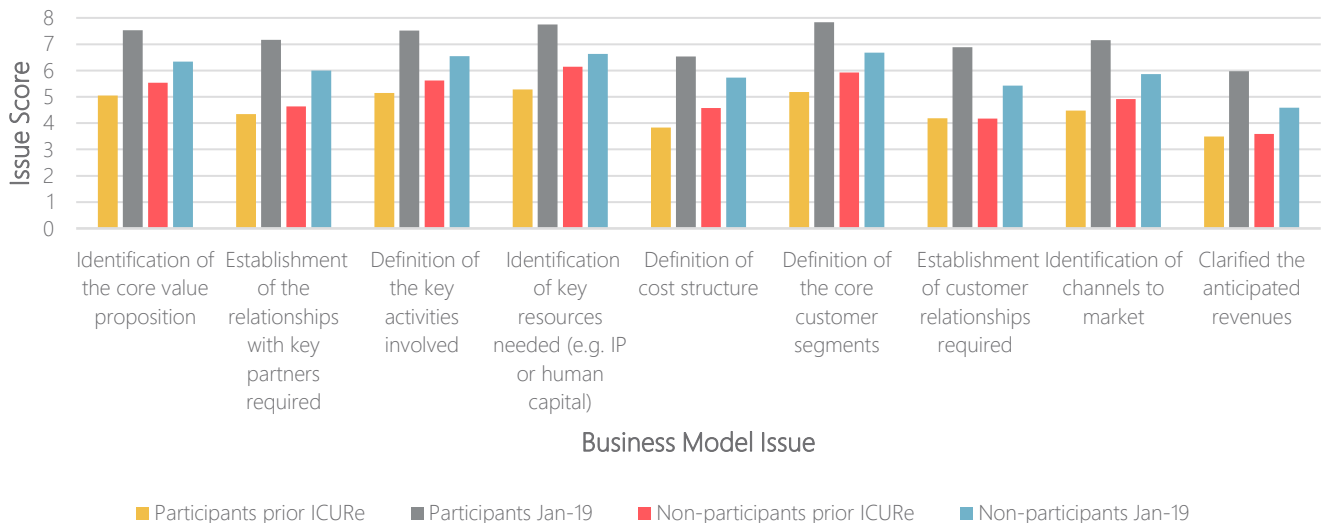
4.2 Business model development

As highlighted above, a high share of participating teams (over 70 percent) continued to engage with potential customers, suppliers, or investors to refine the underlying business model for commercialising the innovation. This is reflected in their self-reported progress in resolving various aspects of the business model as illustrated in Figure 4.2. Participating teams made more rapid progress in resolving business model issues than non-participating team across all dimensions of the Business Model Canvas.¹⁴ This is again consistent with the findings of the evaluation of the first six cohorts. Participants reported particularly rapid progress in the definition of the core customer segments, the establishment of the relationships with key partners, identifying channels to market, and establishing the required customer relationships.

ICURe participants made less progress in defining the cost structure for the business and the clarification of anticipated revenues. This may not be surprising given that many teams have only recently finished the ICURe programme and are still refining their business model and commercialisation route. However, it also aligns with case study feedback received from the business advisors and TTOs (as reported in the preceding section), which highlighted that the ICURe programme could benefit from an increased emphasis on technical commercial training (e.g. preparation of business plans, understanding of burn rates).

Recommendation: UKRI could consider some form of supplementary post-ICURe commercialisation training for ECRs (where appropriate) focused on more technical business skills to maximise the quality of the outcomes attained.

Figure 4.2: Average Business Model Issues Index Score by Category



Source: Ipsos MORI Applicant Survey (February 2019)

Participants from the first 6 cohorts had not progressed significantly further than more recent cohorts with respect to these specific issues. This seems counter-intuitive as it might be expected that they would have further progressed in the resolution of these issues since they participated in the early cohorts of the ICURe programme (which is borne out by the relative growth of the spin-outs established by this group). There is also no obvious explanation for this in the evidence gathered, though it may be that the level of team member's direct commercial involvement in the commercialisation of the underlying

¹⁴ Please refer to footnote 15 that presents a caveat for this analysis relating to the interpretation of the survey question by non-participants.

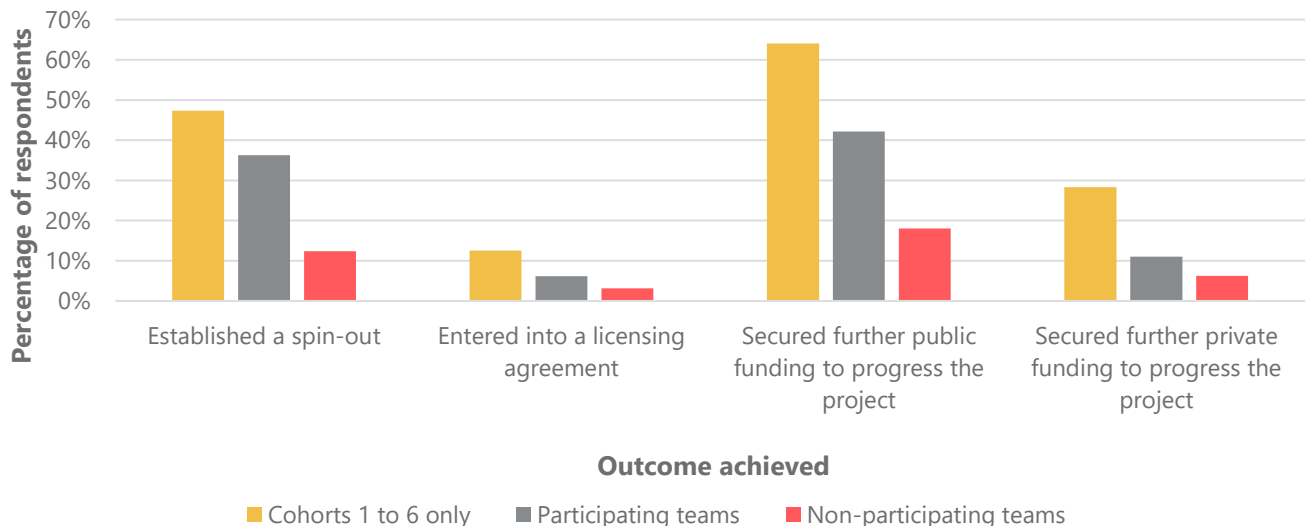
technology drops off with time (e.g. when a commercial management team is appointed). It should also be noted that these figures include participants that did not achieve a commercialisation outcome, who may have put relatively little further effort into developing their business ideas.

4.3 Commercialisation and funding outcomes achieved

The figure below provides an overview of the (self-reported) commercialisation and further funding outcomes achieved by participating teams. There is a clear pattern in that teams participating in the programme outperform non-participating teams in all key areas (issues of how far these differences can be attributed directly to the are considered below):

- **Spin-outs:** The survey indicated that 35 percent of all participating teams had gone on to found a spin-out at the time of the interview (January 2019), relative to 12 percent of non-participating teams. These figures were validated by linking records of PIs and ECRs associated with applications to the programme to Companies House records of Directors associated with new company registrations. These validation checks returned close to identical results (40 percent of participating teams and 6 percent of non-participating teams). Based on these findings, it is estimated that participating teams went on to establish 68 to 73 spin-out companies.
- **Licensing agreements:** Licensing outcomes were, by contrast, comparatively infrequent (a theme identified in the preceding evaluation). Six percent of participating teams reported that they went on to secure a licensing agreement, relative to 3 percent of non-participating teams. While this rose to 12 percent amongst the first six cohorts, this remains a comparatively low success rate given the share of teams advised to pursue a licensing pathway (20 percent) and the share reporting that they had engaged with potential licensees. It is estimated that the 188 teams participating in the programme went on to agree a total 12 licensing agreements.

Figure 4.3: Commercialisation and funding outcomes achieved



Source: Ipsos MORI Applicant Survey (February 2019)

- **Further funding:** The survey also suggested that participating teams also outperformed non-participating teams in terms of securing further funding to progress the development of the technology underpinning their application to the programme. Sixty-four percent of participating teams reported they had secured further public funding and 11 percent reported they had secured further private funding) relative to 18 and 6 percent of non-participating teams).

- **Time to impact:** In all cases, older cohorts were more likely to achieve a positive outcome, indicating that the impacts of the programme increase over time and in some cases, may only be visible in the longer term.

4.4 Spin-outs

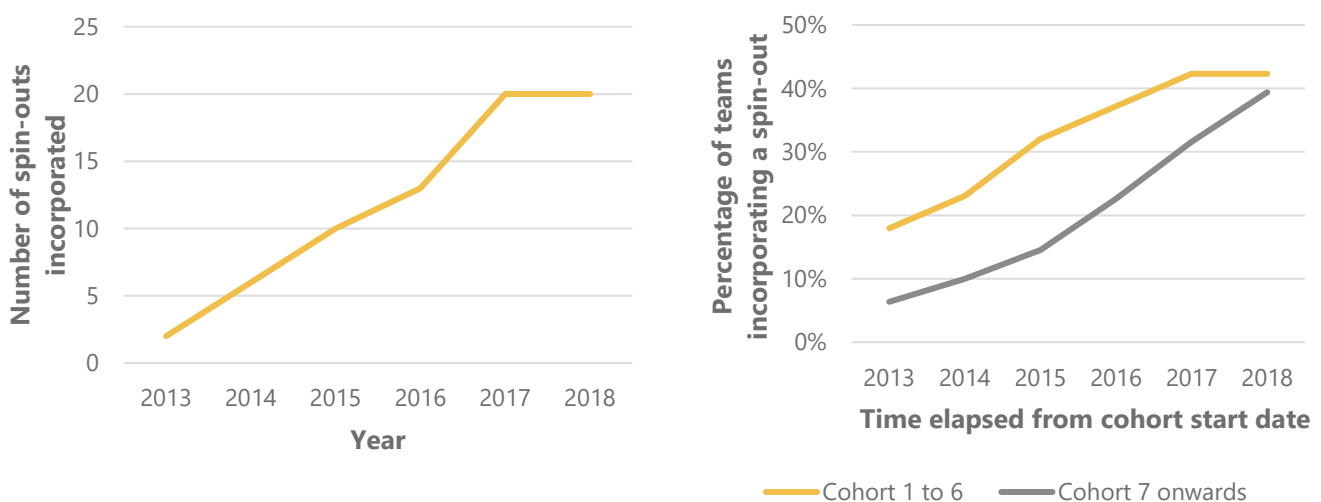
As highlighted in above, it is estimated that 33 to 36 percent of teams participating in ICURe went on to found a spin-out company. This section examines the impact of participating in the programme on the team's ability to incorporate a spin-out and explores issues in relation to their subsequent growth.

4.4.1 Number of spin-outs over time

The figure below shows the number of spin-outs established by participating teams over time:

- **Number of spin-outs over time:** The number of spin-outs incorporated by participating teams rose in each year between 2013 and 2017 before stabilising in 2018.
- **Time to spin-out:** Analysis of the time elapsed between the start date of the cohort and the incorporation date of the spin-out suggests that the speed with which teams establish a company has slowed since the first six cohorts covered in the first evaluation. However, rates converge at around 18 months' following their entry to the programme suggesting that teams may simply be founding spin-outs less rapidly following the Options Roundabout. The preceding evaluation did provide signals that the early rounds of the programme unlocked 'latent' spin-out activity in participating institutions, and this could also reflect a transition to equilibrium conditions.
- **Survival rates:** The survival rate of spin-outs established by participating teams was 94 percent in March 2019 (based on Companies House records), relative to 82 percent amongst those established by those declined a place on the programme. Comparatively, the national survival rate for spinouts one year after incorporation is 91.5 percent¹⁵.

Figure 4.4: Number of spin-outs incorporated by year, and time elapsed between cohort start date and incorporation of a spin-out



Source: Companies House, SETSquared Monitoring Information (2019)

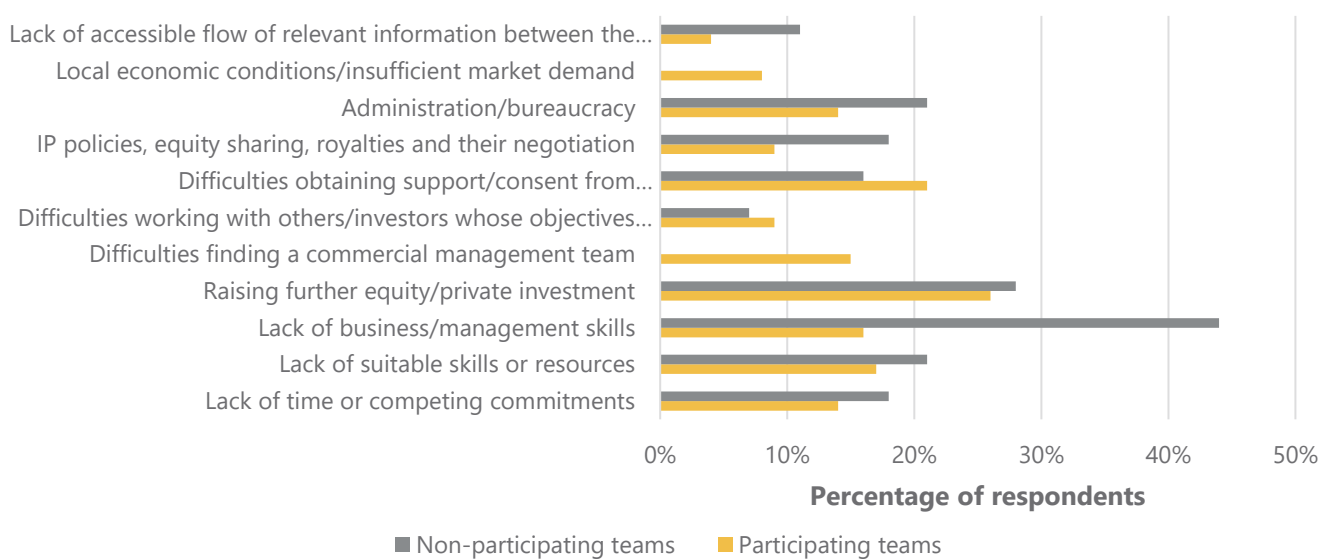
¹⁵ Source: ONS "Business demography, UK: 2017". Available at:

<https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/bulletins/businessdemography/2017>

4.4.2 Issues encountered in taking forward the spin-out

Those applicants that went on to found a spin-out were asked to report the main challenges encountered in progressing the company. The largest difference between participating teams and non-participating teams was in the share reporting that a lack of business or management skills had inhibited their progression. This provides an indication that the skills acquired through the programme has addressed a constraint faced by academics in achieving their commercialisation objectives. For participating teams, the most frequently reported barriers were challenges in raising capital to progress the business (26 percent) and difficulty in obtaining consent from the University or managing conflicts of interest (21 percent).

Figure 4.5: Main challenges reported in progressing the spin-out



Source: Ipsos MORI Applicant Survey (February 2019)

The case studies of projects taken forward by teams participating in the programme yielded similar findings to those uncovered in the evaluation of the pilot programme completed in 2017:

- Time spent fundraising:** As highlighted in the previous evaluation, a key challenge for teams is the time it takes to raise funds, which in some cases led to loss of momentum. It was reported that even when projects had a lot of potential and interest, the time absorbed shifted attention from the development and/or commercialisation project itself. The existing academic responsibilities of PIs and ECRs also created competing demands for their time.
- Funding gap:** The case studies highlighted the challenges associated with the phase between the end of the ICURe programme and the incorporation of the spin-out. In one case, there was a three-month gap when the ECR did not receive a salary, creating challenges given the amount of work needed at a critical time for the establishment of the company. An argument could be made that this represents a 'planning gap' rather than a funding gap.

4.4.3 Impacts on spin-out formation

As highlighted above, those teams participating in the programme were significantly more likely to establish a spin-out than those that were declined a place on the programme. Findings from case studies interviewees and stakeholders viewed ICURe as having an important contribution in accelerating the process of creating of a company, that would have been otherwise slower or more complicated. The market validation exercise was described as facilitating targeting of relevant businesses

and to confirm the innovations' potential, as well as showing investors that there is a commitment to commercialise of the project. Again, this broadly aligned with the findings of the preceding evaluation examining the first six cohorts.

However, it is possible that the differences observed between participating and non-participating teams could be a product of systematic differences between the two groups. For example, if those places on the programme were awarded to teams whose technologies has the greatest commercial potential, then it might be expected that these teams would be more likely to commercialise the technology regardless of their participation in the programme. To investigate these issues in more depth, a range of statistical analyses controlling for both observed and unobserved (but time invariant) differences between the two groups were completed to determine the degree to which these spin-out outcomes could be attributed to the programme. Technical details are provided in Annex A, but the key findings suggest:

- **Impact on the likelihood of a spin-out:** After controlling for differences between groups, it was estimated that 75 percent of the spin-outs established by participating teams would not have been founded in the absence of their participation in ICURe (a high rate of additionality). Robustness checks using administrative data from Companies House records¹⁶ gave a similar finding (suggesting that 72 percent of spin-outs established by participating teams would not have been founded anyway). This is broadly consistent with, though lower than, estimates derived in the prior evaluation focused on the first six cohorts using similar methods (which found a rate of additionality of 81 percent). This would be consistent with the view that ICURe partly works to accelerate company formation, given the additional time that has elapsed.
- **Number of spin-outs attributable to ICURe:** Applying this result to the estimated number of spin-outs that were established by participating teams (68 to 73), it is estimated that ICURe has led to 49 to 55 new start-ups that would not have been established in its absence¹⁷.

4.4.4 Equity investment in spin-outs

Although raising external finance was one of the main challenges reported by teams participating in ICURe, spin-outs established by participants have had substantially greater success in securing investment than those established by non-participating teams. As illustrated in the figures below, 46 percent of spin-outs established by participating firms raised external equity investment, in comparison to 18 percent of those established by teams not awarded places on the programme. The average amount raised by firms securing external investment averaged £839,000, substantially higher than the £155,000 raised by teams declined a place on the programme.

Overall, it was estimated that spin-outs established by participating teams raised between £18.9m and £21.1m in additional external equity funding due to the programme (in comparison to £6.9m estimated in the prior evaluation covering the first six cohorts)¹⁸. Around 56 percent of this funding was reported to have been raised from VC funds, and 41 percent from angel investors. There was little evidence of companies raising funding from Corporate Venture Funds or alternative forms of finance (e.g. crowdfunding). There was evidence of some asymmetry in the returns profile – around 67 percent of the total investment was raised by 21 percent of the companies, though there was no clear pattern in the characteristics of the firms that raised the highest levels of investment (which included the development of sensors, technology to improve

¹⁶ This analysis gave comprehensive coverage of the teams applying for ICURe but a less rich set of controls describing the characteristics of the teams involved.

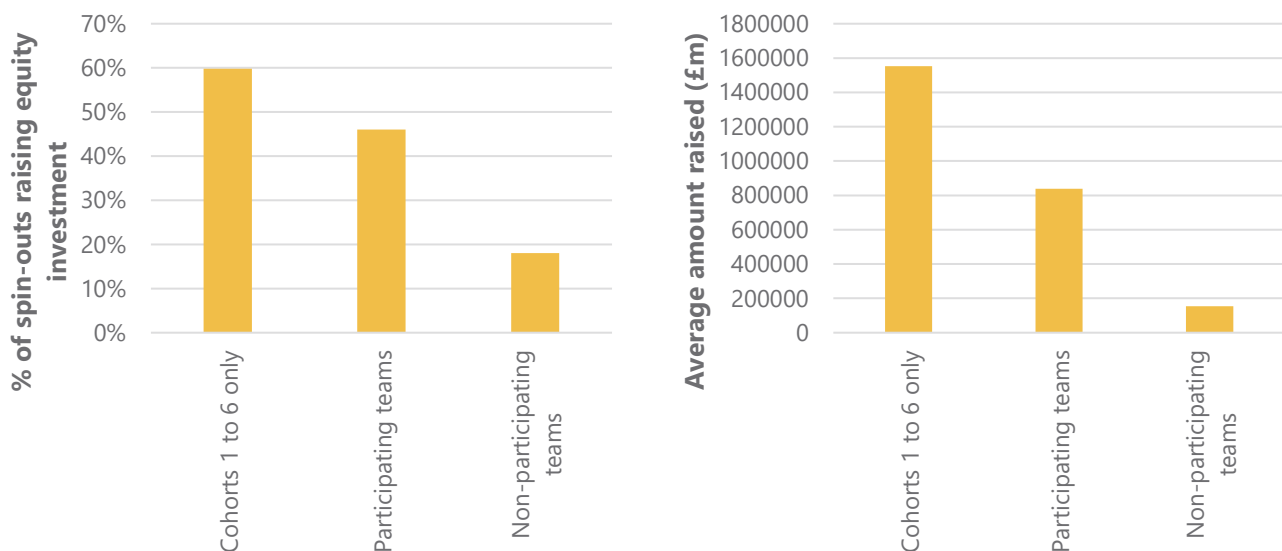
¹⁷ I.e. 68 to 73 multiplied by 0.72 to 0.75

¹⁸ I.e. 68 to 73 multiplied by 0.46 multiplied by £839,000.

transmission of 5G signals, software for networking, manufacturers of innovative polymers, and manufacturers of detectors for radiotherapy applications).

This evidence provides a strong indication that ICURe has important effects in improving the quality of spin-outs emerging from the programme (alongside facilitating company formation). These impacts also appear to increase with time: 59 percent of the spin-outs established by the first six cohorts secured external equity funding (an average amount of £1.5m). However, only one spin-out has so far secured a major exit for their investors to date (Ziyllo). This company was developing a biosensor for glucose monitoring in blood and was acquired by Novo Nordisk for £621m in August 2018.

Figure 4.6: Equity investment in spin-outs



Source: Ipsos MORI Applicant Survey (February 2019). Teams establishing a spin-out only.

4.4.5 Growth of spin-outs

Spin-outs established by teams participating in the programme also grew more rapidly than those established by teams that were declined:

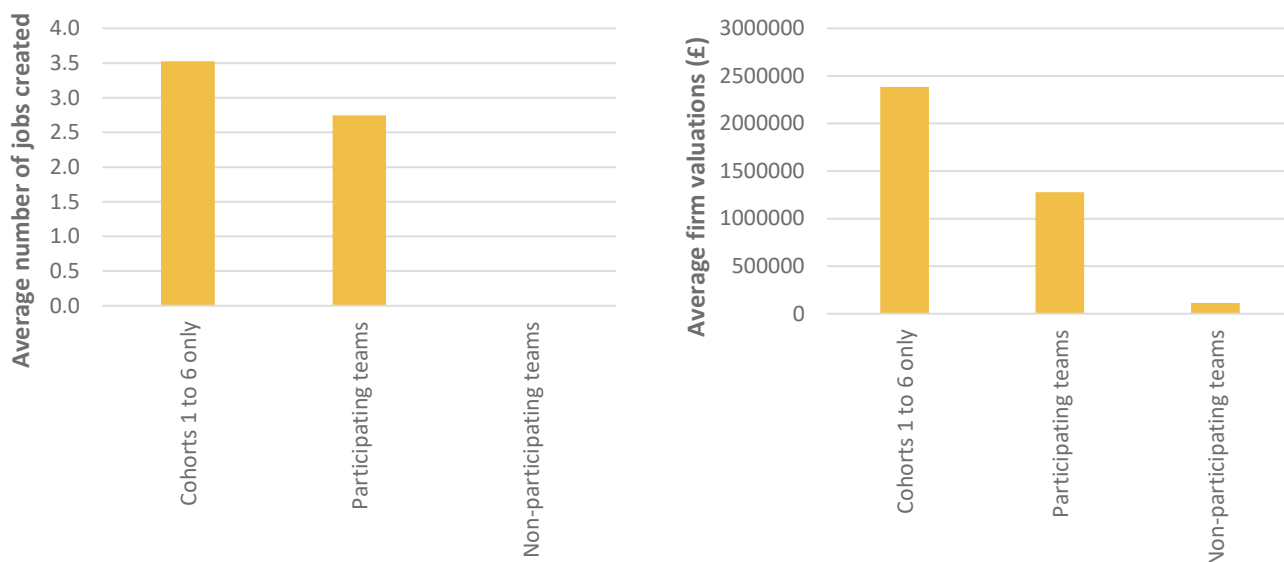
- **Jobs created:** Data compiled from spin-outs' most recent Companies House filings (which in some cases were not available for those established close to the time of writing) indicate that spin-outs established by participating teams had created an average of 2.75 jobs¹⁹, while those established by teams declined a place on the programme had created none. Overall, it is estimated that the programme has now led to between 122 and 127 gross additional jobs.
- **Firm valuations:** Although spin-outs have generally remained at the pre-revenue stages, firm valuations implicit in the size of the most recent equity investment and the level of equity ceded provide a market based measure of investors' expectations of the future profitability of the business²⁰. Assuming those firms whose value is unobserved (because they

¹⁹ Data on jobs were taken from Companies House account filings, which were available for 51 of 73 firms. Jobs were assumed to be zero where accounts were filed for dormant companies. Non-zero figures on employment were available for 25 of the 51 firms.

²⁰ Firm values were estimated for each respondent to the survey as the value of equity investment received divided by the share of equity ceded. The survey gave non-zero observations of the value of 22 spin-outs established by participating teams (compared to an estimated 30 firms receiving equity investment, or 73 percent coverage).

have not attracted external investment) have zero value, it is estimated that the average value of spin-outs established by participating teams was £1.3m relative to £0.1m amongst those established by non-participating team. The increase in the market valuation of spin-outs attributed to ICURe is estimated at between £62.5m and £69.9m²¹.

Figure 4.7: Jobs created and valuations of spin-outs



Source: Companies House and Ipsos MORI Applicant Survey (February 2019)

4.4.6 Role of Aid for Start-Ups and Follow-On Funding

Interviewees highlighted that Aid for Start-Ups and Follow-On Funding was a key factor in accelerating the incorporation of the spin-out and its subsequent growth. It was thought that researchers (and particularly ECRs) would have been otherwise needed to commit to their academic duties and would not have been to take a role in the executive team of a start-up. Aid for Start-Ups and Follow-On Funding was thought to be particularly beneficial when it allowed teams to employ a CEO for the company (and a comment was made that having commercially capable staff is equally important as having a good product to sell in terms of progressing the spin-out). Grant funding was also described as beneficial in leveraging venture capital funding. Those teams not receiving public funding tended to take longer to achieve these results, with time often absorbed by attempts to secure other sources of public and private funding in the short term.

To provide quantitative insight into these claims, a variety of details were compiled from the most recent accounts filed by the spin-outs established by participating teams. A comparison between those established with and without some form of public support in terms of some key metrics of performance suggested that public support may have a significant impact on the success of the spin-out (care should be taken to avoid making causal inferences on the basis of these figures, as those awarded public support may differ in systematic ways to those that do not):

- **Time to incorporation:** Teams receiving incorporated with public support incorporate a business in less than half the time of those that do not (3.5 months versus 7.3 months).

²¹ I.e. £1.3m multiplied by 49 to 55 (note that while there was asymmetric returns profile, the sample mean should provide an unbiased estimate of the population mean regardless of the underlying distribution).

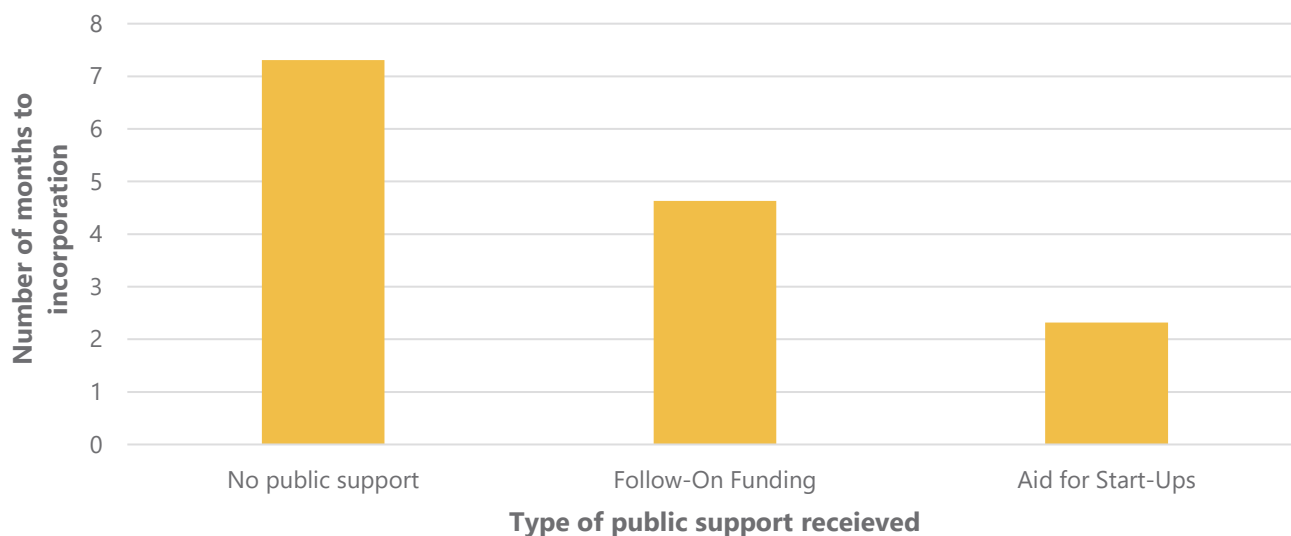
- **Share premium account:** The share premium account provides some indication of the success of the company in attracting external investment. On this measure, those spin-outs incorporated with public assistance raised more than three times as much in external funding than those relying on private funding at the time of their most recent accounts filing (£450,000 versus £140,000).
- **Jobs:** Spin-outs established with public support created 4.6 jobs on average, relative to 1.7 for those that did not receive assistance.
- **Survival rates:** While all spin-outs that received public assistance had survived to March 2019, ten percent of those established without public funding had dissolved.

Recommendation: Public support to help capitalise spin-outs appears to have a substantial impact in accelerating their growth. It is recommended that UKRI retains this element of the programme in any national roll-out, recognising that some adjustments to the model may be needed to reach a design that maximises value for money.

The transition from Aid for Start Ups to Follow-On Funding was reported by some stakeholders as creating some challenges for teams. The requirement to find around £90,000 of private funding was thought to cause problems or hold-ups for the teams, especially as this amount falls in what has traditionally been understood as the 'equity gap', being high for an angel investor but too low to attract interest from venture capital funds. However, some delivery partners argued that the £500,000 in grant funding awarded under previous arrangements was too much for a nascent team to absorb. Teams have also been helped by universities where institutions have their own venture capital funds. Investors pitch days organised by QUB roughly one month after the Options Roundabout have also been reported as helpful in terms of facilitating the attraction of match funding.

It is more challenging to test these arguments using the available data, as those teams establishing spin-outs with Aid for Start-Ups funding will have had longer to attract external finance and develop their operations. However, comparisons between the two groups indicate that the transition to Follow-On Funding may be partly responsible for the apparent increase in the amount of time taken by teams to spin-out. The long-term significance of this remains to be tested, as any differences in the share of teams incorporating spin-outs largely disappear after 18 months and it is not yet possible to determine if this influences their growth. If not, Follow-On Funding may well offer better value for money than the Aid for Start-Ups programme as the unit cost to the public sector per spin-out are substantially lower and the apparent penalties (in terms of time lost) may be considered tolerable.

Recommendation: UKRI should closely monitor the on-going growth of firms receiving Follow-On Funding before reaching a judgement as to whether the optimal model of financial support has been found. UKRI should also consider whether alternative financial instruments could be considered – given the market failure rationale for supporting spin-outs with early stage financing (i.e. missing markets), a natural remedy would be to supply some form of patient equity funding directly – which could, in the long-term, provide some form of revolving fund with future investments funded by future profitable exits. Convertible loans could be another option to consider.

Figure 4.8: Time from cohort start date to incorporation date

Source: Ipsos MORI Applicant Survey (February 2019)

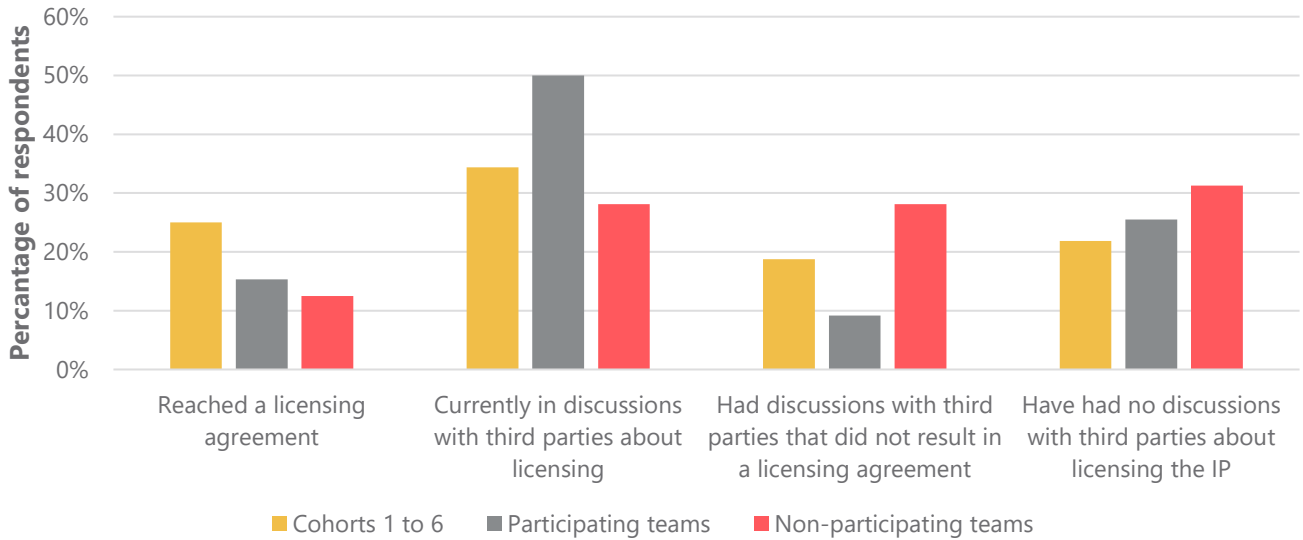
4.5 Licensing

As highlighted above, it is estimated that six percent of teams participating in ICURe went on to secure a licensing agreement. Findings from the statistical analyses also showed that participation in the programme did not have significant effect on the numbers of licensing agreements secured by participating team, although as indicated above it did stimulate additional activity to pursue a licensing agreement. This section explores the impact of participating in the programme on the team's ability to secure a licensing deal and explores issues in relation to this process.

4.5.1 Licensing outcomes

As illustrated in the figure below, participating teams that have attempted to engage potential licensees were not substantially more likely teams declined a place on the programme to secure a licensing deal (15 percent versus 13 percent). The evidence also indicates that participating teams attempting to engage potential licensees were only slightly more likely to have entered any form of discussion with potential licensing partners (59 percent versus 56 percent), though these discussions were more likely to fall through when led by non-participating teams. Taken in the context of the findings set out above, the primary effect of ICURe on licensing outcomes has been in terms of encouraging teams to actively take forward a licensing pathway following the Options Roundabout, rather than influencing the final outcome.

Figure 4.9: Outcomes of efforts to engage potential licensees

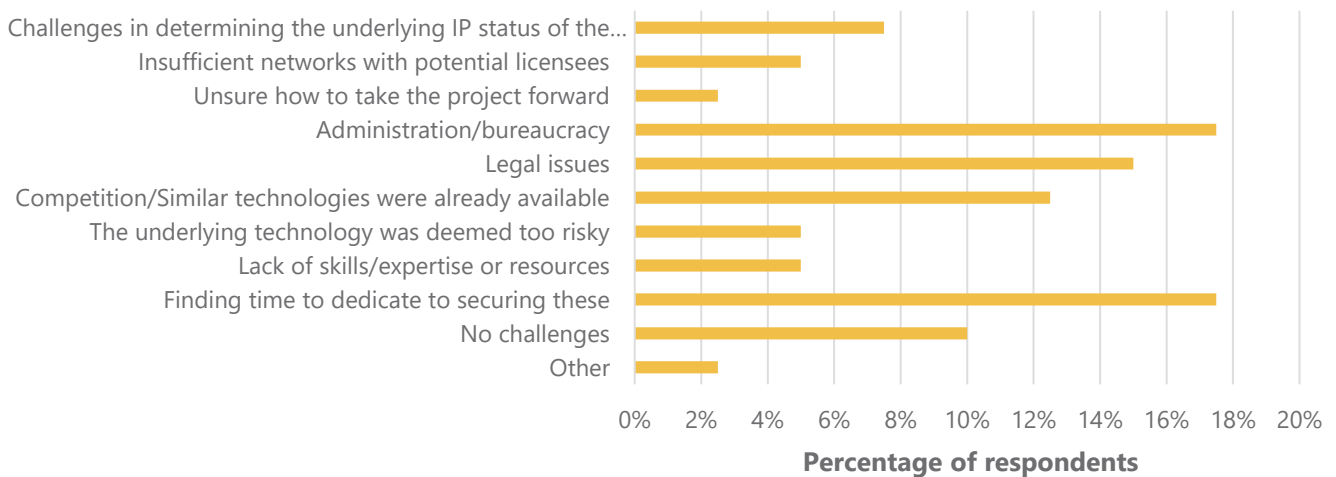


Source: Ipsos MORI Applicant Survey (February 2019). Teams pursuing a licensing outcomes.

4.5.2 Issues encountered in securing a licensing deal

Respondents that had secured a licensing deal were asked to report the barriers they faced in doing so. The most commonly reported challenge was finding time to dedicate to securing these agreements (38 percent). Barriers relating to administration and bureaucracy (31 percent) and legal issues (31 percent) were also widely reported (participating and non-participating teams are pooled in the figure below as only small numbers of respondents were asked this question).

Figure 4.10: Main challenges reported in reaching a licensing agreement

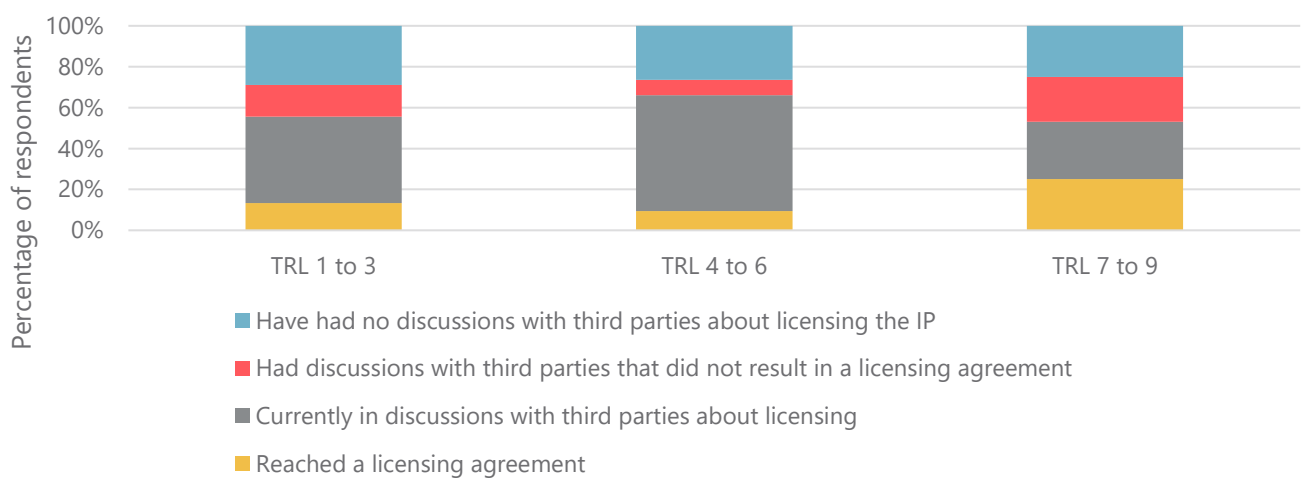


Source: Source: Ipsos MORI Applicant Survey (February 2019). Teams securing a licensing agreement.

The qualitative research and survey findings helped provide further evidence on the difficulties encountered by teams in progressing towards a licensing outcomes:

- Technological maturity:** Qualitative research and survey analysis seem to suggest that the properties of the technologies, and its closeness to the market (measured using the TRL scale), may play a role in the teams' ability to successfully negotiate a licensing agreement with third parties. As highlighted in the figure below, the success rate of teams in securing a licensing deal rose at higher TRL levels (25 percent of teams that had taken their technology to TRL 7 to 9 by the start of the programme had secured a licensing agreement, relative to 9 to 13 percent of those starting at lower levels of technological maturity). This difference is even clearer when allowing for further technological development work achieved following the Options Roundabout - 63 percent of those that had reached TRL 7 to 9 had secured a licensing agreement). However, it is not clear from the data how far this additional work was funded by the licensing partner.

Figure 4.11: Outcomes of licensing discussions and market readiness (measured by the TRL scale)



Source: Ipsos MORI Applicant Survey (February 2019)

This is reinforced by findings from the case studies, where licensing was considered more viable option where projects had completed significant commercial development and refinement in a commercial setting. Challenges were reported by one team in their discussions with third parties with respect to the maturity of technology. Misaligned perceptions and expectations on both sides of the negotiation were mentioned, with industrial partners and third parties often demanding the technology to be at a higher level of readiness than was feasible for the team to achieve in a lab environment. A degree of co-development with potential licensees (or further public funding) may be necessary to bring the technology to a higher TRL to ensure it is ready to operate in its envisaged environment.

The findings also potentially highlight a difference in the level of risk appetite across investors and potential licensees as there was no difference in the level of reported technological maturity across those advised to establish a spin-out and those advised to pursue a licensing agreement. While the spin-outs established by participating teams have generally been successful in raising risk finance, it seems the latter seemingly exhibit a preference for 'de-risked' technologies. There is also a question as to whether the Options Roundabout panel have advised to pursue a licensing pathway before the technology was ready for such an outcome (possibly encouraging abortive efforts secure such a deal).

Recommendation: It is recommended that UKRI consider how the Options Roundabout forms its advice for licensing and whether it may be helpful for the panel to consider in more depth further stages of technological development that could aid the team increase their chances of securing a licensing agreement or maximise the commercial values attained.

- **Team driven factors:** The qualitative evidence also highlighted team level factors that could reduce the likelihood of a licensing outcome. While the programme is agnostic to the optimal commercialisation pathway, and this is made clear to applicants, the case studies showed that the level of motivation amongst teams to pursue a licensing pathway was often limited. For example, one project was advised to license a technology platform following the Options Roundabout, but the team disagreed with this suggestion and decided to try to spin-out a company instead. The team saw a licensing route as too ‘short-sighted’, believing that the technology had numerous applications which could be better exploited by forming a spin-out which could target more than one application area. For those that do wish to pursue an advised licensing pathway, a lack of commercial skills and knowledge in the team was often described as a key inhibitor of progress. This led the teams to turn to their TTO for further support and rely extensively on them to progress post-ICURe, or to lose momentum when TTO support could not be secured.
- **TTO factors and gaps in post-ICURe support:** As indicated above, responsibility for pursuing a licensing pathway often sat with the TTOs, particularly in relation to administrative and legal issues. Interviews with stakeholders indicated that TTOs may not always have the capacity or feel well-equipped to support the realisation of licensing outcomes:
 - **Resource constraints and opportunity costs:** The qualitative research indicated that one effect of the ICURe programme was to ‘lift the burden’ from TTOs and free up capacity before and during the programme. This effect did not persist after teams’ involvement in ICURe came to an end. Most participating teams - regardless of the commercialisation outcome they pursued - indicated that they relied on their TTO for support after ICURe. TTOs were thought to seek the most productive use of their time and could de-prioritise licensing opportunities when faced with more ‘valuable’ or easier to attain results elsewhere (i.e. opportunities to establish a spin-out).
 - **Lack of skills, knowledge, and industry contacts:** TTOs reported that they often lacked the industry knowledge and contacts to fully explore the potential for licensing deals and effectively negotiate those agreements. Case study research highlighted that the ECRs could be better placed to engage (though not negotiate with) potential licensees. As they were leading the market validation exercise, ECRs hold the range of contacts required and have a refined understanding of the most promising opportunities. However, on completion of the programme, there is no financial support available to retain the ECRs involvement, who will need to deal with competing academic and research priorities.
 - **Availability of funding and the wider ecosystem:** In the face of resource constraints, TTOs reported it was important to signpost participating teams to relevant public funding schemes to support further commercialisation. However, both delivery partners and TTOs suggested that the ecosystem to support projects seeking to license after the ICURe programme was relatively weak. It was mentioned that dedicated funding streams (or some form of post-ICURe support) to support teams seeking to license would be particularly useful to:
 - **Secure the time and attention of ECRs post-ICURe (and to some extent of TTOs):** Dedicated funding could help to mitigate the problems caused by the possible loss of the ECRs involvement at the end of the programme. One of the teams that has successfully pursued a licensing route secured Innovate UK funding for a Knowledge Transfer Partnership (KTP) following its participation in the ICURe programme. This enabled focus the ECR on progressing the project. KTP funding was also used to recruit software developers, and allowed the team to continue working with businesses - identified in the market validation exercise - to embed knowledge relating to the technology into the companies’ practices and processes.

- **Boost the team’s motivation to pursue licensing outcomes:** Case study research revealed that teams tended to perceive the ICURe programme as a ‘gateway to further funding’ to progress their project. As such, it was reported that licensing opportunities did not appear appealing in this way, reducing the team’s motivation to pursue the commercialisation outcome.

Recommendation: The issues encountered by teams in progressing licensing outcomes are complex and it is clearly difficult to disentangle those technologies that did not commercialise because they were not sufficiently commercially valuable and those that had commercial potential. However, issues relating to the availability of post-ICURe funding and the maturity of technologies appear to be a constraining factor, raising questions of how teams can best be supported once their involvement in the programme comes to an end. The Knowledge Transfer Partnership programme appears to offer one possible ‘off-the-shelf’ instrument through which this might be achieved – though this does rely on the ECR making contact with potential licensees through the market validation process.

Recommendation: The issues involved are complex and may have broader relevance in the context of wider research and other funding made available to support the commercialisation of academic research (e.g. Impact Accelerator Accounts). UKRI may find value in commissioning specific research into the broader challenges faced by academic institutions in licensing technologies and understanding the common factors underpinning successful and unsuccessful attempts to reach licensing agreements with commercial partners.

4.6 Cost-Benefit Analysis

Using the results above, it is possible to provide an indicative assessment of the benefits of the ICURe programme, and how far they justify the costs involved in delivering the programme.

4.6.1 Benefits

The primary benefits of the ICURe programme will be in the form of increases in productivity associated with the exploitation of technologies under development. Given the early stage of spin-outs emerging from the programme, there are a set of substantial challenges in estimating the value of these benefits. However, it may be reasonable to assume that the amount that the market is willing to invest in the spin-outs offers a useful approximation of the benefits involved provided the following assumptions hold:

- The price the investor is willing to pay for the investment will reflect the net present value of the future profits that the investor expects to earn from its exploitation (i.e. the economic rent) over and above the returns they might expect receive by investing their capital in a risk-free asset. This valuation should, in principle, account for the expected future risks of a technical and commercial nature (e.g. that the innovation does not deliver the expected technical enhancements or the anticipated market does not emerge as envisaged). This also assumes that the investor can accurately assess the risks involved. Additionally, it assumes that the technology is purchased with a view to exploitation rather as a defensive measure to prevent an inferior technology being undermined (which would mean that the potential profits involved are ultimately unrealised). It is worth noting that exploitation may be economically sub-optimal if the spin outs acquire a degree of monopoly power over the innovation at the heart of the project (e.g. because of intellectual property rights).
- Other economic activities activity may be crowded out or displaced by the exploitation of technologies under development. However, if this activity takes place in competitive markets, the firms whose products or services are displaced can be assumed to be earning only a normal return on the capital employed (and the resources used to

produce those products or services can be redeployed for other purposes). This would be consistent with quality ladder models of competitive innovation²² that involve diminishing returns to the use of existing ideas.

Under these assumptions, the economic benefits attributable to ICURe are £62.5m to £69.9m (i.e. the market valuation of spin-outs created as a result of ICURe). Given the possible issues associated with unobserved differences between participating and non-participating teams, this may overstate the net value created by the programme. However, this estimate does not account for any possible future benefits that are yet to be realised through spin outs that are yet to receive equity investment, further start-up activity or licensing agreements or positive spill-overs that may arise. This estimate also does not account for any possible effect of ICURe in enabling teams that would have created a spin-out anyway realise higher valuations. Additionally, these values may change in future funding rounds depending on the success of spin-out in de-risking aspects of the business model and realising its potential commercial returns. In this respect, this is an ex-ante measure of the economic effects of ICURe (and may rise or fall in the longer term).

4.6.2 Costs

The figures available give an approximation of the costs associated with the cohorts in the scope of the evaluation of ICURe of £18.2m covering both the costs of delivering the programme and the start-up aid provided to some teams through Aid for Start-Ups and Follow-On Funding. This does not account for possible hidden opportunity costs (e.g. the absorption of TTO resources to support teams with the commercialisation of spin-outs), or the resource costs incurred by those pursuing a spin out or licensing agreement that were not funded through Aid for Start-ups (or the opportunity costs incurred by those teams that applied for the programme but were not awarded a place. This estimate also does not include any other possible social costs of the programme (e.g. additional private investment in R&D stimulated via contract research).

4.6.3 Value for money

Taking the estimates of costs and benefits as set out above, it is estimated that the ICURe pilot led to a net benefit with an approximate net present value of £44.3m to £51.7m (the time distribution of costs is not available, preventing discounting of costs). The approximate benefit to cost ratio is £3.43 to £3.84 per £1 of public expenditure. This is broadly in line with the findings of the prior evaluation covering the first six cohorts, and provides further evidence that the effectiveness of the programme has proven robust to its extension and expansion. More time is arguably needed to understand the impact of involving additional delivery partners and the transition to Follow-On Funding.

4.6.4 Limitations

The findings should not be treated as definitive, and there are number of factors that have led to an over or understatement of the effects of the programme (and on balance, the results may overstate the net benefits of the scheme):

- **Selection bias:** Participating and non-participating teams may differ in unobserved ways that were not possible to accommodate within the design of the econometric analysis. The expectation is that, given the competitive process of allocating places, participating teams would have been otherwise better equipped to commercialise their research than non-participating teams, potentially leading to an overstatement of the impact of the programme.
- **Complementary programmes:** The results do not account for participation all complementary programmes that may have contributed to the results observed. If participating teams were more likely to benefit from these complementary

²² See for example Quality Ladders, Competition, and Endogenous Growth, Boldrin and Levine, 2009.

programmes than non-participating teams, then there is a risk that a share of these results have been mistakenly attributed to the ICURe programme (leading to an overstatement of the benefit to cost ratio).

- **Costs:** As noted above, the findings do not incorporate any additional costs incurred by universities or the private sector due to the programme (e.g. transaction costs incurred by TTOs in enabling equity investments to be made). This will understate the net cost of the programme.
- **Unrealised benefits:** On the other hand, there are a range of benefits that are not accounted for in the estimates above. This includes any possible future benefits that are yet to be realised through spin outs that are yet to receive equity investment, further start-up activity or licensing agreements or positive spill-overs. Any effects of ICURe in enabling teams to realise higher valuations have not been accounted for. Finally, as explored in section 5, there may be other economic benefits (such as improved productivity of ECRs) that have not been included in this result.

4.7 Summary

- **Actions taken following the Options Roundabout:** The evidence reinforces the findings of the evaluation of the first six cohorts and suggests that the programme has motivated significant levels of commercialisation activity within participating HEIs and its effectiveness in this regard has proven robust to its extension and expansion. Teams participating in the programme were substantially more likely to pursue all different routes to commercialisation as well as seek further public or private funding to develop the technology further. Participating teams also made greater progress in resolving key issues involved in defining the optimal business or commercialisation model.
- **Commercialisation and funding outcomes:** Teams participating in the programme outperform non-participating teams in types of outcomes considered in this study. Spin-outs were the most frequent outcome from the programme – with 35 percent of all participating teams going on to found a spin-out, relative to 12 percent of non-participating teams. Licensing outcomes were, by contrast, comparatively infrequent and the success rate was comparatively low given the share of teams advised or moving on to pursue a licensing pathway. Participating teams also outperformed non-participating teams in terms of securing further private or public funding to progress the development of the technology underpinning their application to the programme.
- **Spin-outs:** The programme had a significant impact on the number of spin-outs established by participating teams, and it was estimated that between 49 and 55 spin-outs were incorporated that would not have been in the absence of ICURe by January 2019. Participation in the programme also appeared to have substantial impacts on the quality of spin-outs established – those established by participating teams grew more rapidly, were more likely to have attracted external equity funding, and attained higher valuations than those established by teams declined a place on the programme. The increase in the market valuation of spin-outs attributed to ICURe is estimated at between £62.5m and £69.9m).
- **Aid for Start-Ups and Follow-On Funding:** The availability of grant funding through the Aid for Start-Ups and Follow-On Funding appeared (on an indicative basis) to play a significant role in accelerating the growth and development of spin-outs and it is recommended that this form of support is retained in any national roll-out of the programme. There are unanswered questions as to the long-term impact of the transition from Aid for Start-Ups to Follow-On Funding. While the requirement to find match funding up front appears to have slowed the progression of spin-outs, it does not appear to have led to a reduction in the overall number of spin-outs incorporated. However, it is too early to judge how far reduced speed has had a long-term impact on the growth or development of the spin-out companies established. UKRI

should closely monitor the on-going growth of firms receiving Follow-On Funding before reaching a judgement as to whether the optimal model of financial support has been found.

- **Licensing agreements:** The impact of ICURe programme on licensing agreements was less significant. While the programme appeared to motivate participating teams to begin the process of engaging licensees in larger numbers, the outcomes of these efforts were less significant and no more licensing agreements were reached than would have been achieved in the absence of the programme. The issues encountered by teams in progressing licensing outcomes are complex, though issues relating to the availability of post-ICURe funding and the maturity of technologies appear to be a constraining factor, raising questions of how teams can best be supported once their involvement in the programme comes to an end.
- **Value for money:** The ICURe programme has offered good value for money, with an estimated benefit to cost ratio of between £3.43 to £3.84 per £1 spent. This reproduces the findings of the prior evaluation focusing on the first six cohorts based on a more robust set of data, giving greater confidence in the judgement reached in the preceding study that the programme is viable candidate for a national roll-out. However, it should be noted that there are some uncertainties with these results. Firstly, it was not possible to control for possible differences between successful and unsuccessful applicants that could bias results, and it is possible that the underpinning statistical analysis has overstated the impact of the programme. Secondly, the results assume that investors can effectively price the risks and potential returns associated with the future commercialisation of the technology (which may not be the case).

5 Wider Effects

This section provides an overview of the most prominent wider term effects of participation in the programme. Some examples include the wider skills and knowledge acquired by ECRs through the delivery of the project, participants' career prospects, and the positive spill over effects experienced by academic institutions.

5.1 Individual Level Effects

As part of the programme, ICURe intended to increase ECRs' commercial awareness and skills, as well as to enhance team members' career prospects and influence their future research agenda.

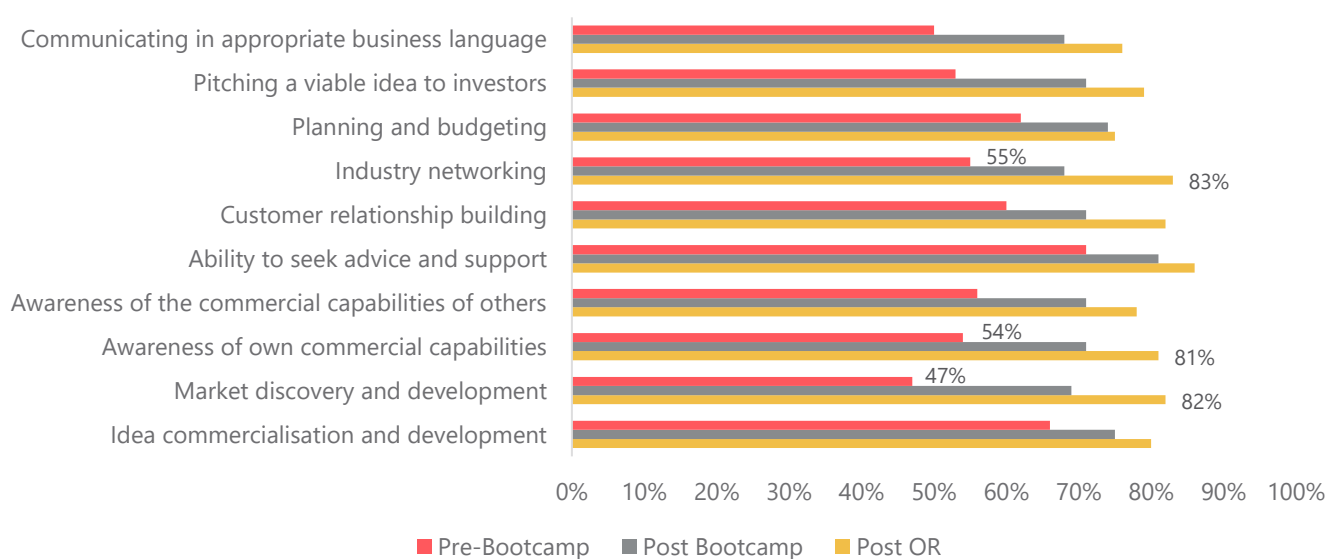
5.1.1 Commercial skills

Participants in the programme were asked to rank their own skill capability across a range of different attributes on a 7-point scale as part of on-going monitoring of the programme, with seven indicating the highest level of competence and one indicating the lowest²³. This data was collected at three points in time in the programme: before the Bootcamp, after the Bootcamp, and after the Options Roundabout.

Commercial skills of Early Career Researchers

As shown in the figure below, ECRs reported increases in their commercial capability skills from the point at which they entered the programme (57 percent on average), to after the Bootcamp (72 percent) and after the Options Roundabout (81 percent). The skills that were perceived as most improved after ICURe were market discovery and development (increasing from 47 percent to 82 percent), industry networking skills (increasing from 55 percent to 83 percent) and the awareness of own commercial capabilities (increasing from 54 percent to 81 percent).

Figure 5.1: Commercial skills of ECRs before and after ICURe



Source: SETSquared Monitoring Information, 2019

²³ For ease of interpretation, scores reported on the 7-point scale were transformed into percentages (e.g. a score of 4 would be 57 percent ($4/7=0.571$)).

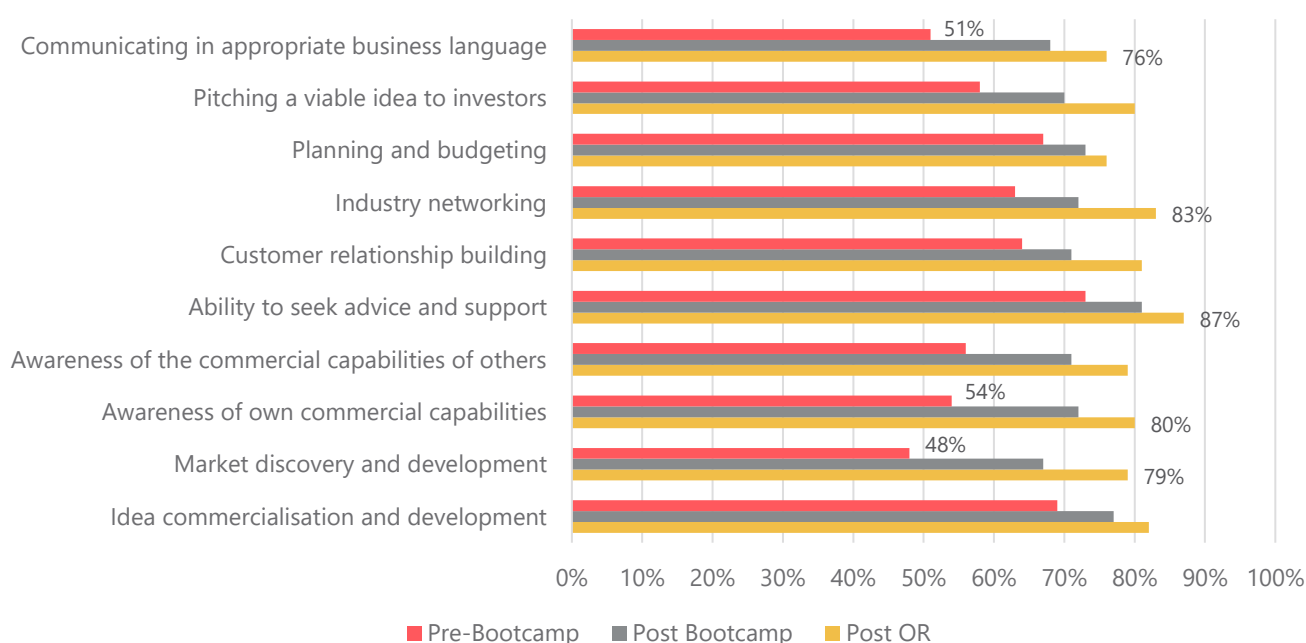
In the case studies, ECRs continuously reiterated ICURe was a transformational experience, and reported that throughout the programme they were able to improve on a range of commercialisation skills:

- **Market understanding:** The case study evidence suggests that the Bootcamp and the market validation exercise led to a greater understanding of where ECRs could apply their research more commercially. Interviewees provided examples of how the programme aided their ability to identify target markets, refine the product, and offer it to external investors.
- **Increased confidence:** The case studies also showed that an increase in ECR confidence was one of the main benefits of both the market validation exercise and the Options Roundabout. During the market validation exercise, ECRs reported increased confidence in taking the project forward and an improved ability to talk to customers and investors. The Options Roundabout mainly contributed to validate their ideas and confirm a projects' potential. During the programme, ECRs also reported an improvement in their presentation skills and their ability to communicate and present in front of investors and managers.
- **Growing networks:** Finally, participation in the programme was thought to help ECRs expand their commercial network, both during and after the programme. For example, some ECRs reported maintained relationships with contacts made during the market validation exercise. Furthermore, two case studies found that ECRs also established a network within universities, allowing advice to be shared amongst fellow researchers and industry events to be organised.

Commercial skills of PIs

Perceived commercialisation skills were also reported to increase at each stage of the programme amongst PIs. As shown in the figure below, the skills that PIs rated most highly after participating in ICURe were the ability to seek advice and support (ranked 87 percent) and industry networking skills (83 percent). The skills that were perceived as most improved among PIs were market discovery and development (rated 48 percent before the programme and 79 percent after the Options Roundabout), the awareness of own commercial capabilities (increased from 54 percent to 80 percent), and communicating in an appropriate business language, increasing from 51 percent to 76 percent.

Figure 5.2: Commercial skills of PIs before and after ICURe



Source: SETSquared Monitoring Information, 2019

Case study evidence suggests that PIs also benefitted from ICURe in terms of research commercialisation skills. Interviewees have highlighted the two main areas of improvement:

- **Enhanced awareness of research commercialisation:** Principal Investigators reported that through their participation in the programme, they became more aware of commercialisation opportunities and more commercially oriented in their approach to research, and learned how to validate ideas to develop research into potential tangible products.
- **Networks and collaboration:** Like ECRs, PIs reported they grew their networks during ICURe. Despite not having created as many new contacts as ECRs, PIs emphasised that the programme helped to build positive collaborative partnerships with businesses that research teams did not previously have.

5.1.2 Career Prospects

Evidence from the survey and case studies suggested that ICURe had an effect in the form of enhanced career prospects for participants, especially for ECRs. Survey responses show that most participants (77 percent) are still working at the same academic institution as when they made their application, and 11 percent are now employed within the spin out (mainly in executive management roles). In comparison, 78 percent of unsuccessful teams remained employed at the same academic institution, eight percent are working at a different academic institution and one percent are employed in the spin out created. Moreover, stakeholder interviews and case studies suggested that ECRs experienced broader career opportunities whereas PIs were less likely to leave their role at universities.

- **Academic employment:** Seventy-seven percent of participants remained employed at the same HEI, while five percent of survey respondents reported being employed at a different academic institution to when they applied for ICURe. Case studies suggest that two of the ECRs who remained within the university and followed an academic career path then mentored future ICURe applicants. In addition, PIs also reported collaboration with ECRs to raise awareness of research commercialisation opportunities between senior researchers.
- **Non-academic employment:** Five percent of participants reported being employed within the private sector. Some case studies and stakeholder interviews found that as a result of improved commercialisation skills developed through the programme, potential opportunities of a career change arose. In one case study, an ECR indicated that participation in ICURe had raised an interest in pursuing a career in the private sector and influenced their decision to leave academia to start working in the media industry.
- **Spin-out roles:** Eleven percent of survey respondents indicated that they are currently employed within the spin out established through ICURe. Of the team members who remained involved in the company, the majority were employed as part of the executive management team (76 percent), while the remaining took non-executive management roles (10 percent), became shareholders (10 percent) or technical advisors (five percent). Case studies suggested that while ECRs were often employed in the management team, TTOs sometimes became part of the board and PIs generally didn't take on any full-time roles. However, in one case study, a PI reported that even though they maintained their current role at the university, they would consider the possibility of becoming involved in the spin out in the future. In another case, an ECR who was involved in the management of the spin out reported that they would remain in research commercialisation, even if the current project failed.

- **Wage effects:** The econometric findings suggest that as a result of the programme, ECRs’ salaries increase by 60 percent.²⁴ The distribution of wages in the figures below indicates to some extent that participants experienced a higher increase in wages after ICURe compared to non-participating respondents. However, there is no evidence from case studies and stakeholder interviews of any examples of increased wages because of participation in programme, as the question was not asked for sensitivity reasons.

Figure 5.3: Salary pre ICURe: Successful versus unsuccessful



Source: Ipsos MORI Applicant Survey (February 2019)

5.1.3 Research Agenda

One anticipated effect of participation in the programme was to redirect the research pursued by the ECR or PI towards more commercial activities. Encouraging academics to give more consideration to the potential impact of their research outputs, the programme aimed to improve researchers’ understanding of market demands to guide future research towards generating solutions to business problems.

Case studies suggested that skills gained through ICURe were beneficial to both ECRs and PIs in their research agenda, broadening the scope of their work from the development of prototypes to commercialisation. In one case, a PI commented that he already had an interest in commercialising his research, and that ICURe further enhanced his awareness of potential opportunities when starting a research programme. In two case studies, ECRs reported that gaining a solid understanding of the commercialisation process and resources required to transfer research outputs from the laboratory to industry helped them to become more commercially oriented whilst simultaneously considering the potential outcomes and impact. It was also suggested that by providing examples of successful experiences, the programme worked as a motivation for academics to exploit their ideas about entrepreneurship. In one case, although not having started any new research programme himself, a PI reported to have engaged in an initiative with the ECR to raise awareness amongst PhD students around research commercialisation.

²⁴ This variable was self-reported and the banded nature of the question may mean that this outcome is less precisely defined and therefore may be over or under estimated.

5.2 Institutional Level Effects

This section provides an overview of the effects of the programme on academic institutions, in terms of benefits for TTOs, greater collaboration between universities and industry, and overall reputation of academic institutions for commercialising technologies.

5.2.1 Benefits and improvements for TTOs

ICURe contributed to improving TTOs' capabilities in three main ways:

- **Reshaping Technology Transfer Offices:** Fifty-eight percent of survey respondents noticed some form of changes in reshaping or rescopeing of their Office's work. In one consultation, it emerged that the TTO completely changed to align to ICURe. There have been changes to business processes, as the TTO was split into different teams and a support person was recruited to deal mainly with ICURe. It was found that there was more value in having cohorts than dealing with projects on a case-to-case basis, and that in this way the TTO can focus on optimising networks of business advisors, investors, and alumni from the programme.
- **Reducing resource burden on TTOs:** By allowing motivated ECRs to lead on projects, ICURe is thought to have reduced the resource burden on TTOs caused by a large portfolio of projects. Case study interviewees suggested that resources were limited for TTOs with relatively small teams, meaning they were unable to provide the type of support offered by ICURe such as entrepreneurial training and market validation.
- **Increasing TTO's skills and networks:** ICURe was considered to have upskilled TTO staff at a faster rate, especially in terms of spin out support and how to market and sell academic research to industry. These improvements in their process management skills and in supporting the establishment of spin outs has contributed to increasing the profile of TTOs within academic institutions. TTOs have also increased their understanding of how to establish closer relationships with academics and increasing their ability to make a more effective case externally (talking to investors and companies). In addition to this, TTOs were able to develop wider networks with universities they don't often interact with. Sixty-four percent of the TTOs surveyed indicated that they had or planned to cooperate with other TTOs following their participation in ICURe.

5.2.2 Greater university-industry collaboration

Survey findings seem to indicate that ICURe has had no effect in this regard. Participants and non-participants were involved in a similar number of collaborative or contract research projects with at least one industrial partner (on average 2.5 for participants versus 2.7 for non-participants). There was also no difference between earlier and more recent cohorts on this aspect (both at 2.5).

5.2.3 Improved reputation for impact

ICURe was thought to have a moderate impact in changing academic culture beyond TTOs (as highlighted above). Case studies and stakeholder interviews suggested that processes to commercialise research have not significantly changed within department and universities more widely. This is substantiated by survey data, as most PIs and TTOs surveyed (59 percent) reported that there had been no changes in their department's approach to training on commercialising research outputs, or in the commercialisation programmes within the University. However, those who had participated in the first six cohorts of the programme were much more likely to report a positive change in training and programmes compared to those in

the most recent cohorts (59 versus 32 percent). This suggests that such changes in culture take time to implement and become apparent.

Academic culture was perceived as having evolved considerably towards increased valuation of research commercialisation. ECRs indicated an increase in commercial awareness in their universities and increasing academics awareness on the importance of potential outcomes. Stakeholders indicated that the positive effect of institution reputation was a major incentive in their choice to participate. ICURe was identified as pertaining to this context, though not considered to be the only nor necessarily the main driver of it. The Research Excellence Framework (REF) was also mentioned as putting an increasing focus on demonstrating the impact of research in universities. However, it mentioned that the ability of ICURe to attract senior academics was limited by:

- **Resistance in academic culture:** Case studies suggested that some individuals perceived commercialisation of research as a distraction from their core research. This was, however, not thought to apply to the majority. Most academics reported that due to resource constraints, commercialisation of research was not a major priority.
- **Preference for other forms of public grants:** In one case study, it was reported that other public grants such as those awarded by Medical Research Council might be perceived as less invasive, allowing universities to bring public funds in-house and use it for their own research purposes with minimal scrutiny.
- **Career progression:** A PI reported that within academic institutions, experiences of research commercialisation are often not considered enough for career progression, with research outcomes remaining the most important factor leading to promotion.
- **Changes in funding allocation:** The evaluation also sought to assess whether since participating in ICURe, universities or departments changed their allocation of funding to support projects with ICURe principles and elements. Most PI and TTOs surveyed reported no changes to the allocation of funding to support projects. However, there are some differences across cohorts: participants in the initial six cohorts were more likely to have noticed changes in funding allocations compared to those who took part in the programme from cohort seven onwards.

5.3 Summary

- **Commercial skills:** The commercial skills of ECRs prior to the programme were reported to be varied across teams. Overall, participating ECRs rated their post-ICURe skill capability index to be 10 points higher than those who did not participate in the programme. The most highly rated skills included idea identification, awareness of commercial capabilities and customer relationship building. Qualitative evidence suggests that ECRs with little commercial experience prior to ICURe were able to significantly improve a range of skills including the understanding of the market, confidence, and the ability to expand networks.
- **Career prospects:** evidence is mixed around participants' career prospects. Most participants (77 percent) are still working within the same academic institution as when they made their application. However, 11 percent of participants are now employed within the created spin out. Stakeholder interviews and case studies suggested that ECRs experienced broadened career opportunities whilst PIs were less likely to leave their role at universities.
- **Research Agenda:** qualitative evidence suggests that both PIs and ECRs benefited from the skills gained through ICURe, specifically in terms of broadening the scope of their research and becoming more commercially oriented about future research programmes.

- **Benefits for TTOs:** evidence from the survey and interviews suggests that ICURe contributed to reshape TTOs (with 58 percent of respondents noticed some form of change). This alleviated previous resource constraints on TTOs during the application stage and allowed TTOs to improve both their project management and networking skills.
- **Improved reputation for impact:** ICURe's impact on changing academic culture was perceived as moderate. Changes in processes to commercialise research were reported more often by those who had participated in the first six cohorts which suggests that changes in academic culture might take some time to materialise. Qualitative evidence suggested that the reputational effects of the institution were considered one of the main incentives to participate, and interviewees perceived an increase in commercial awareness within universities. However, this was not considered to be purely attributable to ICURe, as the REF also contributed to the increased importance placed upon research impact.

6 Conclusions

This subsection contains a set of conclusions and implications relating to the ICURe programme pilot against the key questions set for the evaluation.

Has the programme acted as an accelerator speeding up commercialisation processes?

There was a wide range of evidence to suggest that ICURe has had a substantial effect in accelerating the commercialisation process. Teams participating in the programme were substantially more likely to pursue all different routes to commercialisation following the Options Roundabout as well as seek further public or private funding to develop the technology further. Participating teams also made greater progress in resolving key issues involved in defining the optimal business or commercialisation model. The evidence reinforces the findings of the evaluation of the first six cohorts and suggests that the programme has motivated significant levels of commercialisation activity within participating HEIs and its effectiveness in this regard has proven robust to its extension and expansion.

Most these impacts have arisen through its effects on spin-out activity. The availability of grant funding through the Aid for Start-Ups and Follow-On Funding appeared (on an indicative basis) to play a significant role in accelerating the growth and development of spin-outs and it is recommended that this form of support is retained in any national roll-out of the programme. There are unanswered questions as to the long-term impact of the transition from Aid for Start-Ups to Follow-On Funding. While the requirement to find match funding up front appears to have slowed the progression of spin-outs, it does not appear to have led to a reduction in the overall number of spin-outs incorporated. However, it is too early to judge how far reduced speed has had a long-term impact on the growth or development of the spin-out companies established.

Recommendation: UKRI should closely monitor the on-going growth of firms receiving Follow-On Funding before reaching a judgement as to whether the optimal model of financial support has been found.

Has the programme enabled or created a cultural behavioural change in creating entrepreneurial intent in the academic sector? What is the behavioural additionality?

The findings of the study reproduce the positive findings from the evaluation of the first six cohorts and indicates that participation in the programme stimulated substantial efforts to validate the value proposition for the underpinning the technology that would not have been possible otherwise. These efforts were viewed as instrumental in shaping the later commercialisation of projects. As highlighted above, the evaluation showed that the programme also stimulated substantial levels of commercialisation activity after teams' participation in the programme came to an end.

Has the programme improved the entrepreneurial skills or the intent to commercialise amongst those involved in the programme? What has been the impact on the perception of commercialisation in different universities involved?

ECRs described ICURe as a transformational experience and reported that their participation in the programme enabled them to improve a range of commercialisation skills. These benefits extended to greater market understanding, increased confidence, and growth of networks, and participation in the programme also appears to have positive benefits in terms of raising wages and enhancing career prospects. Case studies suggested also highlighted changes to PIs awareness of potential commercialisation opportunities when starting a research programme and there were anecdotal reports of PIs engaging in initiative to raise awareness amongst PhD students around research commercialisation.

ICURe's broader impact on changing academic culture was perceived as moderate. Case studies and stakeholder interviews suggested that processes to commercialise research have not significantly changed within universities, though academic culture was thought to have evolved considerably towards attaching higher value to research commercialisation. While ICURe was considered relevant to this context, it was not considered to be the only nor necessarily the main driver of it. The Research Excellence Framework (REF) was noted as a key driver of these trends. Additionally, there were indicators that cultural barriers to engagement in commercialisation activity persist – such as a preference for grants for discovery science where the team can take an exploratory approach without being held to key milestones and the relative importance of publications in determining career progression.

Success of the programme in turning research output into the marketplace or further research (including new ventures, product licensing, and development of new products and services)?

Teams participating in the programme outperform non-participating teams in types of outcomes considered in this study. Spin-outs were the most frequent outcome from the programme – with 35 percent of all participating teams going on to found a spin-out, relative to 12 percent of non-participating teams. The programme has achieved a high rate of additionality, and it is estimated 72 to 75 percent of the spin-outs established by participating teams by January 2019 would not have been created without the programme. This is equivalent to an additional 49 to 55 spin-outs that would not have been established without ICURe.

Licensing outcomes were, by contrast, comparatively infrequent and the success rate was comparatively low given the share of teams advised or moving on to pursue a licensing pathway. Participating teams also outperformed non-participating teams in terms of securing further private or public funding to progress the development of the technology underpinning their application to the programme.

Recommendation: The issues encountered by teams in progressing licensing outcomes are complex and it is clearly difficult to disentangle those technologies that did not commercialise because they were not sufficiently commercially valuable and those that had commercial potential. However, issues relating to the availability of post-ICURe funding and the maturity of technologies appear to be a constraining factor, raising questions of how teams can best be supported once their involvement in the programme comes to an end. The Knowledge Transfer Partnership programme appears to offer one possible 'off-the-shelf' instrument through which this might be achieved.

Recommendation: The issues involved are complex and may have broader relevance in the context of wider research and other funding made available to support the commercialisation of academic research (e.g. Impact Accelerator Accounts or the Development Pathway Funding Scheme). UKRI may find value in commissioning specific research into the broader challenges faced by academic institutions in licensing technologies and understanding the common factors underpinning successful and unsuccessful attempts to reach licensing agreements with commercial partners.

What is the programme's impact on the UK economy?

The programme has had substantial economic impacts which have primarily been mediated by the effects of the programme in stimulating economic activity. The key findings of the impact evaluation included:

- **Equity investment:** Spin-outs established by participants had substantially greater success in securing investment than those established by non-participating teams (at both the intensive and extensive margin). This suggests that ICURe has

impacts both on the quantity and quality of spin-outs incorporated. Overall, it was estimated that spin-outs established by participating teams raised between £18.9m and £21.1m in additional external equity funding due to the programme

- **Jobs created:** The growth of spin-outs has led to job creation impacts and it is estimated that the programme has now led to between 122 and 127 gross additional jobs.
- **Firm valuations:** Although spin-outs have generally remained at the pre-revenue stages, firm valuations implicit in the size of the most recent equity investment and the level of equity ceded provide a market based measure of investors' expectations of the future profitability of the businesses. It is estimated that ICURe led to an increase in the market valuation of spin-outs attributed to ICURe of between £62.5m and £69.9m²⁵.

The ICURe programme has offered good value for money, with an estimated benefit to cost ratio of between £3.43 and £3.84 per £1 spent. This reproduces the findings of the prior evaluation focusing on the first six cohorts based on a more robust set of data, giving greater confidence in the judgement reached in the preceding study that the programme is viable candidate for a national roll-out. However, it should be noted that there are some uncertainties with these results. Firstly, it was not possible to control for possible differences between successful and unsuccessful applicants that could bias results, and it is possible that the underpinning statistical analysis has overstated the impact of the programme. Secondly, the results assume that investors can effectively price the risks and potential returns associated with the future commercialisation of the technology (which may not be the case).

²⁵ I.e. £1.3m multiplied by 68 to 73.

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