



Ipsos MORI
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ICURe Evaluation

Final Evaluation Report

Ipsos MORI, George Barrett & Tomas Ulrichsen

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Executive Summary

Ipsos MORI (in association with Tomas Ulrichsen and George Barrett) were commissioned to undertake a mixed methods evaluation of the Innovation to Commercialisation of University Research (ICURe) pilot programme by Innovate UK in October 2016.¹ This report sets out the key findings from the evaluation which drew on in-depth research with stakeholders in the programme, analysis of management information collected, a survey of participating teams and those not awarded a place on the programme, and detailed case studies of 10 projects funded.

ICURe

The ICURe pilot programme was established in 2014 in response to a 2013 House of Lords Inquiry² that found that while the UK has an internationally competitive base of scientific research, more should be done to create a commercial demand for university engagement to which they are already primed to respond. ICURe aimed to tackle several barriers to the commercialisation of university research, (including levels of commercial awareness and entrepreneurial skills amongst academic personnel, weak networking between academic and industrial communities, and cultural conventions and reward systems) through the delivery of a programme of commercialisation support for teams of academic researchers wishing to explore the commercial potential of research originating in universities.

Overall Effects of ICURe

The evaluation provides encouraging data to suggest that the ICURe pilot has been an effective and economical instrument for accelerating the commercialisation of academic research and producing a range of wider benefits in strengthening links with industry and enhancing the entrepreneurial skills of early career researcher. The programme achieved all of its objectives, and there was a high rate of additionality associated with its results (81 percent). Its benefits (as far as it is possible to measure at this early stage) already exceeded its costs. The key impacts of ICURe are summarised in the box below.

ICURe: Headline Impacts

- 78 teams benefitted from the first six rounds of ICURe at an approximate cost of £8.9m (of which £6.5m was awarded to 13 teams as Aid for Start Ups seed funding).
- Participation in the programme increased and deepened links between participating academics and industry, accelerating the commercialisation and the technology development process.
- An estimated 24 additional spin-outs were created, with an average age of one year at the time of this evaluation, raising a total of £6.9m in private equity finance. This valued the businesses at a total of £35m. A larger proportion of Aid for Start Ups recipients reported they had secured private equity investment than those spinning-out without public funded support (74 versus 31 percent).
- Spin-outs employed an average of three workers and were generating an average of £86,000 in revenues by January 2017. Spin-outs taken forward with Aid for Start Ups funding grew more rapidly, reporting an average of six FTEs employed and average turnover of £145,000. The total present value of licensing agreements signed as a result of the programme was £8.7m.
- The ICURe programme is estimated to have created £3.94 of economic benefits for every £1 invested to date. The findings should not be treated as definitive as there are a number of factors that may have over or understated the effects of the programme (and there is ambiguity as to which of these factors are likely to dominate).

¹ This study evaluates cohorts one to six of the pilot only, as these were the only cohorts completed at the time the study was commissioned.

² URL: <https://www.publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/34802.htm>. Date accessed: 30/03/17.

Specific Evaluation Results

- **Programme context:** Barriers associated with commercialising academic research were identified at the individual, project and institutional level. A key theme was a perception that academics had a low willingness and weak commercial skill set to effectively engage in commercialisation. Commercialisation activity and capabilities across academic institutions are also highly variable. Those institutions that were invited to apply to ICURe (during cohorts 1-6) were more active than the national average in terms of spinning out, registering intellectual property (IP), securing licensing agreements and obtaining support to complete R&D through public grants and private contracts. As such, conclusions made about the effects of the pilot may not always generalise to other academic institutions.
- **Improved commercial awareness:** There was strong evidence that completion of the ICURe programme aided the commercial development of projects in several ways. The Bootcamp was thought to be an effective primer for the market validation exercise. It significantly increased the confidence and capability of team members to complete a market assessment, especially the early career researcher. Participants made around 83 more contacts than they would have done had they not participated in ICURe. Qualitative evidence gathered also suggested the programme enabled teams to better understand the optimal commercialisation strategy for their technology.
- **Commercialisation effects:** Findings suggested that participation in ICURe increased the likelihood that teams pursued a commercialisation outcome (i.e. a spin-out or a licensing deal) from 15 to 79 percent, and the likelihood a commercialisation outcome was achieved by January 2017 from 8 percent to 40 percent (a gross additionality rate of 81 percent). It should be noted that these findings may overstate the effectiveness of ICURe, as only a limited number of variables were available to control for differences in the appropriateness of the projects and the readiness of teams for a commercialisation outcome. In addition, earlier cohorts were more likely to realise positive results. As such, the results may understate the eventual gross outcomes of the first six rounds of the ICURe programme
- **Commercial skills development:** Sustained or increased levels of perceived competence in commercialisation skills were reported by early career researchers and Principal Investigators between their respective Options Roundabout and the time of the survey (64 to 75 percent). This effect was more pronounced for Principal Investigators (and there was some evidence of decay amongst early career researchers).
- **Resolution of business model issues:** Participating teams made more rapid progress in resolving business model development issues than those that did not, particularly in terms of establishing new customer relationships, identification of channels to market, and clarifying the potential cost structure.
- **Licensing:** Eighteen percent of participants had secured a licensing agreement by February 2017 (implying 14 licences agreed by participants) with an average value of £145,000 and average duration of seven years. Assuming a private discount rate of 10 percent per annum, this would give a total present value of future licensing income associated with licensing agreements of £10.8m (£8.7m of which would not have been realised in the absence of the programme). These licensing agreements were all secured by those teams spinning out, and there was evidence that a variety of barriers may inhibit the pursuit and achievement of licensing agreements.
- **Development of the early career researcher:** Evidence indicated that ECRs become more employable and improved their wages due to participation in ICURe. 15 percent of participants reported they were employed in a spin-out and qualitative evidence indicated the skills gained during the programme made evidencing commercial awareness to private employers easier.

1 Introduction

Ipsos MORI (in association with Tomas Ulrichsen and George Barrett) was commissioned to undertake an evaluation of the Innovation to Commercialisation of University Research (ICURe) programme by Innovate UK in October 2016. This report sets out the findings of the evaluation. The ICURe pilot aimed to address a set of system failures that prevented opportunities for the commercialisation of academic research being taken forward by academia and industry. It did this by providing funding and training to university researchers from all academic fields with potential commercially viable research outputs, enabling them to conduct focused market validation activities. Findings from the programme were then presented to relevant experts who provided recommendations on the most appropriate commercialisation strategy. The ICURe pilot was delivered by the SETsquared Partnership and funded by Innovate UK and the Higher Education Funding Council for England (HEFCE).

1.1 Evaluation Aims and Objectives

The evaluation had three key objectives:

- Produce a logic model for the ICURe programme explaining how the support provided will produce its intended effects on the entrepreneurial skills of participants, accelerate the commercialisation of ideas originating in academic institutions, and generate economic impacts.
- Agree an approach to, and conduct, an evaluation of the ICURe pilot, quantifying both its effects on entrepreneurial skills and commercial awareness, and downstream impacts on the commercialisation of R&D via spin-outs, licensing activity or other routes to market, alongside a process evaluation explaining how those effects were achieved.
- Provide recommendations to inform an evaluation of a national version of the programme³.

1.2 Method

Evidence to support the evaluation was collected using the following set of 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. Monitoring information for later cohorts out of the scope of the evaluation (cohort 7 onwards) was also examined where relevant.
- **Stakeholder consultations:** Consultations with a group of 15 stakeholders in the programme were completed to obtain views on the impact of ICURe. These focused on testing the programme rationale, understanding the issues academic institutions face when commercialising university research, and effects that emerged from the programme. A range of organisations were engaged, including those involved in the delivery and strategic oversight of the programme, academic institutions benefitting from the programme, and organisations with a broader interest in accelerating the commercialisation of academic research.

³ This was produced as a separate internal paper for Innovate UK.

- **Case studies:** Ten in-depth case studies of individual projects were completed. 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 provide a detailed examination of how the programme contributed to short-term commercialisation outcomes or wider impacts for applicants. The case studies were selected to cover a range of Options Roundabout recommendations and outcomes achieved to facilitate comparative analysis across different scenarios and explore the role of the programme in producing its effects under different conditions.⁴
- **Applicant survey:** A telephone survey of 291 valid contacts 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. The final sample achieved was 222 (a response rate of 76 percent), with 163 participants and 59 non-participants responding to the survey.
- **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, non-participating teams were viewed by stakeholders to be at an earlier stage of technical development than participants (a view borne out by the results of the survey). The findings of this element of the evaluation may overstate the impacts of the programme as a result. Additionally, participating teams may have participated 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 (namely, the Researcher to Innovator programme delivered in SETsquared institutions), the impacts reported may not be attributable in full to ICURe alone where teams are participating in other commercialisation support programmes.
- **Analysis of secondary data:** Access to the Higher Education-Business and Community Interaction Survey (HEBCIS) was obtained to inform the evaluation. A descriptive analysis provided contextual information on commercialisation activity in institutions participating in the programme and supported a supplementary assessment of the commercialisation outcomes achieved through ICURe using synthetic control group methods.

1.3 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** provides a review of the context for the programme.
- **Section 4** focuses on the short terms effects of the individual components of the programme.
- **Section 5** examines the commercialisation effects of ICURe.
- **Section 6** considers the potential wider benefits associated with the programme.
- **Section 7** concludes and identifies a set of lessons from the delivery of the platform.

⁴ Please see section 2.3.2 for a description of the Options Roundabout.

2 ICURe

This section provides an overview of the ICURe pilot 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.

2.1 Overview of the Programme

The ICURe pilot programme was established in 2014 in response to a 2013 House of Commons Inquiry that reviewed the UK Government's innovation policy with respect to improving commercialisation of research⁵. While the review notes the UK's internationally competitive scientific research, it suggests that the 'Government's objective should be to create a commercial demand for university engagement to which they are already primed to respond'. The 2003 Lambert Review also highlights this as a key issue that needs to be addressed if the UK is to increase the flow of productive knowledge between universities and the economy.⁶ ICURe is one of several programmes (see subsection 3.3) aiming to tackle these barriers to commercialisation, (including levels of commercial awareness and skills amongst academic personnel, weak networking between academic and industrial communities, and cultural conventions) through the delivery of a programme of commercialisation support for teams of academic researchers wishing to explore the commercial potential of their research. The programme had the following objectives:

- 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 pilot, the initiative also aims to provide lessons on how a national rollout could be optimally implemented.

2.2 Rationale

The UK has an internationally competitive scientific research base, accounting for 16 percent of the world's most highly cited articles.⁷ Additionally, some studies also suggest that the UK performs relatively well to international comparators in commercialising university research outputs via spin-outs and licensing⁸. However, given the potential social and economic benefits associated with the commercialisation of university research, many initiatives have been introduced to address the barriers thought to constraint the commercialisation:

- **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

⁵ UK Government (2013). Bridging the Valley of Death-Improving Commercialisation to Research.

⁶ Lambert, R., (2003). Lambert review of business-university collaboration: final report. HM Treasury, London.

⁷ BIS (2013). International Comparative Performance of the UK Research Base. The UK's high performance in this case is noted in the McMillan Review (2016), Sainsbury's 2007 Race to the Top Review and Graham, R. (2014). Creating university-based entrepreneurial ecosystems evidence from emerging world leaders.

⁸ McMillan, T (2016). University Knowledge Exchange (KE) Framework: Good practice in Technology Transfer. Report to UK Higher Education Sector and HEFCE by the McMillan group.

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.⁹ The variety and frequency of university researcher interactions with 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 collaborations¹⁰.

- **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 suboptimal technologies, resulting in the slow realisation of the economic benefits¹¹.
- **Incentives:** The set of rules and conventions that govern academic institutions as well as reward systems may impede innovation and commercialisation activity. A number of studies exploring barriers to commercialisation have identified insufficient rewards from engaging in such activity as an obstacle. Dowling (2015) highlighted that pressures to publish can create tensions with business engagement for universities¹², while a recent 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)¹³. However, a recent 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 2008/09.¹⁴ This may reflect wider changes in incentives in the UK landscape over the past decade with the introduction of pathways to impact in making grant decisions, impact in research quality assessments which drive the allocation of block grant funding for research, and the growing efforts on the ground underpinned by funding programmes such as HEIF and Research Councils Impact Acceleration Accounts to affect culture change that make this type of activity be seen as more legitimate.
- **Financial market imperfections:** The conversion of research undertakings into commercial businesses carries a high degree of risk and this is especially true for high technology R&D activity. Several financial market failures have been identified that constrain availability of capital for start-ups and potentially justify public intervention. These include the presence of information asymmetries that can cause 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 not straightforward to monitor activity after an investment is made, and the transaction costs of doing so can be high, deterring small investments. In addition, there are a set of broader market failures and barriers which pervade this area: externalities such as knowledge spill-overs from innovations that are not valued by investors, coordination failures between actors and institutional weaknesses.¹⁵
- **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

⁹ See Criaco et al. (2014), Shane and Stuart (2002) and Colombo and Piva (2012).

¹⁰ 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

¹¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/334369/BIS_14_852_The_Case_for_Public_Support_of_Innovation.pdf
Date accessed: 28/10/16.

¹² Dowling, A., 2015. The Dowling Review of Business–University Research Collaborations.

¹³ Hewitt-Dundas, N., 2015. Profiling UK university spin-outs. Enterprise Research Centre, Warwick, UK

¹⁴ 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.

¹⁵ Bravo-Biosca (2014). Access to finance for innovation: Rationales and risks of public intervention.

technologies may fail to emerge in a timely fashion (and may exhibit public good qualities themselves). Additionally, 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 programme involves tailored support to develop the commercial awareness and skills of project team members and introduce an understanding of appropriate commercialisation strategies for research. While several programmes offering financial and business support exist in the UK, few focus on the development of a team and most focus on company creation. In addition, few offer seed capital alongside commercialisation support. 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 initial stages of ICURe provides tailored support to academic teams in raising their commercial awareness and capabilities. At the heart of the programme is a market validation exercise in which the teams involved make contacts (largely with potential customers) to establish how far there is demand for the innovation at the heart of the project, at what price points, and adjustments that could be made to increase its value. The process gives teams a broader understanding of the considerations required in developing an optimal business model and commercialisation strategy.	While the scheme aims to directly address the issues associated with the commercial capabilities of academic staff, the experience will not give teams the full breadth of skills required to successfully commercialise technologies through an external vehicle. 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 enabling the anticipated outcomes from the programme.
Bounded networks	The market validation exercise – and for some, the process of developing a business plan – will force the acquisition new relationships outside of the closed networks to which teams may be accustomed. These new links may have significant long-term benefits in enabling academic personnel to more rapidly evaluate the commercial potential of future innovations and engage more effectively with the needs of potential industrial customers.	The market validation exercise is heavily focused on understanding the needs of customers. However, to commercialise, teams will need to build relationships with a wide range of other organisations (such as manufacturers, distributors, and financiers). This may not be directly supported by ICURe, though it is anticipated that the skills acquired may ease this process.
Incentives	It is anticipated that 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 take time to embed. It is likely that external factors may be equally – if not more important – in changing incentives and cultural norms.
Financial market imperfections	The provision of seed funding through Aid for Start Ups for some teams will directly address issues of imperfections in financial markets. In turn, the availability of this funding may support a range of follow-on outcomes. It will enable those involved to focus on progressing commercialisation rather than seeking venture finance in the early stages of the spin-out. Capitalisation of spin-outs may also make it more straightforward to attract an appropriate management team or	Local availability of venture capital may act as a constraint on commercialisation. These challenges will be particularly acute where the costs involved are high and long-term, potentially forcing teams to license technologies. This could lead to suboptimal realisation of value for the universities and the UK, particularly if licensees are based overseas. Where teams have accessed Aid for Start Ups or other finance to begin the commercialisation process, challenges may be encountered in

Market Failure or Barrier	ICURe Mechanisms	Constraints and Dependencies
	follow-on finance from business angel investors or venture capital funds.	accessing follow-on finance (possibly resulting in abandonment of technologies or slow progress).
Other complementarity failures	Though ICURe does not involve a direct mechanism to address local weaknesses in capital, labour and technology markets that may inhibit the commercialisation of research, it is possible that the programme addresses 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 have an indirect effect in terms of attracting 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 Theory of Change

2.3.1 Inputs

Initial funding of £3.2m was made available for three pilot cohorts (later extended to six), of which £2.8m was secured from the HEFCE Catalyst Fund, a £30m annual fund that aims to increase excellence and efficiency in higher education¹⁶ and £400k from Innovate UK. The bulk of these resources (£2.5m) were initially earmarked for funding the salary and travel costs of the participating teams, who received grants of up to £50,000. However, upon implementation of the programme, this allocation was deemed too high and a new budget of £35k was set providing up to £15k in salaries and £20k in travel expenses to teams. This, combined with an unspent contingency budget of £320k, enabled the SETsquared institutions to submit a successful request to HEFCE to continue ICURe for a further two cohorts (which are out of the scope of this evaluation), where emphasis would be placed upon expanding the reach of the programme and to test and develop new delivery concepts and training resources. An additional £6.5m was made available in Aid for Start Ups funding by Innovate UK, which was allocated in the form of grants of up to £0.5m to a subset of participating teams (owing to budget constraints, this funding was exhausted in 2016, before the initiation of cohort 6).

Complementary in-kind resources were brought to the programme in the form of the time inputs of the Technology Transfer Offices (TTOs) associated with participating academic institutions. TTOs were tasked with managing their institutions' involvement in the programme, promoting the programme to academic staff, and supplying Technology Transfer Officers to support project teams. Business advisors (BAs) assigned to each participating project team supplied their services and time on a pro-bono basis.

2.3.2 Activities

The inputs described above supported the following programme delivery activities:

- **Application and assessment process:** Each cohort required project teams (made up of an early career researcher (ECR) that had completed their PhD, Principal Investigator (PI), and a Technology Transfer Officer (TTO) to make an online application explaining their technology, its commercial potential, and their motivations for taking part in the programme. Places on the programme were awarded on the basis of a scored assessment. The programme was initially delivered in the SETsquared group of institutions¹⁷ and rolled out to a further 10 institutions by cohort 6. A total of 167 applications were received (against a target of 150), with 78 teams being selected (exceeding the target set of 50). Acceptance rates

¹⁶ <http://www.hefce.ac.uk/funding/catalyst/>. Date accessed: 21/10/16.

¹⁷ Bath, Bristol, Exeter, Southampton and Surrey.

varied from 34 percent in cohort 5 to 94 percent in cohort 1 (which was intentionally small and targeted in order to begin testing the ICURe model).

- **Orientation and start-up training (Bootcamp):** An intensive residential training programme is delivered over several days to project teams. This focuses on developing participants' understanding of lean start-up principles, a hypothesis driven validation and business model identification process. The majority of the 'Bootcamp' is delivered to the ECR with the other team members contributing at a later stage to support strategy and planning. The staging of the training exercise attempts to create a level of professional distance between the ECR and the PI, to help ensure that the former is not diverted to other activities (e.g. delivering on-going research projects).
- **Three-month market validation exercise:** The ECR then leads a focused market assessment of the commercial potential of the research with support from the programme team. This primarily involves forming new contacts with potential customers, suppliers, collaborators and/or competitors. The aim of these interactions is to: collect the information needed to validate the presence and level of market demand for the technology under development; understand any 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. Ideally, the TTO maintains regular communication with the project team to ensure the academic institution has a record of the team's progress. A part time version of the programme was offered (only taken up by teams in cohorts 3 and 4) that lasted six-months. However, this option was withdrawn 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.
- **Teleconference updates:** During the market validation exercise, project teams take part in fortnightly teleconferences with programme delivery staff to provide an update on progress and receive guidance, based on monitoring information forms completed by teams.
- **Business mentorship:** Each project team is assigned a business advisor to support the business model discovery process. Advisors were required to engage on a 'good-will' basis whereby they do not expect any commercial benefit from their involvement in the programme. They were required to take part in a subset of the 'Bootcamp' training, provide the team with guidance as the market validation exercise unfolded and support the refinement and presentation of the findings at the Options Roundabout. This differs from the concept of a business mentor that acts in some instance in a similar manner to a business angel. Work was completed over the course of the pilot to define the role of business advisors in the programme more precisely.
- **Options Roundabout presentations:** After the market validation exercise, project teams draw on what they learnt and attend a one day 'camp' to further develop their business models. The results are presented to an independent panel of business experts at an event named the 'Options Roundabout'. The panel provides recommendations on the optimal commercialisation strategy based on the presentation. Projects are assessed against a range of criteria, including the quality of the market validation exercise, business model development, the size of the commercial opportunity, team strength and consideration of the next steps for the project. The criteria included the extent to which the team were likely to be able to secure funding in the absence of financial aid (i.e. an additionality test).
- **Aid for Start Ups:** Projects identified as potentially scalable businesses, but needing public funding to help them move at the pace required to capture the opportunity, were recommended to apply for Aid for Start Ups funding. Thirteen grants of up to £0.5m were made available to support the development of spin-outs. Applications require project teams to submit a full business plan for review which is assessed using normal Innovate UK processes (though with variations in

the 10 criteria for assessment, and the inclusion both of members of the Options Roundabout panel and independent technical assessors involved in the assessment).

- **Business plan development:** Participants that were recommended to apply for Aid for Start Ups were given additional financial support of up to £35k to further develop their findings into a concrete business plan. Project teams at SETsquared institutions were given an opportunity to make use of incubator facilities at a reduced cost (it is important to note that non-SETsquared institutions do not all have similar access to incubation facilities, mentorship and network support).

2.3.3 Outputs

These activities could be expected to lead to the following outputs:

- **New contacts:** As part of their engagement with customers, project teams are expected to investigate the commercial potential of their research outputs through making connections with potential customers, suppliers and competitors.
- **Market validity assessments:** ICURe participants produce a market validity assessment which is largely comprised of business model and value proposition canvases¹⁸ (which is subject to continual refinements over the course of, and after, the programme). A full business plan is not an expected output at this stage.
- **Options Roundabout recommendations:** A clear recommendation is provided to participating teams by an independent panel with relevant expertise and experience in the commercialisation of academic research.
- **Business plan:** Some teams will 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 types of outcome at the project, individual and institution level.

Individual

- **Commercial awareness:** Participation in the ICURe programme is expected to produce an increased commercial awareness on the part of ECRs and PIs. The programme aimed to develop understanding of how lean start-up principles could focus their technologies around various sets of different customer needs. This, combined with experience in designing and implementing a business development strategy, is expected to increase the capability of ECRs and PIs to effectively engage with businesses.
- **Commercial intent:** In addition, participation in the programme may also produce other attitudinal changes relating to intentions to commercialise and increases in their belief in their ability to do so (i.e. self-efficacy).
- **Commercial skills:** Participation in the programme may also help build the capabilities of participants to start-up a new venture successfully. However, there is an acknowledgement that commercial skills may not be sufficiently developed to lead the commercialisation of the innovation in the event that 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).

¹⁸ Osterwalder &, Pigneur (2010) Business Model Generation. URL: <https://strategyzer.com/canvas/business-model-canvas>. Date accessed: 24/10/16.

- **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 would be achieved by encouraging academics to give more consideration to the impact and potential uses of the research outputs they produce. Improved understanding of the needs of potential customers may also guide future research plans.
- **Ongoing engagement with new contacts:** Network theory suggests that those that are 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 through the creation of more opportunities to collaborate). Maintenance of new relationships (internally and externally) formed through the market validation process may produce ongoing benefits by creating opportunities for researchers to pursue the commercialisation of their research.¹⁹
- **Reputational effects:** Participation in ICURe could also produce important outcomes in terms of raising the reputation of individuals involved with regard to 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.

Project

- **Resolution of business model issues:** A key expectation is that participants in ICURe make some progress in discovering the optimal commercialisation strategy, resolving key business model development issues. The discovery process 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 the programme more generally is likely to influence the decision to commercialise and the route to market 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:** The completion of ICURe is likely to result in the leverage of additional public or private investment. Project teams will have an increased understanding of the commercial merits of their research and may be better at communicating these when applying for funding or pitching for equity investment.
- **Start-up creation:** In some cases, project teams commercialise through the establishment of an external commercial vehicle. In this event, it is likely that teams will undergo a management reorganisation whereby the PI and ECR initially support the technical and commercial aspects of the start-up and, over time, it is possible that they will withdraw from the commercial development of the business. As a management structure and commercial team is introduced, the ECR may take a Chief Technology Officer role, though the creation of executive management team posts is not a direct objective of the programme.
- **R&D spending:** Both participants and non-participants may increase their level of R&D spending to complete further validation of their technology to reduce their technology risk moving forward. This is especially true for project teams that are advised to return to their institution to complete further translational R&D.

¹⁹ For example: Ronald (2004). Structural Holes and Good Ideas. American Journal of Sociology.

- **Technological progress:** While the activities of ICURe are focused entirely on the commercial validation of research it may be that after the initial stages of engagement are complete a project team receives a recommendation to complete further translation research or development work. As a result, further technological progression is possible.

Institutional

- **Visibility and capability of TTOs:** TTOs are likely to benefit from the programme through increasing their knowledge of the distribution of academic research being conducted in their institutions and strengthening their business and financial networks (including amongst non-participants who may benefit by being referred to other forms of support with their ideas). The signposting and the inclusion of a TTO 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 may result in the generation of knowledge of more 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 to produce a wider cultural change within the institutions concerned).
- **Improved reputation for impact:** The reputation of academic institutions for commercialising technologies may also increase as a result of participating in ICURe. A proven record of commercialisation may also lead to a greater likelihood of receiving basic and/or translational research funding. Clear examples of impact may aid the production of impact case studies which feed into the Research Excellence Framework and have direct consequences for the amount of quality related (QR) research funding received.

2.3.5 Impacts

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

- **Employment:** Where the programme has led to the creation of spin-outs, 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 turn, the projects may result in the launch of new and/or improved products as a consequence of accelerated commercialisation. If successful, this will lead to an increase in turnover for the spin-outs concerned (and an associated increase in output, and potentially further employment, to satisfy demand). The products or services introduced will potentially displace the sales of products or services supplied by competitors (leading to offsetting displacement effects to the extent that they are based in the UK). However, displacement will still lead to economic benefits if they involve a transfer of output from less to more productive producers (or if the consumer of the technology is able to realise efficiency gains).
- **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 those firms licensing the technology.
- **ECR career prospects:** The programme provides time and resources for ECRs to develop their own commercial experience, develop a reputation for conducting commercialisation activity and increase the size of their professional networks, which may produce wider labour market effects in the form of enhanced career prospects and/or productivity. This type of effect should be visible both in increased employment probabilities for the ECRs, and in their wages.

- **Local cluster development:** It may be the case that the increased commercial capacity and capability of TTOs and academic researchers resulting from ICURe will lead to a set of positive local economic development effects. For example, improved institutional reputation for commercialisation may attract additional investments or talent to the area, contributing to local cluster effects.

2.4 Performance Against Targets

The table below sets out the performance of the programme against the targets that were put forward in the business case. This assessment was completed using monitoring information collated by SETsquared documentation relating to ICURe.²⁰ This evidence provided suggests that ICURe has exceeded its initial expectations:

- The number of participating teams totalled 78 by cohort 6 (against a lifetime target of 50), although the number of proposals received fell just short of expectations. SETsquared institutions were able to use the available resources more economically than originally anticipated by staging the release of funds. This has permitted the delivery of a further two application cohorts (Rounds 7 and 8).
- Twenty-eight participating teams have been able to spin-out (against a lifetime target of 16) and 28 have attained an alternative outcome involving a progression of the project (a licensing deal, sponsored research or further research). It should be noted that these outcomes are not mutually exclusive – a total of 39 teams achieved one or more of these outcomes (50 percent of participating teams).

Table 2.2: ICURe pilot programme – performance against core lifetime targets

Output or Outcome	Lifetime Target	Achieved at the End of Cohort 6
Proposals received	150	142 (including resubmissions)
Teams created	50	78
Teams presenting to Options Roundabout panel	48	78
Spin-outs created	16	28
Licensing, sponsored research, etc.	12 teams	5 licensing deals 7 sponsored research 16 further research
Educated and informed staff	21 teams	42 staff plus 21 business mentors
Signposting from original proposals received to alternative routes	20 teams	32 projects referred to HEI TTO In addition, survey evidence suggests that 58 percent of teams not awarded places on the programme continued to be supported by their TTO

Source: Monitoring Information supplied by SETsquared, October 2016 (note that some teams have attained more than one positive outcomes – e.g. spinning out and securing a licensing deal).

²⁰ It is important to note that the quality of monitoring records provided for the evaluation was not suspected to be high. This was largely due to incomplete, missing and/or out-of-date records. For example, it was not always clear if a team had not secured an outcome or whether it was unknown. In some cases, placeholder comments were provided to suggest that an outcome was about to be realised – but had not at the time of recording.

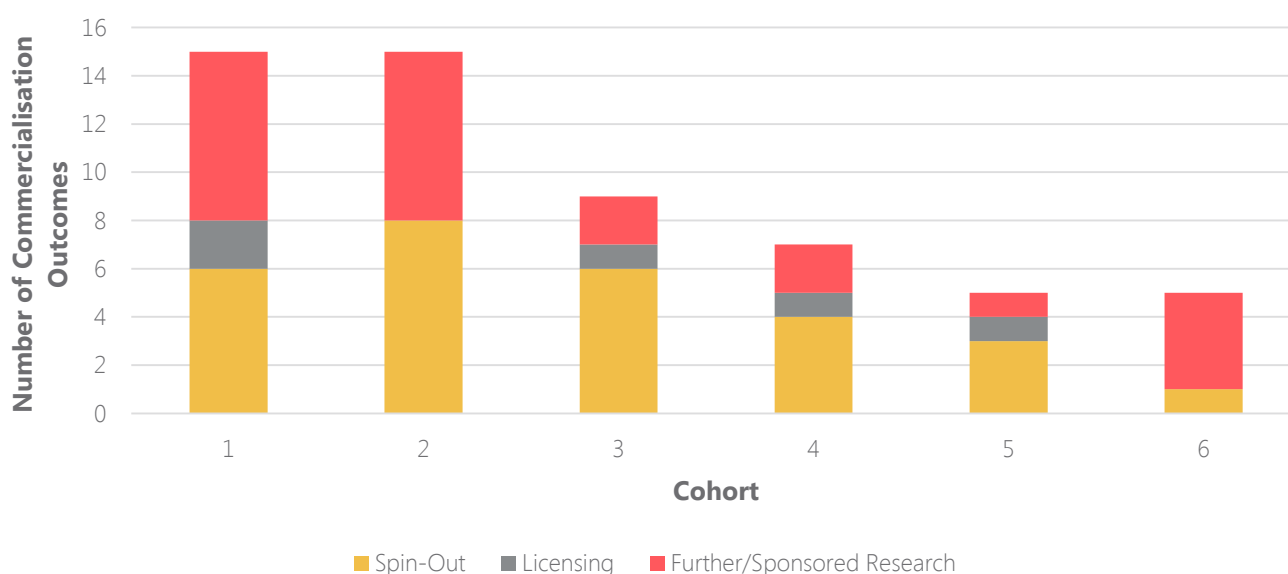
2.4.2 Outcomes

The headline outcomes emerging from cohorts 1 to 6 of the programme (as described in the monitoring data at October 16) are as follows:

- **Spin-outs:** Twenty-eight projects formed a spin-out company. Details captured on the number of jobs created by these spin-outs suggest that 19 of these businesses have begun to employ workers, with a total of 62 jobs created (though these firms were all microbusinesses employing less than 10 workers). The relevant teams had also raised a total of £4.8m in private funding since leaving the programme (with two teams accounting for 50 percent of this total).
- **Licensing deals:** Five teams had secured licensing agreements since participating in the programme. The value (assumed to be annual) of these agreements was £10,000 in four cases, with one team securing a licensing agreement of £180,000 (a team that has also spun out and secured £1.2m in private funding).
- **Further and sponsored research:** Nineteen teams had secured further funding for further or sponsored research (10 of which had also spun out the project). Evidence on the value of this funding is not always available, though the data suggests that a minimum of £4.6m had been secured (it is unclear if this is also counted in figures on private funding).²¹
- **Other private funding:** Teams not spinning out raised £0.5m in further private funding following their participation.

The monitoring information suggests that these outcomes may take time to arise. As the following figure illustrates, earlier cohorts were more likely to realise positive results, and the figures available at the time of writing will likely understate the eventual gross outcomes of the first six rounds of the ICUR programme. These patterns could be explained by differences in the characteristics of projects or teams across rounds, and as discussed later in section 4.2, the Options Roundabout was also increasingly less likely to recommend a commercialisation outcome over time.

Figure 2.1: Outcomes realised by application cohort

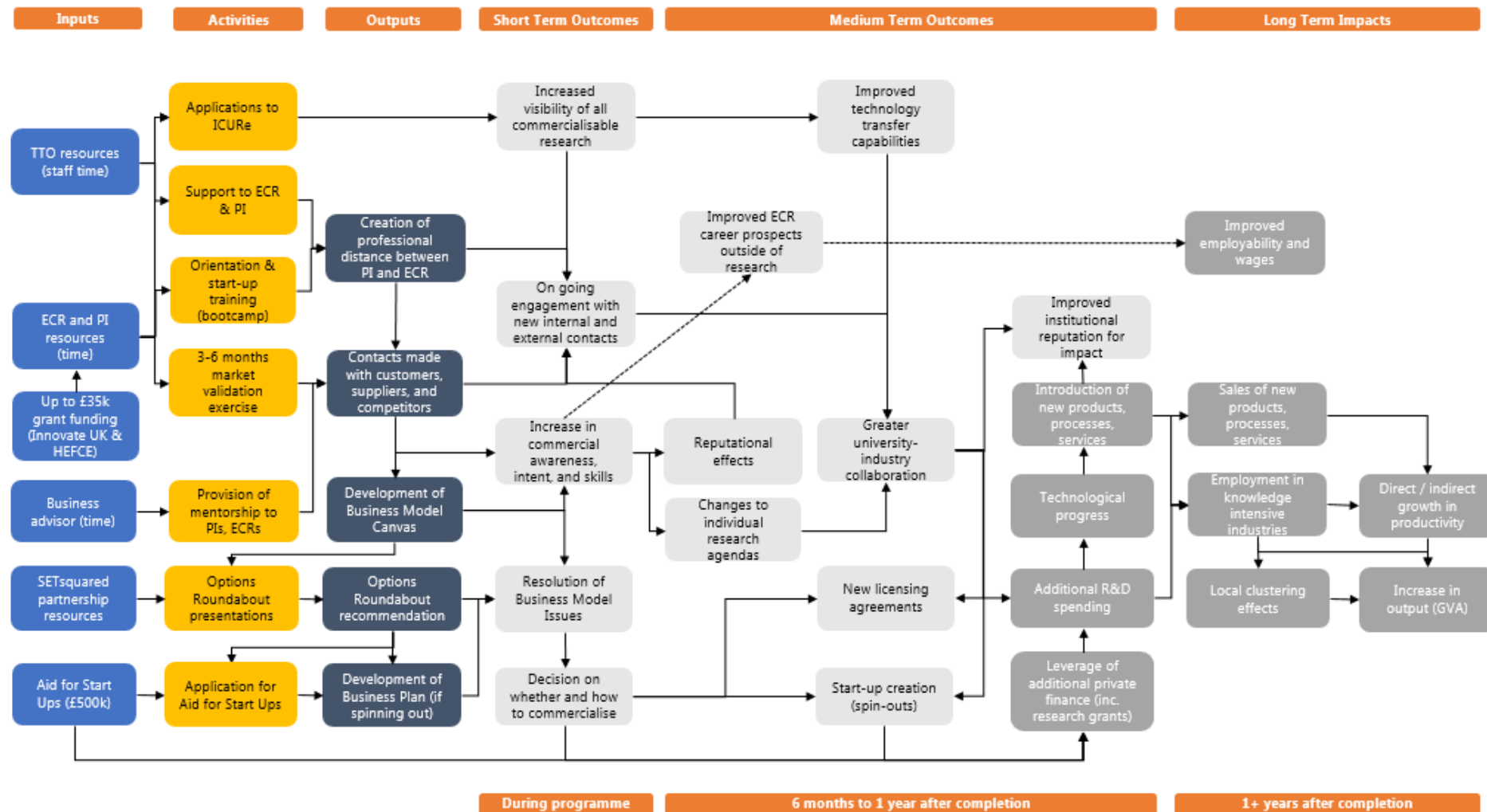


Source: Monitoring information supplied by SETsquared, October 2016

²¹ Respondents were asked whether they had made any attempts to secure further funding for further research and development. This funding could have been provided by a public body or private organisation.

2.5 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.

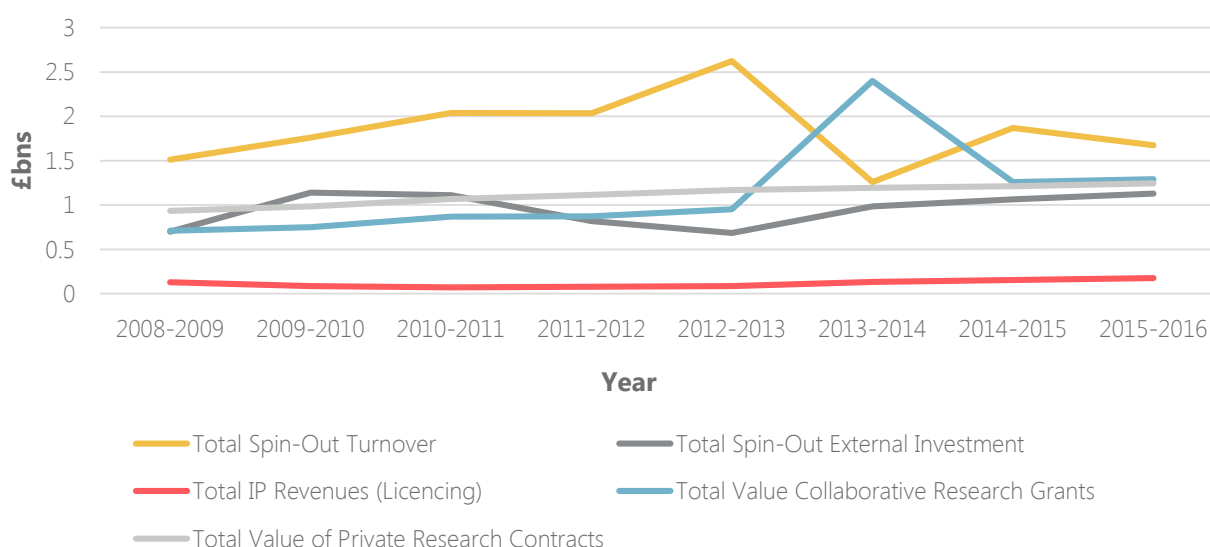


3 Context

This section provides a historic overview of all reported commercialisation activity completed by UK HEIs and the institutions participating in ICURe.²² It provides an analysis of commercialisation results over time and draws out differences between participating and non-participating institutions. This section also provides a general discussion on the processes HEIs adopt to complete commercialisation activity, the barriers they face in doing so and the possible role of analogous schemes in contributing to the outcomes of the programme. This analysis is not intended to provide an assessment of the ICURe programme itself and makes use of data collected as part of the Higher Education – Business and Community Interaction Survey (HEBCIS), between 2008 and 2015 by HEFCE and then HESA from 2009 onwards. It also draws on desk research and stakeholder views collected as part of the evaluation.

3.1 UK Commercialisation Activity

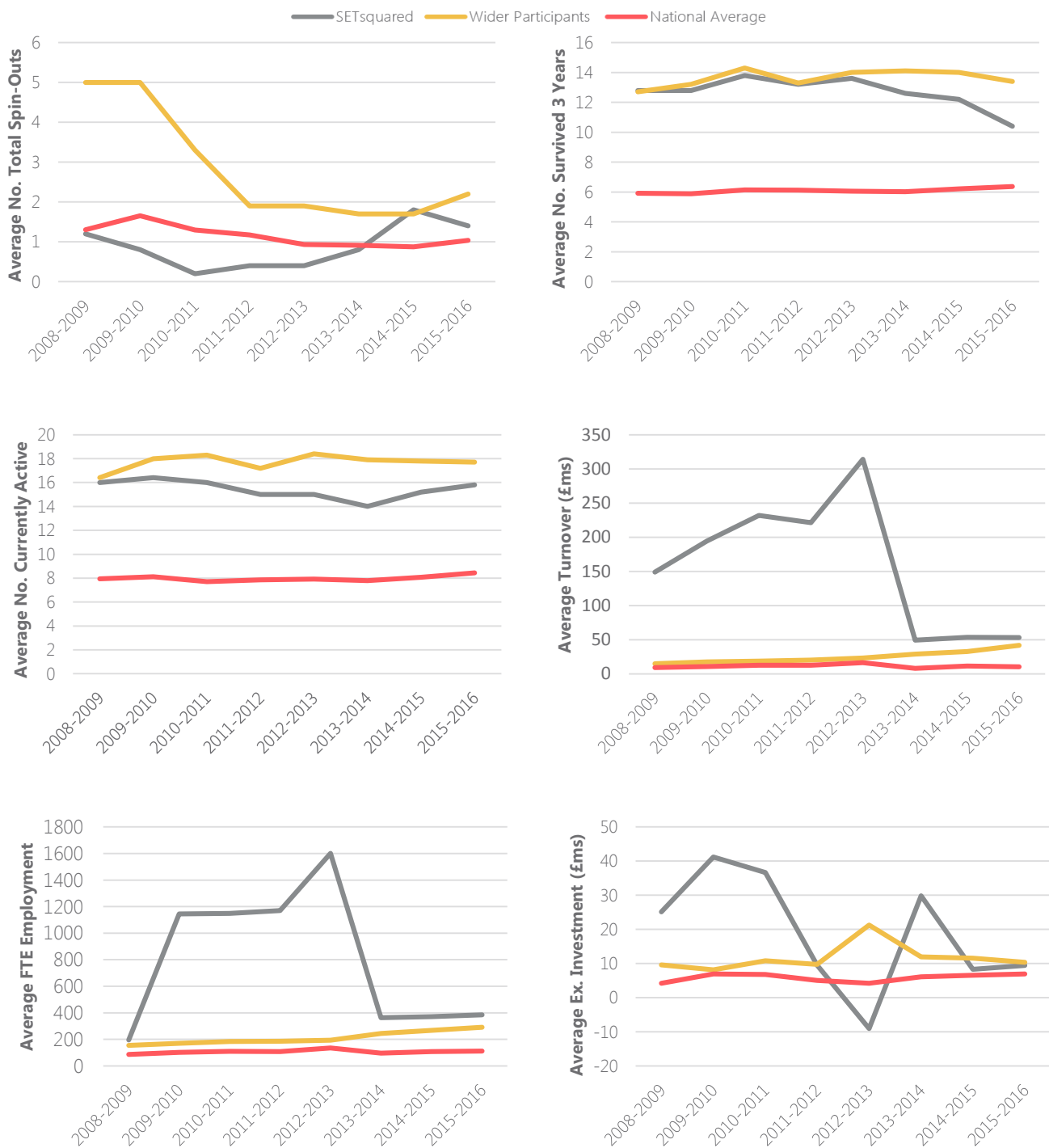
Figure 3.1: UK HEI commercialisation activity



Source: HEBCIS data, Ipsos MORI analysis, April 17.

Commercialisation activity in academic institutions in the UK is monitored in the HEBCIS which estimates of the number and value of spin-outs, licences and research and development contracts. Overall, turnover generated by spin-outs increased from £1.5bn to £1.6bn between 2008/09 to 2015/16 (as illustrated in the figure below). Revenue generated from IP (i.e. licensing revenue) was the smallest contributor to academic institution revenues, rising from £115m to £176m over the period.

²² In this section, 'wider participants' refers to non-SETsquared institutions that submitted at least one application to cohorts 1-6 of ICURe.

Figure 3.2: Average HEI spin-out activity

Source: HEBICIS data, Ipsos MORI analysis, April 17.

3.1.2 Spin-outs

SETsquared institutions produced fewer spin-outs than the national average between 2008/09 and 2015/16. However, the spin-outs they did produce were more likely to survive for at least three years and produced higher levels of average turnover and employment (on average). Other institutions participating in ICURe also outperformed the national average in terms of the performance of spin-outs. It should be noted that there is a considerable amount of variation in the data and a large proportion of this is driven by a small number of institutions (for example, the universities of Bath, Portsmouth and

King's College London). Again, this analysis does not provide an indication of the success of the ICURe programme, but rather a descriptive overview of spin-out activity.

3.1.3 Patents and Licensing

On average, participating institutions were more active in applying for patents and generating higher levels of licensing income than non-participants:

- **Patents:** Participating institutions were responsible for the registration of 18 percent of all new patent applications made by all HEIs between 2008/09 and 2015/16. The average number of new patents registered annually by SETsquared institutions fell from 36 to 23 between 2008/09 and 2015/16 and from 27 to 25 in other participating institutions (in comparison to a national average of 13 over the period).
- **Licensing:** Revenues secured from the licensing of technology varied substantially between 2008/09 and 2015/16, though participating institutions did not generate more income from licensing than other institutions. Average IP revenue per annum from licensing by SETsquared institutions decreased from £10.7m in 2008/09 to £0.7m, while the national average increased from £0.8m to £1.1m. Other HEIs participating in ICURe increased the level of licensing income from £0.8m to £1.1m over the same period. Licensing activity was dominated by non-software licensing.

3.1.4 Research and Development

- **Contract Research:** SETsquared institutions completed a higher number of annual private research contracts on average (560) than wider participants (403) and the national average (191). Participating institutions secured a higher value of private research contracts on average, rising from £13m to £21m amongst SETsquared institutions between 2008/09 and 2015/16 and remained at £11m amongst other participating institutions. This compares to a national average that rose slightly from £6m to £8m.
- **Public Research Grants:** On average, SETsquared and other participating institutions received a larger amount of public funding to support collaborative research and development between 2008/09 and 2015/16 (an increase from £8m to £21m for SETsquared institutions and £11m to £18m for other participating institutions), relative to the national average (an increase from £4m to £8m).

3.1.5 Implications for the Evaluation

The analysis indicates that institutions that participated in ICURe generally displayed higher and more sustained levels of commercialisation activity than other academic institutions over the eight years to 2015/16. As such, some caution should be exercised in drawing generalisations from the pilot programme to its possible effects in other academic institutions.

3.2 UK HEI approaches to Commercialisation

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.

3.2.1 HEIs Identification of Academic Research with Commercial Potential

Qualitative evidence gathered suggested that HEIs typically adopted systematic processes to identify research projects with commercial potential. These processes were typically being managed by a Technology Transfer Office (TTO), which in some

instances, is combined with the institution's research commercialisation function. TTOs varied in size ranging from two to 20 members of staff. Where staff numbers were higher, TTOs often divided their activities by research field. Staff typically held experience in both commercial and academic settings. Case study research suggested that experience in a relevant technical field enabled TTOs to support teams more effectively – particularly in facilitating links with appropriate contacts and identifying relevant funding opportunities. Stakeholder research suggested that TTOs often had to be proactive in identifying potential projects through either internal events and scanning of patent and grant applications. However, case study evidence suggested that ECRs and PIs were also active in contacting their TTO for support, prior to their application. This is validated to some extent by the survey indicates that over 80 percent of ECR and PI survey respondents had met with their TTO representative prior to their application to ICUR.

3.2.2 Selecting Commercial Opportunities for Further Support

The qualitative evidence suggested that commercialisation opportunities identified by academic institutions go through a form of screening that enables the TTO to prioritise projects and identify the appropriate level of support required. This involves the completion of an innovation disclosure form that notes the current technical and commercial progress of projects, and the completion of a basic due diligence exercise, which has the initial aim of identifying whether the idea is unique and the team have the legal 'freedom' to pursue the research commercially. Those engaged in the study reported that their offices reviewed between 80-100 of these forms per year, typically in the form of a weekly review meeting, with anywhere between five and 25 being selected for further support annually. Ideas were typically at an early stage of development (TRL 1-3) and concentrated in STEM research areas. Once projects were selected additional support was provided including the completion of market assessments (completed internally or using external contractors), the allocation of targeted funding to support commercial development, the provision of mentorship and access to the networks and professional memberships of the academic institution and its partner organisations.

3.2.3 Barriers Associated with Commercialising Academic Research

Research with stakeholders largely confirmed the presence of the hypothesised barriers to commercialisation of academic research (as set out in section 2). Several barriers were identified during the stakeholder and case study research that limited the overall ability of HEIs to commercialise academic research. These barriers feature at the individual, project and institutional level.

Individual

- **Low willingness to engage in commercialisation activity by academics:** In some cases, it was suggested that there was not an appropriately qualified or experienced team available and willing to develop a technology. This factor was reported to often be overlooked during early commercialisation activity. Optimal team composition was indicated to be more important than having a highly effective TTO supporting a project (with some stakeholders suggesting that TTOs were sometimes used as scapegoats for failure in some instances).
- **Limited academic commercialisation capability:** Academics were reported to often have little experience of testing their research against 'real world' problems, and are incentivised to focus their energies on basic theoretical and empirical research rather than undertaking the type of sequential experiments and testing activities required to refine a technology. Academics were also reported to find it challenging to operate outside an 'academic' mind-set when thinking about their research. An example that was repeatedly given was the inability of academics to communicate their research in non-technical terms or how it could be used as a commercially viable solution. Some academics were reported to have insufficiently developed soft and/or interpersonal skills that are required to conduct commercialisation activities such as

time management or an understanding of presenting or conversing with different audiences. A lack of suitable support and training available for individuals before they had started companies was suggested as a possible reason for this.

Project

- **Associated transaction costs:** The costs involved in making an investment in a spin-out originating in universities were reported to be particularly acute. Firstly, unlike in other scenarios, the individuals that developed the IP would not necessarily be keen to be involved in the management of the spin-out, and a range of negotiations need to take place to secure the involvement of the PI. A venture capital firm would also need to seek an IP pipeline agreement (i.e. an agreement that secures ownership of future IP generated by the PI, to avoid the risk that they develop a superior product or technology that is taken up by a competitor). Additionally, the investment would require a series of negotiations with the academic institution to agree the terms of the investment, including ownership of IP and the terms under which any licensing of the IP might take place.
- **Access to appropriate finance:** Stakeholders had mixed views on the extent to which access to appropriate finance at the right level was a significant challenge, suggesting that evidence relating to the existence of the 'Valley of Death'²³ phenomenon was largely anecdotal, especially in the case of spin-outs. Stakeholders also indicated that raising finance for projects at TRL1-3 is not a significant issue and not generally something that halts progress if a project is of a high quality and has a strong team behind it.

Institutional

Several factors were reported to limit the effectiveness of HEIs in conducting commercialisation activity, though it is important to note that the leading institutions (examples given were Imperial College London, Cambridge, Oxford and UCL) were thought to be highly effective in commercialising their research (typically regarded as world class). The differentiating factor was the volume and quality of research undertaken at these institutions, which enabled them to invest in and fund their technology transfer capabilities (as well as enabling them to attract talent). The tier of institutions below this do not offer similar scale economies and face substantially greater challenges in the following areas, even where these institutions have centres of excellence in particular areas:

- **Constrained TTO resources:** A key limitation of the TTO is the lack of resources available to effectively support all viable commercialisation opportunities. Representative of HEIs indicated that not all research teams could receive help and certain types of activity were prioritised, such as contract research opportunities. For example, one TTO reported it was challenging to support approximately 1,300 researchers with 15 personnel.
- **Suboptimal TTO networks for commercialisation:** While a large number of HEIs have forged successful industry supportive networks, stakeholders indicated that SETsquared was somewhat unique in that the strategic relationship here was implemented to support commercialisation activity. Many other HEI networks such as the M7 group were reported to be more focused on supporting basic or fundamental research.
- **Overvaluation of IP:** Stakeholders reported that universities that overvalue IP typically have little understanding of how it can be translated to market, resulting in problems when interacting with the industry and potential investors.

²³ Whereby early stage companies fail to generate sustainable revenues after an initial injection of investment capital, is a key deterrent of commercialisation activity.

- **Suboptimal university leadership:** Some HEIs have senior leadership that is not commercially minded or lacks the ability to communicate the importance or interest in commercialisation amongst its internal network. It was suggested that universities that perhaps do not have the best research but have the right leadership are likely to have better commercialisation outcomes; it was suggested that this mind-set takes time to foster and develop.

3.3 Other Relevant Schemes

A number of other public schemes and support programmes have been developed to support early career researchers 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, as well as a discussion of their similarities with/differences from ICURe:

- **Researcher to Innovator (R2I):** The R2I is another programme delivered by SETsquared which lasts around four weeks with the aim of providing a light touch introduction to commercialisation and entrepreneurship to PhD candidates who are interested in understanding the extent to which their own research and ideas could result in a commercially viable business prospect. Just 20 percent of ECR survey respondents indicated that they took part in the R2I programme.
- **SETsquared Business Incubator:** The provision of working space and business support to teams and companies originating from in and outside SETsquared institutions. A subset of participating ICURe teams are offered the opportunity to make use of the incubator and reduced rates to support business development activities. The focus of the programme is relatively more focused on the development of the commercial awareness of participants rather than completing a market validation exercise.
- **Royal Academy of Engineering (RAEng Enterprise Fellowship):** This 12-month fellowship²⁴ provides successful applicants with engineering projects that have demonstrated proof of concept in both lab and operational settings (TRL4 or above) tailored mentoring and up to £60,000 of funding to develop a business plan and seek investment. It differs from ICURe in that its focus is on developing a business plan and raising investment for a start-up.
- **Enterprise Fellowship Scheme:** The Royal Society of Edinburgh offers a fellowship that provides a years' salary (typically around £37,000) for 12 months to support the development of a business plan and securing external investment, with an overall aim of supporting fellows to develop a commercial case for a spin-out company. Fellows can be supported by either Scottish Enterprise, the UK Quantum Technology Hub, the Biotechnology and Biological Sciences Research Council or the Science and Technology Facilities Research Council. However, fellows supported by research councils must have previously received public grant funding from the same research council. Again, this scheme is different to ICURe in that it assumes a spin-out is the selected commercialisation route.²⁵
- **Private seed accelerator and incubator programmes:** A number of private and corporate-backed start-up support schemes provide seed funding to newly formed companies, sometimes in exchange for an equity share in the company, and advisory support, typically in the areas of business administration, recruitment and business development. Examples include Wayra, Techstars, Oxygen and startupbootcamp. These programmes, like ICURe, tend to focus on market validation and favour lean start-up principles, but have historically focused on digital/ICT companies.

²⁴ <http://www.rse.org.uk/wp-content/uploads/2016/09/enterprise-brochure-2016-web.pdf>. Date accessed 13/03/17.

²⁵ Stakeholder evidence indicated that a set of individuals that took part in ICURe then went on to receive a fellowship from one of the fellowship schemes described.

While not strictly comparable to ICURe, a set of start-up support schemes do exist that provide capital and advisory services to start-up companies. A set of example schemes are included below:

- **Enterprise Investment Scheme (EIS)²⁶ and Seed Enterprise Investment Scheme (SEIS)²⁷:** These schemes were designed, in particular for early-stage, high-risk technology companies, and offer tax breaks to investors in companies that meet its criteria, making the raising of funds easier. The EIS provides tax relief at 30 percent and can be claimed up to a maximum of £1,000,000 invested in company shares and the investee can raise no more than £5m in the round in question (the SEIS relief is at 50 percent, and the company can raise no more than £150,000). The scheme does not support investors that would own a majority share (more than 30 percent) or that are connected to the company through employment.
- **The SME Instrument:** High growth, high aspiration SMEs with close-to-market innovations, based in the EU or a Horizon 2020 associated country, are eligible to apply for a range of grant funding and support services through the Horizon 2020 research and innovation funding programme. Grant funding (typically covering up to 70 percent of the project cost) is supplied in two stages: first, feasibility assessment grants of up to €50,000 are available for SMEs to support the assessment of the technical feasibility and potential commercial opportunity of an innovation over six months. Second, business innovation grants of between €500,000 and €2.5m are available to SMEs for one to two years that have developed a 'sound and strategic' business plan to support commercial development, for example, through prototyping, miniaturisation or scaling up. In addition to these phases of funding, the instrument also provides support to SMEs looking to receive investment, develop investor and customer relationships or tailored business development coaching. The Enterprise Europe Network supports the delivery of the 'softer' aspects of the instrument, through connecting member organisations, chambers of commerce and industry, technology centres, universities and development agencies. This scheme duplicates Aid for Start Ups to some extent but it should be noted that Aid for Start Ups does not require a static business plan, in fact, this opportunity is designed to support the development of business plan that better reflects customer demand.
- **Start Up Loans:** The British Business Bank back and support the delivery of a government scheme²⁸ that seeks to increase entrepreneurship in the UK through supplying loans of up to £25,000 at six percent interest alongside a package of mentoring support to early stage businesses that have been in operation for less than a year. This scheme is distinctly different to ICURe because it does not have a focus on IP or HEI businesses and uses debt as its main instrument.

Overall, ICURe appears to have complemented the set of programmes that exist to support commercialisation activity in the UK. The training support schemes discussed above are either narrower in technology or they emphasise the use of a start-up as a vehicle for bringing a technology to market. While ICURe is more general in these two dimensions, the programme caters for technology at an early stage of development where the technology does not have a firm commercial exploitation strategy. In addition, the qualitative evidence highlighted that the only schemes to be completed by ICURe participants were the fellowships described although these schemes were not stated to be substitutes. The figure below indicates that while providing commercialisation support, ICURe is unique in that it couples this support with a focus on individuals looking to assess the commercial merits of their research, rather than teams.

²⁶ <https://www.gov.uk/government/publications/the-enterprise-investment-scheme-introduction/enterprise-investment-scheme>. Date accessed: 13/03/17.

²⁷ <http://www.seis.co.uk/about-seis>. Date accessed: 13/03/17.

²⁸ <http://british-business-bank.co.uk/partners/start-up-loan-company/>. Date accessed: 13/03/17.

Figure 3.3: Mapping of relevant schemes

		Programme Characteristics							
		Commercialisation support	Seed capital	Debt/equity	Individual mentoring	HGF focused	Start-up/SME focused	IP focused	Focus on an individual
Programme	ICURe								
	Research to Innovator								
	SETsquared Business Incubator								
	RAEng Enterprise Fellowship								
	RSS Enterprise Fellowship								
	Private seed accelerator/incubators								
	EIS/SEIS								
	SME Instrument								
	Start-up Loans								

Source: Ipsos MORI, 2017.

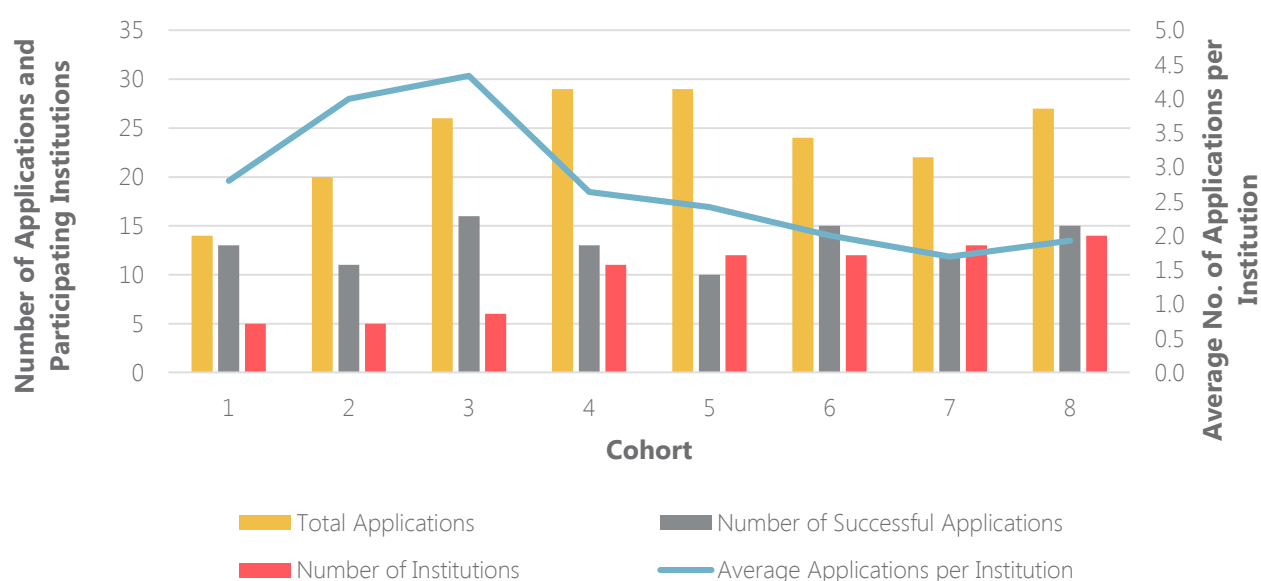
4 Short Term Effects of ICURe

This section provides a detailed overview of how the components of the ICURe programme supported participants in planning and progressing the commercial development of their technology. This analysis was completed using evidence from the survey of applicants, an assessment of monitoring information and analysis of qualitative evidence.

4.1 Applications to ICURe

Applications to the ICURe programme were mediated by Technology Transfer Offices within participating academic institutions. Stakeholder research suggested that TTOs typically identified candidates using normal processes for finding research with commercial potential (requiring proactivity on the part of the TTO, including surveys of recent grant, funding or patent applications, or workshops with academic staff to raise knowledge of the remit of TTOs). Less proactive measures (such as advertising on university intranet pages) were reported to have had limited effect on demand for the programme. Intensive engagement with TTOs was often required to ensure that the objectives of the ICURe programme were communicated and embedded into the process of identifying appropriate teams.

Figure 4.1: Number of applications and participating academic institutions by application cohort



Source: Monitoring information supplied by SETsquared, October 2016.

The monitoring information indicates that the volume of applications to the ICURe programme increased between cohorts 1 and 4 before broadly stabilising. However, the number of participating institutions doubled between cohorts 3 and 4, with the volume of applications per participating institution falling. Stakeholders suggested that this pattern reflected a degree of pent-up demand for the programme, with some universities putting forward teams that were already further forward with their commercialisation attempts. A comparison of teams featuring in earlier (1-3) and later (4-6) cohorts using survey data provided mixed evidence on this point. Earlier cohorts had also made more potential customer contacts prior to the programme (9 and 5 respectively), and were more likely to have registered intellectual property rights (IPRs) (74 versus 37 percent). Later cohorts reported that a larger amount had been spent on R&D (£400,000) in connection with the innovation at the heart of the proposal prior to their application than earlier cohorts (£231,000). However, using Technology Readiness

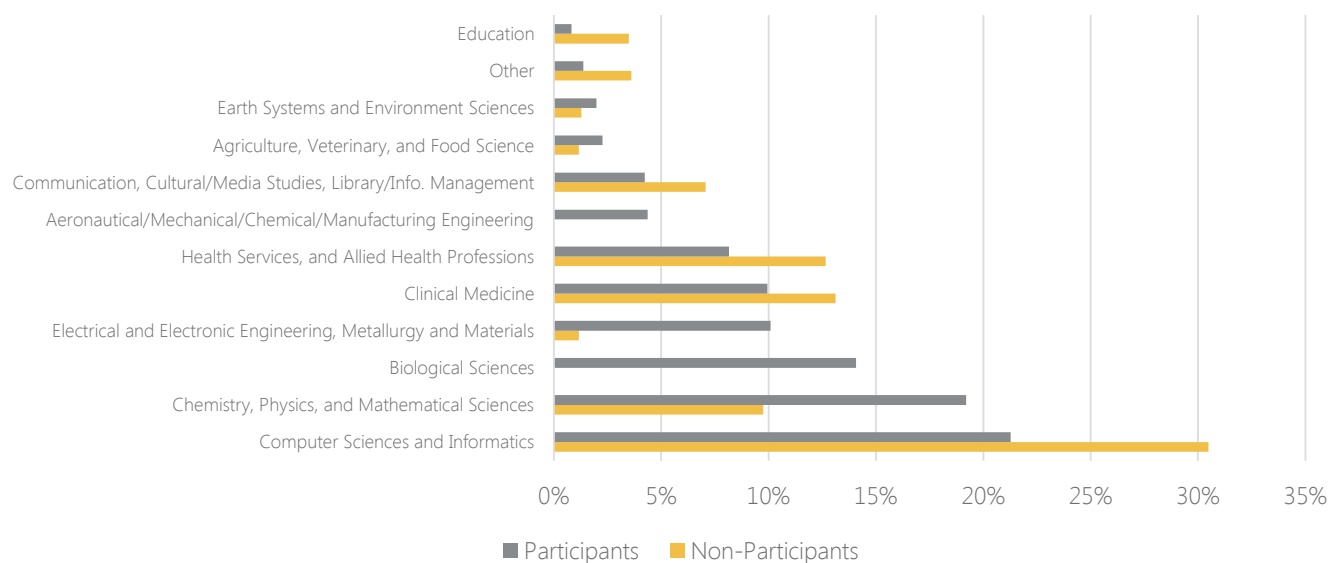
Levels (TRLs) as an approximation of closeness to market, both groups were at a similar stage of the development pathway levels (3.4 for earlier cohorts and 3.6 for later cohorts).²⁹

4.1.2 Characteristics of Applicants

This section uses the survey to describe a set of baseline characteristics for both participating and non-participating teams. Overall, just prior to ICUR, participating teams were leading projects that were more technologically developed than projects led by non-participating teams. All ECRs and PIs had relatively low levels of commercialisation experience but were supported by TTOs and business advisors with greater levels of commercialisation skills and knowledge:

- **Technical field, development and focus:** The technical field of applicants' experience and the focus of project proposals was dominated by STEM subjects, with a quarter associated with computer science, 16 percent with chemistry, physics, and mathematical sciences, 11 percent with biological sciences and 10 percent with electrical and electronic engineering. Participating teams reported that they were closer to market than non-participating teams (TRL4 versus TRL3). Sixty-six percent of participants intended to produce a new or improved product (in comparison with 60 percent of non-participants) and 36 percent intended to produce a new or improved service (48 percent of non-participants). However, the difference in R&D spending on projects prior to ICUR was not significant across participating and non-participating teams (£341,000 versus £333,000).

Figure 4.2: Distribution of applicants by technical field



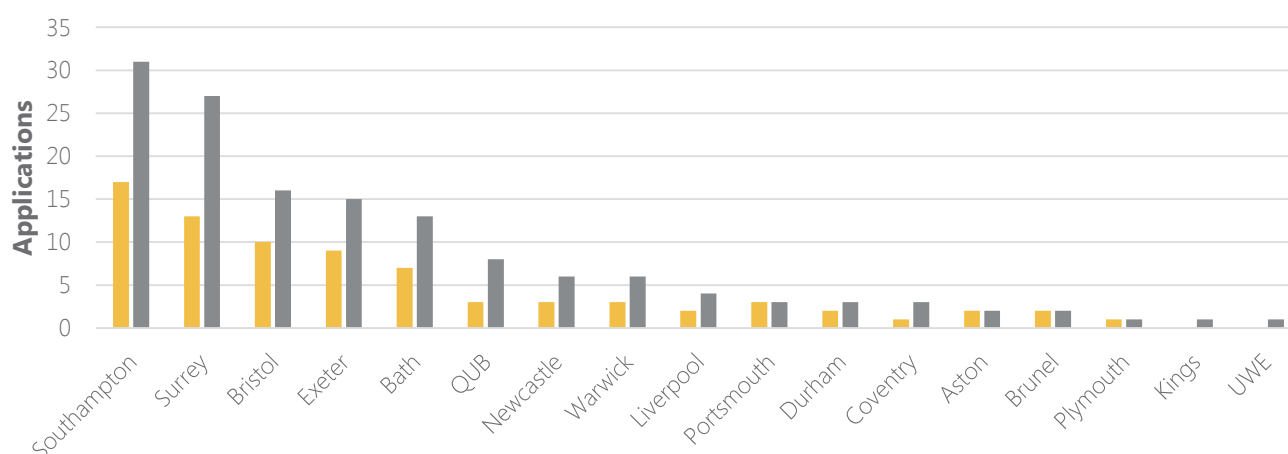
Source: Ipsos MORI Applicant Survey, January 2017. Sample sizes: 163 participants and 41 non-participants.

- **Publication and patenting activity:** Participating teams were significantly more likely than non-participating teams to have registered a patent relating to the technology forming the basis of project proposals prior to ICUR (62 versus 31 percent).

²⁹ Throughout this report, differences between subgroups are only reported where they are significant at the five percent level.

- **Commercialisation experience:** All ECRs reported a low degree of experience in completing commercialisation activity (an average of 1 year). Business advisors and TTOs brought an average of 13 and 9 years of commercialisation experience to teams respectively.
- **Previous commercialisation activity:** Twenty-three percent of respondents had made a previous attempt to commercialise their project prior to their application. Of these, over 50 percent had attempted to spin-out using private funding and 47 percent of those surveyed had sought a licensing agreement. Over 90 percent of all ECR and PI survey respondents had taken a leading or supporting role in developing the research underpinning the project. However, less than 9 percent had sought to interact with potential customers and only three percent had held prior discussions with their TTO about commercialising the technology.
- **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), giving a score on each between 1 and 10 (with 10 signifying the issue was completely resolved). 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. Prior to ICURe, non-participating teams reported they had made more progress in resolving these issues overall (44 versus 35 percent). However, participating teams indicated that they had made the most progress in correctly identifying their core customer segments and non-participating teams suggested that they had progressed most in identifying the key resources needed for their proposed business. Both groups of teams reported that the least progress had been made in clarifying the value and source of anticipated revenues.

Figure 4.3: Applications received, and participant applications, by academic institution (cohorts 1 to 6)



Source: Monitoring information supplied by SETsquared, October 2016.

There was also variability in demand and participation rates across participating academic institutions. The universities of Southampton and Surrey put forward the largest volumes of applications to ICURe over the first six rounds (accounting for 41 percent of all applications to the programme). However, Bristol and Exeter had the highest success rates (63 and 60 percent respectively, compared to 55 percent in Southampton, 54 percent in Bath and 48 percent in the case of Surrey).

Evidence from the stakeholder interviews suggested that some TTOs engaged in sifting activities (e.g. putting forward those teams they viewed as having the greatest likelihood of success in the process), which may partly explain the patterns observed.

4.1.3 Benefits of Completing an Application

Completing an ICURe programme application was reported to have given a number of benefits to applicants. Both case study and stakeholder research indicated a key benefit of the application was that it acted as a means for applicants to articulate their initial thoughts on the commercialisation plan for their technology. In addition, the application process benefitted some team members specifically:

- **ECR:** The application provided first time exposure to commercially oriented briefs and the opportunity to develop skills in completing an application using a different writing style that had more focus on commercial outcomes rather than technical traits.
- **TTO:** The process gave TTOs an opportunity to provide feedback to ECRs and PIs on how to refine their writing style to suit an investor's needs and gain an understanding of the commercial exploitation plan of the team, which enabled the TTO to plan resources more effectively over time.
- **Business advisor:** It provided a useful occasion for the business advisor to engage with the project and assess how best they might support the project's development through the programme before it commenced.

4.2 Participation in ICURe

This subsection summarises the evidence regarding the effectiveness of each component of the ICURe programme.

4.2.1 Bootcamp

The Bootcamp was thought of as a useful primer to the programme. Survey evidence indicates it was widely attended by team members (all ECRs, 90 percent of Principal Investigators, 88 percent of TTOs and 77 percent of BAs) and attendees had positive views of the effectiveness of the Bootcamp in preparing teams for the market validation exercise (with over 90 percent reporting it to be very or fairly effective). The qualitative evidence supports these findings:

- **Improving ECR confidence to complete the programme:** The views of stakeholders were that teams required highly motivated and confident ECRs to complete the programme successfully and it was suggested that the Bootcamp was instrumental in creating this commitment. Expectations of ECRs and the roles of their team members were clearly outlined and the evidence suggested that teams often did not appreciate the importance of contact generation and value proposition discovery and refinement prior to their application. In addition, the stakeholder and case study research suggested that the positive personalities of delivery staff were central in motivating and enthusing teams, introducing a sense of belief in their ability to complete the exercise. Evidence collected during a previous ICURe evaluation showed positive and significant impacts upon commercialisation intent and self-efficacy, aligning with this result and is discussed further in section 5.³⁰ The apparent importance of the qualities of the delivery staff during the Bootcamp do raise some questions, however, as to how straightforward it may be to replicate ICURe on larger scale.

³⁰ Newbury (2016). ICURe Programme Evaluation.

- **Development of commercial awareness:** Stakeholders consulted suggested that effective communication of the commercial traits of the technology was vital and that ECRs and PIs typically had little prior experience of doing this because they often had a limited need to talk about their research to non-technical audiences. By the end of the Bootcamp, ECR respondents reported they were now able to explain their technology in a manner that highlighted its commercial benefits, not just its technical traits. This was facilitated by a logical framework to explore commercialisation options in the form of a set of strategy canvases which provide a structured means to approach the market validation exercise. The development of the Business Model and Value Proposition Canvases, Budget and Action Plan (approved by the delivery team) provided a clear approach and strategy for the exercise. Without this framework, participating teams reported they may have struggled, especially in the early stages of the market validation exercise, in generating leads for the first time. The development of a menu of question topics also enabled ECRs to quickly generate evidence on the factors that may create value for customers and how much they would pay for applications, rather than only understanding customer interest in technologies in their own terms.
- **Time allocation to complete a plan and budget:** The Bootcamp also offered teams time to plan activities as a team, a process thought to be unachievable in the absence of ICUR given the time constraints faced by the constituent team members. This time also facilitated the development of positive team relationships with one another before the programme commenced. Evidence indicated that the canvases (and the Business Model Canvas in particular), action plans and budget produced were of a higher quality than would have been likely if they had been completed without the physical presence of team members (although this is a difficult proposition to formally test).
- **Knowledge sharing:** Evidence from the case studies suggested participating teams thought the Bootcamp was a good opportunity to meet other teams to share and discuss ideas and thoughts about potential markets to explore. This process was reported to have resulted in useful refinements to the team strategies. The cross-team networking and communication facilitated shared learning and peer support across institutions and research fields was considered to have not happened otherwise. For example, one team that intended to speak with contacts in the oil and gas sector as part of the programme only became aware of the extensive compliance and regulation in that sector after discussing their plans openly with other teams - a business advisor supporting another team signposted them to useful resources that aided them during the later stages of the programme.
- **Development of interpersonal skills:** Developing the interpersonal skills of ECRs was reported to increase engagement with new contacts as they became more adept in reading body language and guiding discussions. Teams reported that the Bootcamp introduced several exercises to support ECRs in becoming more personable and engaging when completing the market validation exercise, through role play exercises and feedback sessions relating to non-technical explanations of technologies. In addition, ECRs practiced trying to set up and deliver meetings, which was reported to have made the process of doing this during the market validation process less daunting. Several other approaches were discussed during the Bootcamp such as how to write follow-up emails, how to use professional networking sites and how to manage gatekeepers within organisations.
- **Business Model and Value Proposition Canvas Tools³¹:** These tools were reported to have been useful preparation for the teams for several reasons. They provided a framework with which to complete the exercise; and completion of the different segments forced teams to reflect upon and analyse key aspects of their business model they may have missed otherwise – the importance of the correct identification of appropriate customer segments was a key example offered

³¹ It is important to note that qualitative evidence did not pick up a perceived distinction in the purpose of each of the canvas tools. As such, this analysis presents an assessment of the usefulness of the tools jointly.

as it enabled teams to more efficiently target the right companies. Secondly, the tools were useful because it could be used to track and monitor business model issues systematically (particularly where it was used as a 'live tool' updated regularly to reflect changes and developments).

However, qualitative evidence also suggests that some aspects of the Bootcamp's delivery could be refined:

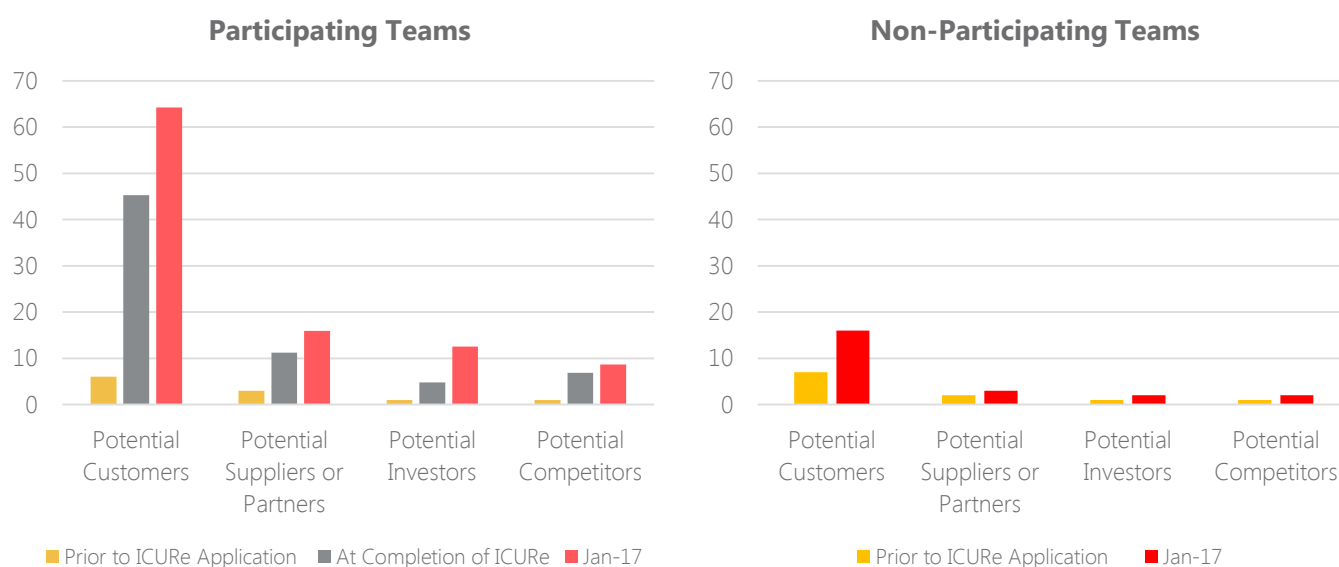
- **Canvas Tools:** These tools were considered to be too focused on the process of populating segments rather than understanding the implications for the exercise. This view was primarily held by projects that had already completed a significant amount of commercial development prior to ICURe (perhaps suggesting that ICURe may not be as appropriate for those teams further ahead with the commercialisation process) or by teams where their underlying technology had a relatively complex route to market, for example, a technology attempting to solve a business problem that was predicted to occur at a future point in time (with the implication that the potential demand for the technology does not currently exist).
- **Researcher to Innovator (R2I):** As noted in section 3, the R2I is another programme delivered by SETsquared which lasts around four weeks and aims to provide a light touch introduction to commercialisation and entrepreneurship to PhD candidates. ECRs that had completed the R2I programme suggested that it duplicated the content of the Bootcamp by as much as 50 percent. Evidence from the case studies indicated that the Bootcamp was more effective for those who had not completed R2I or for those that had not completed it immediately prior to ICURe. However, the survey results do not validate this result and suggested ECRs reported the Bootcamp was as equally effective irrespective of whether they had completed R2I (with 88 percent of R2I participants reporting it was very or fairly effective against 85 percent of those that did not participate).
- **Presence of BA and TTO:** The usefulness of the presence of the BA and TTO during the educational supplements of the Bootcamp was challenged with evidence from the case studies suggesting that their attendance during these stages may be counterproductive. Instead, the value added by these team members was reported to be during the planning stages, when teams were developing a budget and action plan. It should be noted that this finding came primarily from teams that participated in cohorts one and two and the requirements of supporting team members during the Bootcamp has changed substantially in response to this feedback.
- **Alignment of expertise:** Evidence from the case studies suggested that the Bootcamp, in its current format, 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 ICURe with other project teams from a similar technical field or who intended to approach similar customer segments. More targeted support could be provided, 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. A 'sector focused' ICURe was tested with DCMS funding, focusing on cyber-security technologies, though this cohort was out of the scope of this evaluation.

4.2.2 Market Validation

The market validation exercise required the ECR to contact potential customers to validate or develop the value proposition defined during the Bootcamp phase of the programme. The evaluation provides evidence to suggest that this aspect of the programme increased and sustained the engagement with potential customers, with participants making 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 beyond participation in the programme and the econometric analysis suggests that participating teams had made around 83 more contacts with customers, suppliers, investors or competitors than they would have done had they not participated in ICURe (by January 2017). This result should be treated with some caution as the survey only collected responses from ECRs and PIs. Stakeholder evidence indicated that TTOs may have completed market validation activity without the involvement of academic staff for projects after their unsuccessful application to ICURe.³²

Figure 4.4: Average contacts made with customers, suppliers, investors and competitors



Source: Ipsos MORI Applicant Survey, January 2017. Base: 101 participants and 38 non-participants (only routed to ECRs and PIs).

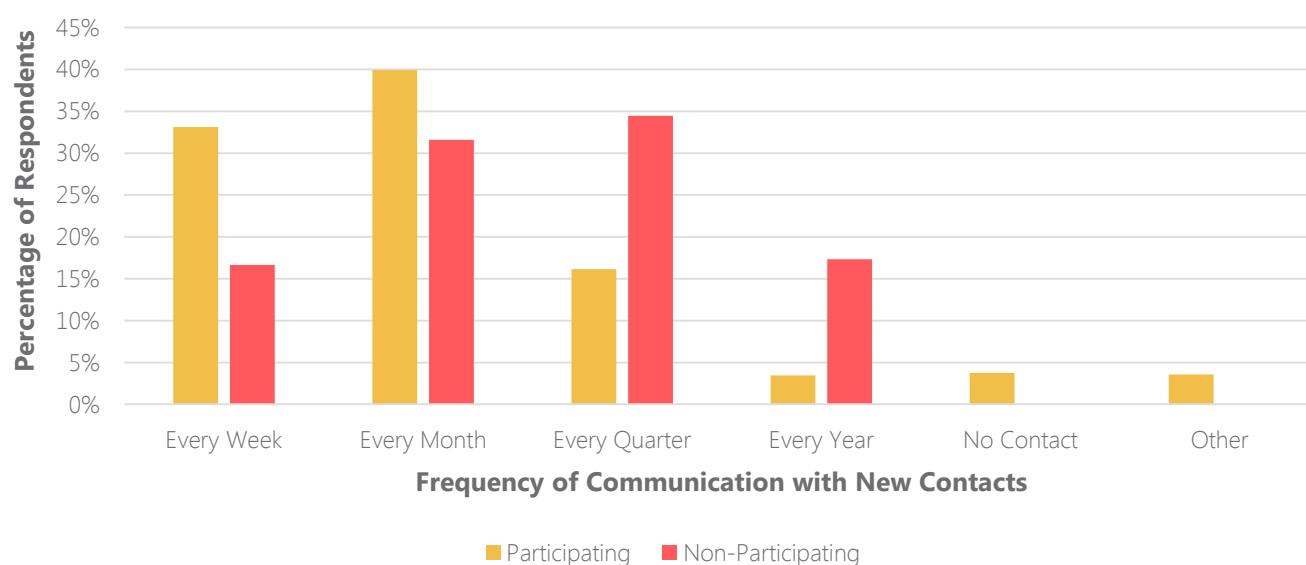
Evidence from stakeholders suggested that the exercise forced teams to challenge their own assumptions about the potential applications of their technology, its value to customers and understanding of the characteristics of markets into which the product or service might be introduced. An improved knowledge of the associated barriers to entry, existing market players and regulatory frameworks was instrumental for teams in resolving business model issues and refining their approaches to market. Qualitative evidence also suggested that the market validation process revealed the actual demand for technology applications and was a useful validation mechanism and tool for understanding the problems of businesses. Evidence from the case studies indicated that this process may have been made more efficient because of the requirement to provide regular reporting updates to programme staff. Regular meetings were reported to encourage teams to reflect and analyse their findings within a strict timeframe and create a sense of urgency when completing the exercise.

ECRs also reported that the process revealed additional traits, specifications or parameters of technology applications that would make potential products or services more valuable to customers. In one case, it was determined that the technology under investigation would provide a useful monitoring capability to firms, but would be of higher value if the system was small (in size) and had low power requirements. This knowledge guided parallel research and development to test the feasibility of introducing these traits and enabled the team to incorporate this into their value proposition. These results were contingent on the ability of the team to make use of additional resources, such as the time of the PI and additional PhD students. However, none of the case studies showed that limited access to this type of resource prevented this activity.

³² This point is useful for any future evaluation of the programme.

The strength of relationships with new contacts, as approximated by the intensity of regular contact, was also higher for participating teams. As illustrated in the figure below, amongst applicants reported to have engaged with new potential customers, suppliers, investors or competitors, 33 percent of participants reported they continued to be in weekly contact with these contacts, in comparison with 17 percent of applicants who did not.³³ Qualitative evidence suggested that sustained relationships developed by participants produced later benefits. Teams that had secured new sales, licensing agreements or private research contracts reported that these were often realised through the contacts made through the market validation exercise.

Figure 4.5: Frequency of communication with new contacts after ICURe application



Source: Ipsos MORI Applicant Survey, January 2017. Samples size: 62 participants and nine non-participants.

In addition, the case study evidence indicated that some contacts made remained dormant until further R&D and validation activity was completed, leading to a pipeline of demand being achieved in some cases where technology was at too early a stage of development. For example, some cases showed that potential customers offered 'soft' commitments to teams to work with them in the future on jointly developing their technology application, under the proviso that the team meet a set of criteria (which often related to the generation of further validating and evaluative evidence on their technology).

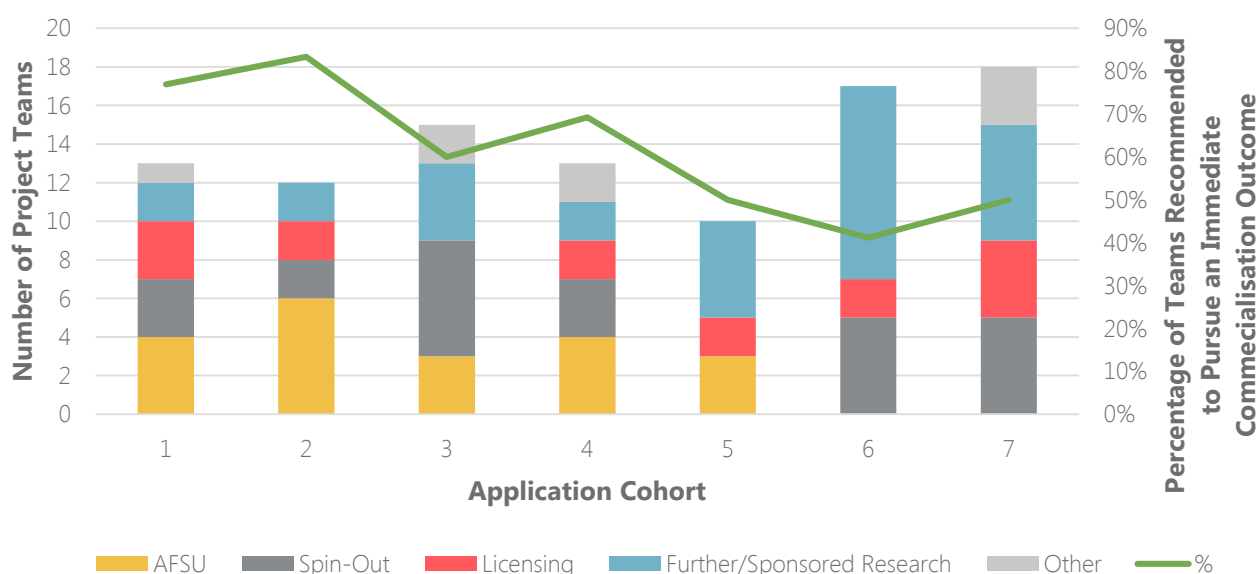
4.2.3 Options Roundabout

Following the market validation exercise, teams completed a final analysis of evidence generated at a preparation event prior to the Options Roundabout that provided guidance on its requirements and format and enabled teams to come together and develop their proposals (again, reported to be an unlikely occurrence in the absence of ICURe given the busy schedules of team members). Teams then presented their 'story' and proposed their commercial exploitation plan which was scored by the Options Roundabout Panel, giving a basic measure of the quality and completeness of the content teams were seeking to communicate. Monitoring information shows that the average score was 57 percent, and that there was little variation across rounds or technology areas.

³³ Although these differences are statistically significant, these comparisons should be taken with caution given the low samples sizes for non-participants (only respondents that had made new contacts where asked this follow-up question).

In terms of the recommendations made by the Options Roundabout Panel, the following figure shows that the panel was increasingly less likely to recommend a commercialisation outcome as the programme progressed (and the general trend continued into cohort 7 of the programme, which is out of the scope of this evaluation). There are several possible explanations for this. It could indicate that the supply of university research projects that are at an appropriate stage of development to consider pursuing a commercial outcome has decreased during the period. Alternatively, that the reduced availability of start-up aid may have reduced the commitment of teams to find a commercially viable model for their innovation. Finally, it may reflect a decrease in the appropriateness of applicants as new academic institutions joined the programme (which as newcomers, may not have been fully acclimatised to the aims and objectives of the programme).

Figure 4.6: Recommendations of the Options Roundabout panel by cohort³⁴



Source: Monitoring Information supplied by SETsquared, October 2016.

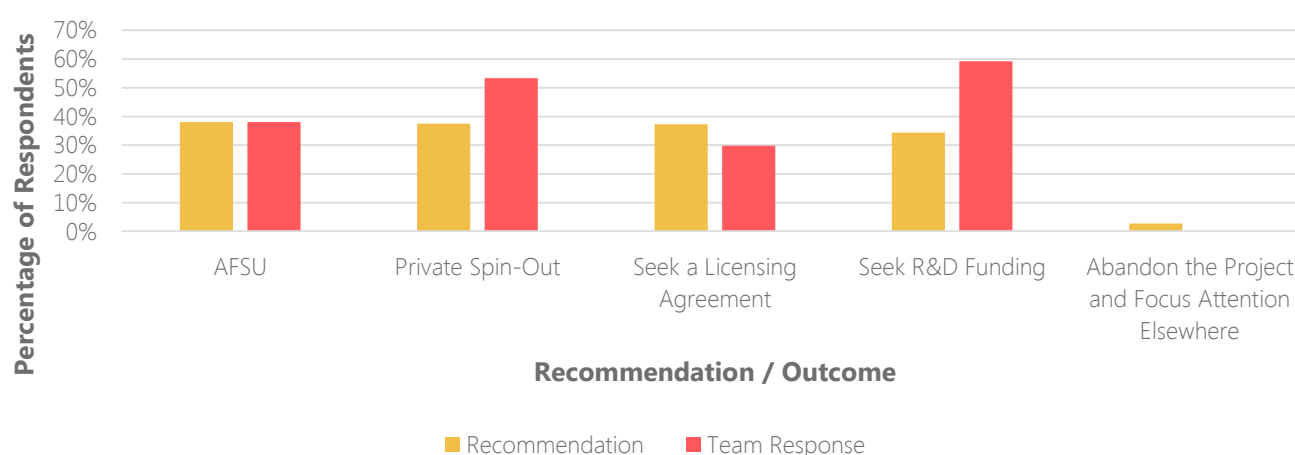
Qualitative evidence suggested that several factors influenced both the determination of recommendations provided to teams and their subsequent responses:

- Aid for Start Ups:** Teams generally approached the Options Roundabout with the assumption that they wanted to start a business, despite the design principle that no outcome realised by teams is invalid or incorrect (and this was especially true when Aid for Start Ups funding was available). The evidence suggested the presence of Aid for Start Ups funding created a distortionary effect whereby projects developed their presentations around spinning out using this public support with seed capital of £0.5m. Panellists were reported to be more critical where teams were thought to have been behaving strategically (i.e. that they were viewed to not be pursuing an optimal commercialisation path). Stakeholders indicated that the presence of this funding created a sense that any recommendation received by teams other than to apply for Aid for Start Ups was deemed a 'failure' by participants. More broadly, there were signals that it is difficult to shift the perception amongst academics that commercialisation always implies a spin-out (despite this being explicitly addressed by the design of ICUR).

³⁴ Cohort 7 has been added to this figure for reference only. This cohort was not included as part of the evaluation.

- **Proposal quality:** Stakeholders reported that the quality of proposals at this stage was varied and suggested that teams did not always deliver a presentation that was focused on the value proposition of their technology or that they provided superfluous information relating to the technical properties of the technology. Where a proposal was perceived to be of low quality or completeness, it resulted in strong criticism from panellists and a recommendation that was not supported by the team, demotivating those involved (though it should be noted that no participants reported that they abandoned their project post-recommendation). Proposals with a clear exploitation plan that presented results coherently, making use of qualitative research such as customer quotes, were received well by panellists. Case study research also indicated that when the quality of proposals was high, panel recommendations often aligned with what the team sought to achieve.
- **Panellist relevance:** Mixed views were held on the relevance of individuals selected to be panellists. While the programme selected panellists on their ability to judge the commercial merits of propositions rather than the underpinning technical traits, evidence from the case studies highlighted the frustrations of teams that did not receive a 'favourable' recommendation. These teams questioned the extent to which panellists were qualified to provide valid feedback on the commercial development of their projects (and often ignored the recommendation made). Evidence suggests that when a panellist's expertise and experience were particularly complementary, they sometimes took on an advisory role, supporting commercial development beyond the Options Roundabout.

Figure 4.7: Comparison of Options Roundabout recommendation and team response



Source: Ipsos MORI Applicant Survey, January 2017. Base: 155 participants and 55 non-participants.

An overview of the Options Roundabout recommendations and the subsequent decisions made by teams are illustrated above (based on the survey evidence). All 38 percent of teams participating in ICUR that were recommended to apply for Aid for Start Ups by the Options Roundabout reported that they did so. A further 52 percent sought to spin-out privately (though only 38 percent were recommended to do so, further reinforcing the idea that teams were committed to starting a business rather than other commercial outcomes).³⁵ Sixty percent of participants reported that they sought further private or public funding for research and development (again, higher than the 33 percent that were recommended to do so). No participating teams abandoned their project following the Options Roundabout (even when recommended to do so).

³⁵ It should be noted that Aid for Start Ups was an issued recommendation for teams that demonstrated a potentially scalable business proposition that was in need of public funding to progress it effectively. A private spin-out recommendation was made to teams with propositions of equal potential that were thought not to need public funding to develop by the panel.

4.2.4 Team Support

In general, supporting team members provided an appropriate level of support to participating ECRs. Survey evidence suggests that ECRs viewed the support received from Principal Investigators, Technology Transfer Officers and Business Advisors equally favourably (giving average scores of 7.6 to 7.7 out of 10 for the quality of support received from each). Qualitative evidence indicates that support from the BA and TTO was generally helpful but varied in type and quality:

- **Role of the Business Advisor:** Evidence from the case studies indicated business advisors were often a valuable resource for participating ECRs. They were reported to be helpful in the initial development of a BMC and action plan, especially in developing a menu of questions to collect evidence on the commercial value potential customers placed on technology applications. During the exercise, business advisors provided contacts and guidance on the implications of new evidence for the value proposition. This created a positive feedback loop as continual analytical support introduced new potential contacts. Stakeholder evidence indicated that business advisors were highly effective when they were ex-entrepreneurs with a relevant academic background (as predicted by previous studies on the qualities of effective business mentors³⁶); case study evidence also suggested that previous mentoring and managerial experience made advisors more effective, as they could offer advice and guidance at appropriate times and provide higher quality personal and interpersonal support.

Mixed views were held on whether business advisors should be incentivised to take part in the programme. On the one hand, it was suggested that business advisors should offer their services out of good will to ensure that commercialisation strategies were adopted to suit the best interests of the team and technology, rather than their short-term interests. However, high quality business advisors were also thought to only be available if they were paid or offered remuneration in the form of an expected directorship in the event of a spin-out. Evidence also suggested that while stakeholders reported that business advisors mostly acted in goodwill and did not skew the outcomes of the programme negatively for teams, case study findings indicated that business advisors did sometimes support teams with their own interests in mind (and ECRs thought that it was fair for them to do so because they were providing advisory services in-kind). One view collected during the case study research was that it would be helpful if advisors would make the conditions of their support clear at the point of application.

- **Role of the TTO:** Qualitative evidence indicated that the TTO supported the realisation of outcomes for teams to some extent. This support took the form of provided contacts from university networks and provide strategic advice for teams over the course of the exercise. Evidence from the case studies suggested that relocating the ECR to work closer to the TTO increased their focus on the programme and facilitated more efficient logistic and administrative support. However, the case studies also suggested that regular ECR conversations with their PI were also valuable; especially where PIs had a high number of industry contacts prior to ICUR.

4.3 Summary

- **Participant characteristics:** The main technical fields associated with applications received were computer science, chemistry, physics, mathematics and biological sciences. All applicant ECRs and PIs had minimal commercialisation experience prior to ICUR, though TTO and BA team members had much higher levels of experience. A high proportion of applications came from SETsquared HEIs (especially Southampton and Surrey).

³⁶ Nesta (2009). A review of mentoring literature and best practice. Creative Business Mentor Pilot. SQW Consulting; BIS (2012). Estimating the provision of Business Mentoring. GHK Consulting.

- **Bootcamp:** The Bootcamp was widely attended and mostly regarded to be an effective preparation for the market validation exercise (with over 90 percent of attendees reporting it to be very or fairly effective). Qualitative evidence indicated that the development of confidence and commercial awareness among ECRs and PIs through interactive exercises were instrumental in preparing teams for the market validation process, as well as the creating time to plan with all team members present. Some issues raised challenged the usefulness of the Bootcamp for ECRs that were recent R2I alumni or where projects were more commercially developed.
- **Market Validation:** A key success of the market validation exercise was the relative increase in the number of sustained contacts made by participants. Econometric modelling suggests that participating teams made around 83 more contacts with customers, suppliers, investors or competitors than they would have done had they not participated in ICURe.
- **Options Roundabout:** The process created a clear deadline for participants to develop a first draft commercial exploitation plan. The presence of Aid for Start Ups was reported to have distortionary effect whereby participants developed their plans on the premise that they would spin-out with public support. Over time, the proportion of teams recommended to pursue a commercialisation outcome at the Options Roundabout decreased over time and a number of factors were identified that contributed to this result.
- **Team Support:** Overall, ECRs were content with the support they received from their TTO and business advisor counterparts. Mixed views were offered on what the appropriate incentives for business advisors should be, with some suggesting that they need to be appropriately commercially incentivised to support teams. TTOs were key in supporting ECRs in a strategic and administrative function but academic policy on IP ownership was challenged and sometimes acted as a constraint.

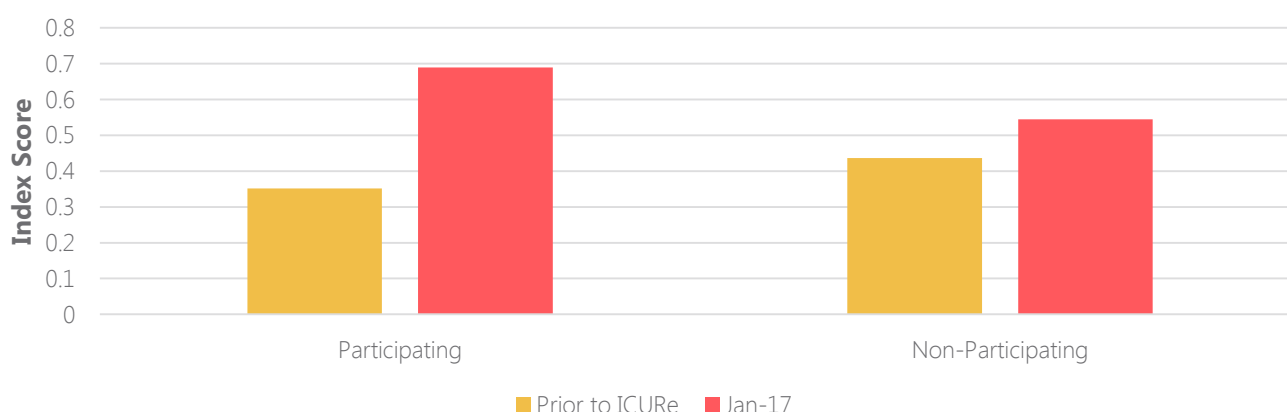
5 Project Level Outcomes

This section assesses the progress made by participants in developing and implementing a commercial exploitation plan and the realisation of commercial outcomes achieved by project teams to date. Again, analysis was completed using evidence from the survey of applicants, an assessment of monitoring information and analysis of qualitative evidence.

5.1 Business Model Development

As illustrated in the figure below, teams participating in ICURe made more rapid progress in resolving business model development issues than those that did not (as measured by the business model readiness index described above in section 4.1.2).³⁷ However, the survey suggested that by January 2017, participating teams often faced several remaining challenges in determining the optimal configuration for their business model (including identifying the key resources needed to implement the business model, establishing relationships with key delivery partners or suppliers, and clarification of the revenues they might anticipate). Econometric modelling suggests that participating teams progressed between 16 and 21 points further on this index than they would have done anyway. Teams that had progressed further prior to application progressed less rapidly than those teams that had made less progress before application.³⁸

Figure 5.1: Business model readiness index – Prior to ICURe and January 2017



Source: Ipsos MORI analysis; Applicant Survey, January 2017. Base: 159 participants and 55 non-participants.

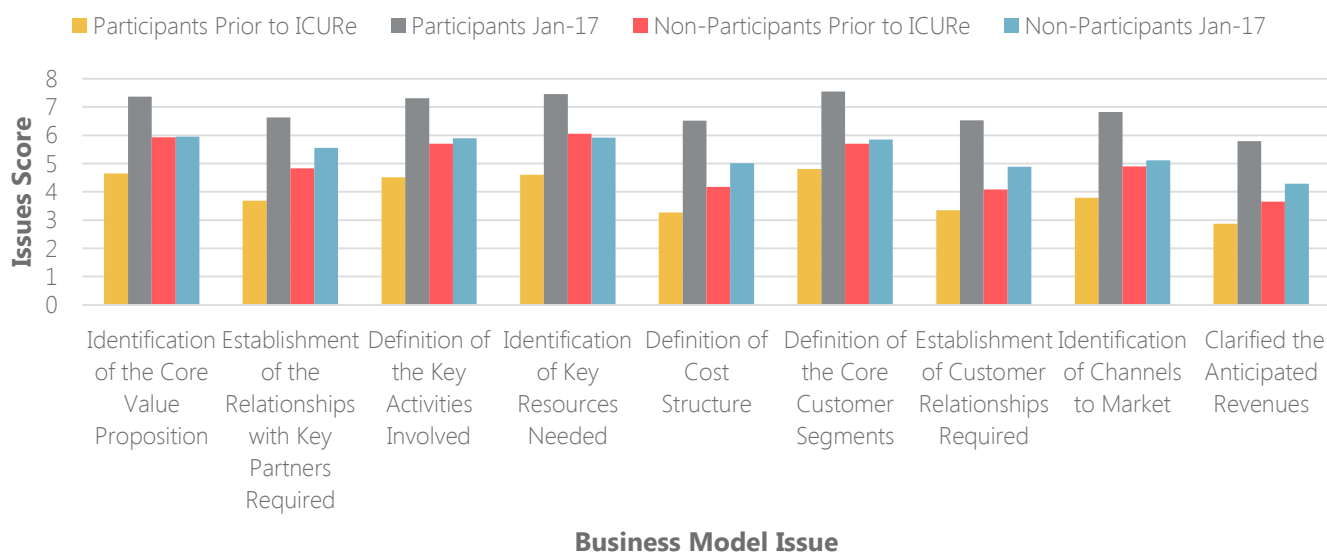
Decomposing the index, as depicted in the figure below, indicates that participants progressed most rapidly in establishing a cost structure, establishing customer relationships and identification of channels to market. Participants progressed more rapidly than non-participants in all areas. Qualitative evidence gathered through the case studies suggested the contacts made through the market validation exercise were critical in enabling participants to resolve issues relating to the development of their business model. For example, ECRs reported collecting useful evidence on the distribution of business problems that their technology could solve and in many cases, uncovering new ideas that they had not previously thought of. Business problems were also uncovered indirectly through contacts with trade associations and professional membership

³⁷ Please refer to footnote 21 that presents a caveat for this analysis relating to the interpretation of the survey question by non-participants.

³⁸ This is likely a result of the increasing difficulty and therefore time needed to resolve business models issues the further a project progresses which, due to the lack of a time control, we are unable to account for. In addition, the extent to which non-participants are well-equipped to respond to the survey questions should be questioned. The terminology and phrases used for these questions would have been well known to participants who had access to course materials. However, non-participants could have misinterpreted the meaning of questions as a result of their own bounded rationality.

organisations which were suggested to be a useful source of evidence for the technical, compliancy and regulatory issues faced by their respective industries. On occasion, teams realised that a commercial opportunity they thought was valid was not borne out in practice. The reasons for this included understanding that existing suppliers were offering better solutions or that potential customers faced high switching costs. The ability to achieve these types of result was reported to be directly related to the quality of interviews completed by the ECR. If the evidence collected by ECRs insufficiently explored the value firms placed on a technology, then little progress in resolving business model issues was reported.

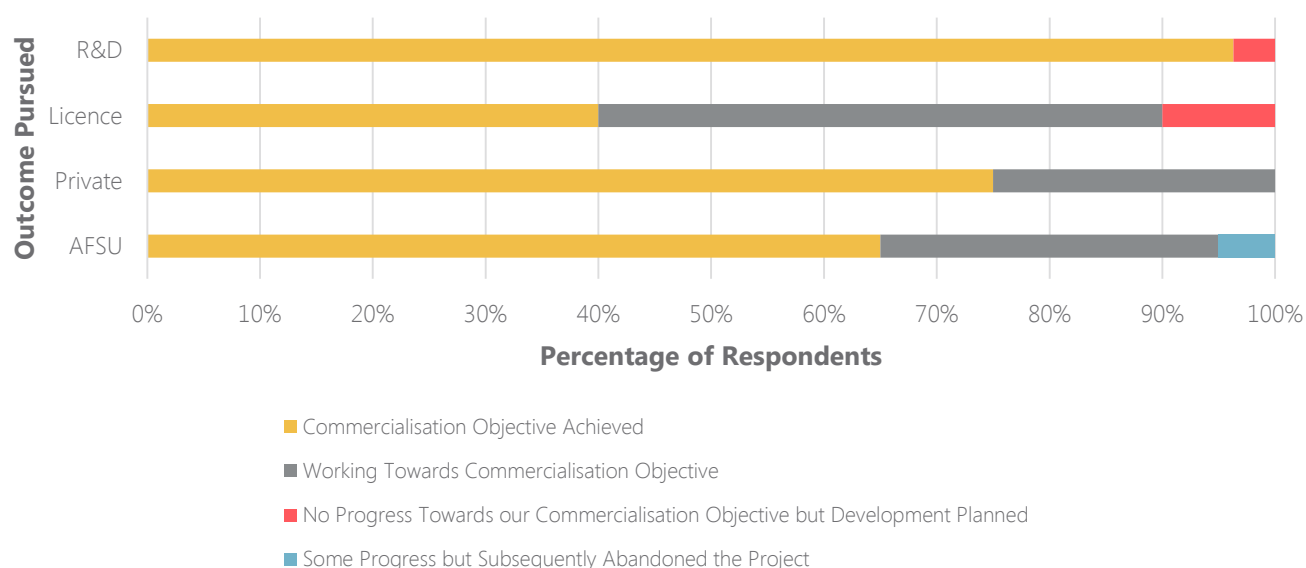
Figure 5.2: Average business model issues index score by category



Source: Ipsos MORI analysis, Applicant Survey January 2017. Base: 159 participants and 55 non-participants.

5.2 Achievement of Commercialisation Objectives

The figure below shows the proportion of respondents that reported that they had achieved their commercialisation objectives by outcome pursued. A higher proportion of those pursuing spin-out outcomes reported that they had achieved their objectives than those pursuing licensing deals.

Figure 5.3: Participant progression made against objectives set at the Options Roundabout by teams

Source: Ipsos MORI Analysis; Applicant Survey, January 2017. Sample size: 73 participants.

5.2.1. Econometric Analysis

The econometric analysis suggested that ICURe had a significant impact on the likelihood of teams pursuing and achieving a commercialisation outcome (a detailed description of these results is provided in Annex A):

- Acceleration of commercialisation outcomes:** The results suggested that participation in ICURe increased the likelihood that teams pursued a commercialisation outcome (i.e. a spin-out or a licensing deal) from 15 to 79 percent, and **the likelihood a commercialisation outcome was achieved by January 2017 from 8 percent to 40 percent (a gross additionality rate of 81 percent).**³⁹ Case study evidence indicated that while those that developed a spin-out thought they would have done in the absence of ICURe, the time taken to do so would have been longer, ranging from six months to two years. The ability to complete an intensive validation process in one period was also reported to be catalytic in increasing their understanding of the value proposition of their technology.
- Interactions with R2I:** Participation in ICURe complemented the Researcher to Innovator programme. Where participating teams had ECRs that participated in the R2I programme, the likelihood of commercialisation rose to 54 percent (relative to 39 percent if the ECR had not participated in R2I). The R2I programme itself also appeared to have influenced the likelihood non-participating teams achieving a commercialisation result (40 percent for non-participating teams that took part in R2I relative to 6 percent of non-participants that did not). This indicates that ICURe still has a positive effect when participants have completed complementary programmes, though this effect is smaller than for those without this background (as might be expected). Evidence from the case studies suggested that participation in R2I provided ECRs with experience in contacting prospective customers about a technology and encouraged ECRs to be in regular contact with their TTO representative. These precursory activities gave participants a basic understanding of commercialisation activity which made assimilation during the programme more efficient. It should be noted that the econometric analysis

³⁹ I.e. $(40 - 8) / 40$

completed was unable to account for other schemes that may have in part contributed to the outcomes realised, such as the New Enterprise Competition, delivered by Bristol University.

- **Importance of the characteristics of the Business Advisor:** There were insufficient observations to establish the relative importance of different characteristics of the business advisor with a high degree of confidence. However, there were signals that, as expected, levels of experience could be significant, with models suggesting that each additional year of commercialisation experience increased the likelihood of a commercialisation outcome by 1.7 percent. The likelihood of a commercialisation outcome also increased where the BA and the team shared a technical background. These findings were significant at the 90 percent level but not at the 95 percent level. These points broadly confirm the results of other studies examining the critical characteristics of business mentors.⁴⁰ However, there appeared to be no link either between the perceived quality of the support provided by the business advisor or their involvement in the underpinning research and the likelihood of a commercialisation outcome.
- **Influence of the TTO:** There were no signals that the level of experience or the perceived quality of support provided by the TTO had an influence over the likelihood of a commercialisation outcome.
- **Other complementary programmes:** As noted in the introduction to this report, participants in ICURe may have benefitted from other complementary commercialisation support (beyond the Researcher 2 Innovator programme) which is not accounted for in the results above. As such, the impacts may not be fully attributable to the programme.

5.2.2 Synthetic Control Group Results

A parallel analysis examining spin-out and licensing outcomes at an institutional level was completed using the HEBIS data between 2008/09 and 2015/16. This analysis focused on each of the five SETsquared institutions that had participated in the ICURe programme for the longest duration of time (giving two years of post-ICURe data against which to assess the impacts of the programme on commercialisation activity). The analysis drew on synthetic control methods, a set of econometric methods developed to provide an estimate of the causal effects of programmes where one or a small number of units benefit from the programme. These approaches involve weighting the available control units (i.e. those academic institutions that did not benefit from ICURe) so they as closely resemble the SETsquared institutions in terms of their commercialisation activity prior to the programme and other variables that might be thought to influence those results (creating a synthetic 'control' institution against which comparisons can be made).

The findings of the analysis were broadly supportive of the results described above:

- **Spin-outs:** Four of the five SETsquared institutions outperformed their synthetic counterpart in terms of the number of spin-outs established from 2014/15 onwards.
- **Licensing:** Only two of the five SETsquared outperformed their synthetic counterpart in terms of the number of active licensing agreements.

The findings above should be treated with some caution. Substantial underlying volatility in the data, concerns regarding the completeness and quality of some of the underlying data, and the low frequency nature of the outcomes involved (e.g. some SETsquared institutions reported no spin-outs for several years prior to ICURe), has meant that the application of

⁴⁰ As defined in Nesta (2009). A review of mentoring literature and best practice. Creative Business Mentor Pilot. SQW Consulting; BIS (2012). Estimating the provision of Business Mentoring. GHK Consulting.

synthetic control method did not always produce a 'synthetic control' that closely matched the SETsquared institutions in terms of their pre-treatment characteristics.

5.2.3 Distribution of Outcomes Achieved

The survey also highlighted some patterns in the distribution of outcomes achieved:

- **Differences across technical fields:** The distribution of commercial outcomes by technical field matches the distribution of participating projects, indicating that technical field may not influence teams in their decision to pursue or ability to achieve a commercial outcome. This suggests the effectiveness of ICURe is not linked to the nature of the underlying technology.
- **Role of Aid for Start Ups:** It is not possible to assess the importance of Aid for Start Ups (owing to the small number of teams that ultimately received this support), though all successful Aid for Start Ups applicants reported they had developed a spin-out. Case study evidence indicated that the funding provided teams with a level of security, enabling them to devote their time to the commercial development of their project. Teams that were unsuccessful in receiving Aid for Start Ups reported more frequently that they were working towards their commercialisation objectives but had not achieved them yet. The case studies suggest that some teams may have struggled to spin-out because they did not have sufficient levels of funding to allocate resources needed to progress (though this was not true in all instances). In some cases, ECRs were required to abandon their project not out of choice but due to the need to pursue new employment opportunities as their contract with their academic institution expired.
- **Licensing deals:** Case study and survey evidence also pointed to specific issues with respect to teams recommended to pursue a licensing deal but not to spin-out. Amongst teams that created a spin-out, 92 percent of those seeking a licensing deal, secured an agreement. No team that did not spin-out reported they signed a licensing agreement. Where teams approached the Options Roundabout with a view to starting a company and were recommended to secure a licensing agreement, this resulted in a loss of momentum and delayed project progress (as the recommendation was interpreted as a view that their technology was not suitable for commercialisation). Additionally, stakeholder and case study evidence suggested one issue with a licensing recommendation is that insufficient guidance was provided to help teams to seek one out. Securing a licensing agreement was reported to be dependent on the types of contacts engaged during the exercise, who in some instances were not willing to licence the technology without the completion of further R&D.

5.3 Spin-outs

Teams participating in ICURe were substantially more likely than non-participants to pursue a spin-out outcome following their application or participation in the programme. Just under 66 percent of participating teams had the aspiration of spinning out following the Options Roundabout (including several teams that were not recommended to spin-out by the panel). Two-thirds of participants reported that they had developed a business plan for a potential spin-out (compared to 29 percent of those teams that were declined), while just over 40 percent of participating teams had gone on to incorporate a new spin-out (relative to 15 percent of those that did not participate). **Based on this evidence, it is estimated that teams**

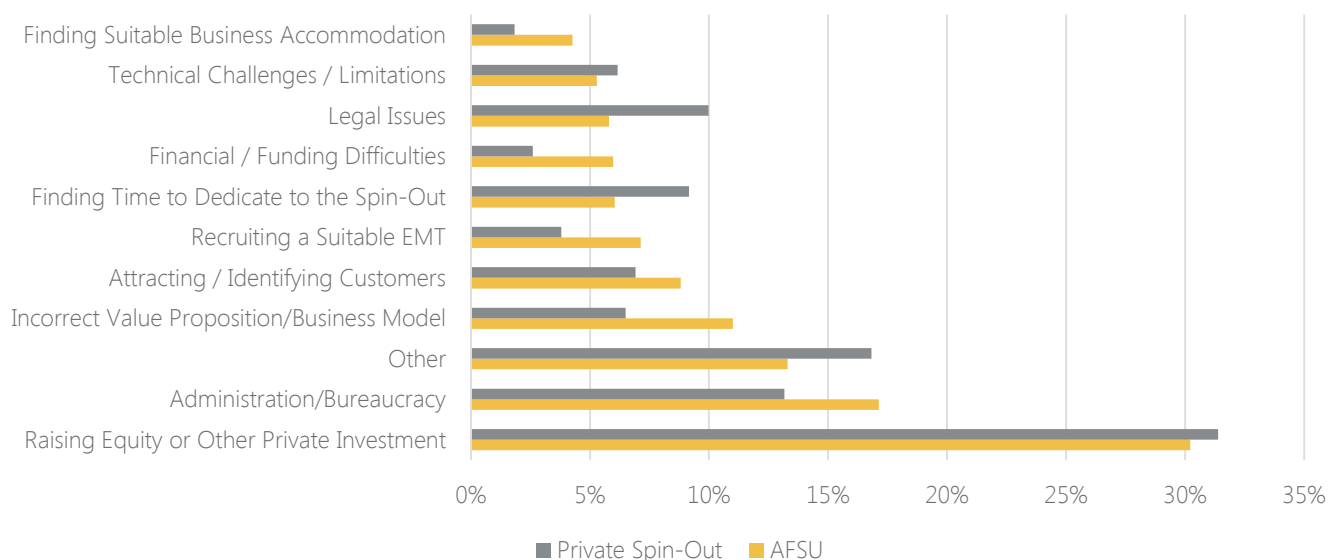
participating in ICURe created 30 new spin-out companies⁴¹ by January 2017 (of which it is estimated that 24 would not have been created in the absence of the programme using the estimates of gross additionality set out above).⁴²

- **Commitment to establishing the start-up:** Survey evidence suggests participating ECRs establishing a spin-out committed a higher proportion of their available time (81 percent) to the variety of activities involved in establishing the spin-out relative to non-participants (36 percent). Higher levels of effort were reported across numerous commercialisation activities, including further business model development, and engagement with potential investors, suppliers, and customers. ECRs and PIs receiving Aid for Start Ups allocated more time to the spin-out (89 percent of their available time) than those taking forward a spin-out without funding (74 percent). Evidence from the case studies suggested that ECRs that were involved in a spin-out previously lacked the confidence or belief in the commercial merits of their research to warrant allocating enough time to commercial development. Participation in ICURe was reported to promote confidence and convince ECRs that commercialisation was a viable pathway and that they could effectively engage with the ideas with respect to their academic research as identified in a previous evaluation⁴³ of ICURe and in section 6.
- **Challenges encountered:** The central challenge encountered by participants spinning-out was difficulties in raising equity or private investment (reported by 30 percent of survey respondents). Evidence from the case studies provides several examples of teams suggesting that the resources required to seek investment and prepare for pitches was incompatible with academic work commitments after the completion of the programme. Resource constraints were particularly acute for teams that had been recommended to spin-out privately. However, stakeholders reported that securing finance for high quality ideas is a minor issue in comparison with the issue of a general lack of commercialisation experience among academic staff. The challenges reported by Aid for Start Ups recipients were similar to those faced by participants pursuing a private spin-out, as illustrated below. However, a higher proportion of Aid for Start Ups recipients reported they faced issues relating to administration and bureaucracy and correctly specifying their value proposition or mode of business than those pursuing a private spin-out. This latter group experienced greater relative difficulty in finding the time to spin-out and in dealing with the legalities of spinning out.

⁴¹ This estimate compares to 28 captured in the monitoring information (and has been rounded).

⁴² I.e. $30 \times 0.81 = 24.3$

⁴³ Newbury (2016).

Figure 5.4: Comparison of spin-out challenges faced by teams receiving AFSU and those that did not

Source: Ipsos MORI analysis; Applicant Survey January 2017. Sample size: 105 participants and 12 non-participants.

- Equity investment:** Among teams establishing a spin-out, 40 percent of participant respondents reported they had received private investment (though the differences between the two groups were not significant). A larger proportion of Aid for Start Ups recipients reported they had secured private equity investment (74 versus 31 percent of those spinning-out privately). On average, participating teams that secured equity investment reported an average of £685,900 in private funding. **It is estimated that teams participating in ICURe raised a total of £8.6m in private investment in spin-out companies emerging from the programme (of which £6.9m would not have been raised without the programme).**⁴⁴ Case studies also suggested projects receiving Aid for Start Ups were led by teams with a high level of commercialisation experience or had a highly developed technology that had received interest from investors prior to ICURe (implying that there is a degree of selectivity influencing the results, i.e. those receiving Aid for Start Ups may have been those with the most commercially viable proposals that needed public finance to support a rapid degree of scale-up activity).
- Employment and turnover:** Survey evidence indicates that spin-outs established by teams participating in ICURe grew more rapidly than those established by non-participants. On average, spin-outs established by participating teams employed three workers (FTEs) and had an average turnover of £86,000 during 2015/16 (from sales and licensing income). The average age of a spin-out was just over 1.6 years for cohorts 1-3 and 0.6 years for cohorts 4-6. Spin-outs taken forward with Aid for Start Ups funding grew more rapidly, reporting an average of six FTEs employed and average turnover of £145,000.⁴⁵ Average employment was one FTE worker in spin-outs established by teams that had not participated in ICURe, and none reported that they were at the point at which they were generating revenues. Case study evidence suggested that Aid for Start Ups funding enabled the immediate hire of key staff needed to support business growth. Teams that received the funding indicated that rapid recruitment of an executive management team to direct the spin-out was a high priority.

⁴⁴ I.e. $78 * 0.40$ (% of teams spinning out) * 0.40 (% of spin-outs securing equity finance) * £686,000 (average value of investment reported)

⁴⁵ A previous university spin-out profiling study (see footnote five) indicated that the average age of a UK spin-out was 9.6 years and employed an average of 10 FTE employees.

- **Valuation of spin-outs:** The equity stake taken by external investors and the value of investment secured, as reported by survey respondents, was used to generate an estimate of the valuation of the spin-outs created by teams participating in ICUR. Private funding was raised in exchange for an average equity share of 20 percent, giving those spin-outs receiving investment an estimated market valuation of £43m (and creating assets valued at £7.0m for participating universities, which retained an average equity share of 16 percent), of which £35m would not have been realised without ICUR.⁴⁶

5.4 Licensing

- **Licensing agreements:** Survey evidence indicates that eighteen percent of participants had secured a licensing agreement by February 2017 (implying 14 licensing agreements had been signed by teams participating in ICUR)⁴⁷, with a further 41 percent in discussions with third parties about licensing the IP associated with their project. These agreements were highly concentrated amongst those teams that had spun out (and in general, the survey found little in the way of positive commercial outcomes outside of those choosing to spin-out). No non-participating applicants reported they had secured a licensing agreement, although 38 percent indicated they were in discussions. The case study research did not offer strong explanatory evidence for this pattern.
- **Value of licensing agreements:** The annual value of licensing agreements reported by participating survey respondents was £145,000 on average with a duration of an average of seven years. Assuming a private discount rate of 10 percent per annum, this would give a **total present value of future licensing income associated with licensing agreements of £10.8m (£8.7m of which would not have been realised in the absence of the programme).**

5.5 Technology Development

- **Private research contracts:** Participating survey respondents were more likely than non-participants to have obtained private research contracts than non-participants (33 versus 12 percent). The average value of grants secured by participants was £90,000 and average duration of these contracts was 1-2 years. Evidence from the case studies provided examples of teams that were able to convert contacts made during the validation exercise into contract research clients, to enable these firms to work on tailoring the technology to their needs. For example, one project secured a private research contract to understand whether it was feasible to include their technology as part of the company's portfolio of product materials. In cases where private research contracts had been secured, participants indicated that they saw the contract as an opportunity to develop a long-term relationship with a customer rather than a collaborative research relationship.
- **Public research grants:** Just over 60 percent of both participant and non-participant survey respondents had been successful in securing additional public or charitable grants to complete further R&D in relation to their project. The average grant value for amongst participants was £360,000. Case studies also provided examples of participating teams leveraging contacts generated during the programme to form consortia around public funding opportunities. For example, in one case, a project team submitted a grant funding application to Innovate UK as part of a consortium led by a large prime in the sector. This opportunity developed through preliminary discussions completed as part of the market validation exercise. Case study evidence also identified that participants felt more confident in completing funded R&D with requirements to complete a commercial exploitation strategy or provide some analysis of the potential market.

⁴⁶ The average implied valuation of spin-outs was £3.46m. The total is given by $78 * 0.4$ (% of teams spinning out) $* 0.4$ (% of spin-outs securing equity finance) $* £3.46m * 0.81$ (% of spin-outs that would not have occurred otherwise) = £35m.

⁴⁷ Higher than the monitoring data suggests which indicated that only five deals had been secured, as of Nov 2016.

In one case, a participant indicated they completed an existing funded R&D work package independently that required them to complete a commercial exploitation strategy, without the need to hire an external consultant.

- **Technological progress:** The econometric analysis suggests that participation doubled the rapidity of technological progress. Case study evidence provided some examples of how this was achieved. Participants were in some cases able to inform additional translational R&D that aimed to understand the feasibility of customer queries, and as such, support an increased understanding of technology applications in an operational setting. One project made use of customer interview evidence to test alternative combinations of parameters for a conductive technology where it was thought an application in flat panel displays was viable. In another case, interviews with potential suppliers enabled additional research to be completed that looked to understand whether certain combinations of materials could be used to cost-effectively build a technology application to a specific customer specification. This evidence enabled the time to complete additional testing that resulted in the registration of a patent.

5.6 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.

5.6.1 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 to 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 than 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 suboptimal if the spin-outs acquire a degree of monopoly power over the innovation at the heart of the project (e.g. because of IPRs).
- Other economic 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 innovation⁴⁸ that involve diminishing returns to the use of existing ideas.

Under these assumptions, the economic benefits attributable to ICURe is £35m (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-

⁴⁸ See for example Quality Ladders, Competition, and Endogenous Growth, Boldrin and Levine, 2009.

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 effects 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).

5.6.2 Costs

The figures available give an **approximation of the costs associated with the first 6 rounds of ICURe of £8.9m** covering both the costs of delivering the programme and the start-up aid provided to some teams through Aid for Start Ups. This does not account for possible hidden opportunity costs of the programme (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).

5.6.3 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 £25m (the time distribution of costs is not available, preventing discounting of costs). **The approximate benefit to cost ratio is £3.94 per £1 of public expenditure.**

5.6.4 Limitations

The findings should not be treated as definitive and there are a number of factors that may have led to an over or understatement of the effects of the programme:

- **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 in all complementary programmes that may have contributed to the results observed. If participating teams were more likely to benefit from these complementary 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 6, there may be other economic benefits (such as improved productivity of ECRs) that have not been included in this result.

5.7 Summary

- **Achievement of commercialisation outcomes:** The results suggested that participation in ICURe increased the likelihood that teams pursued a commercialisation outcome (i.e. a spin-out or a licensing deal) from 15 to 79 percent, and the likelihood a commercialisation outcome was achieved by January 2017 from 8 percent to 40 percent (a gross additionality rate of 81 percent).
- **Team Support:** The likelihood of a commercial outcome increased where the business advisor was more experienced and their technical field aligned with that of the technology (aligning with the results of other studies on mentorships). The likelihood of a commercial outcome was not linked to the experience of the TTO team member.
- **Business Model Issues:** Participating teams made more rapid progress in resolving business model development issues than those that did not.
- **Spin-outs:** It is estimated that teams participating in ICURe created 30 new spin-out companies by January 2017 (of which 24 would not have been created in the absence of the programme).
- **Licensing:** 18 percent of participants had secured a licensing agreement by February 2017 (implying 14 licences agreed by participants) with an average value of £145,000 and average duration of seven years. Assuming a private discount rate of 10 percent per annum, this would give a total present value of future licensing income associated with licensing agreements of £10.8m (£8.7m of which would not have been realised in the absence of the programme). These licensing agreements were all secured by those teams spinning out, and there was evidence that a variety of barriers may inhibit the pursuit and achievement of licensing agreements.
- **Technology Development:** The results suggest that participation doubled the rapidity of technological progress. On average, £90,000 was accrued from private research contracts, and £890,000 from public R&D funding.
- **Value for Money:** The approximate benefit to cost ratio of the ICURe programme is estimated to be £3.94 per £1 of public expenditure.

6 Wider Effects

As stated from the outset, the pursuit of commercialisation objectives of participating teams is not the sole objective of the programme. ICURe also looks to increase and sustain the entrepreneurial skills and market knowledge of ECRs that may not have previously considered a career outside the domain of academia. It is also hoped that the programme may make some contribution to facilitating a wider cultural change in academic institutions with respect to the commercialisation of research. This section provides an examination of the evidence related to the presence of these effects and draws on evidence largely collected through the case studies and applicant survey. It also makes use of data collected in a previous evaluation of the ICURe pilot, completed by Robert Newbury.⁴⁹

6.1 Individual Level Effects

The ICURe pilot was intended to produce several benefits for team members. It aimed to increase the commercial awareness, intent and skills of ECRs, produce positive labour market effects in the form of enhanced career prospects and/or productivity. For PIs, the programme was intended to increase the production of academic research with commercial potential and forge more HEI-industry partnerships (though given the short time that has elapsed since the programme began, only nascent effects of this nature were expected at this stage). ICURe also aimed to increase the efficiency of participating institution's TTO function by increasing their visibility of research with commercial potential and increasing their engagement with academic research staff and relevant industry contacts.

6.1.1 Commercial Skills

Respondents were requested to record their agreement with a set of commercialisation skills competency statements using a seven point Likert scale (where 7 denotes the highest possible level of agreement).⁵⁰ These questions built on those employed in a previous evaluation⁵¹ of the ICURe programme and were linked to those measures to give an overall assessment of the effect of the programme on commercial skills.⁵²

- **Overall increase in perceived skills competency:** On average, ECR and PI participants reported a significant increase in their commercialisation skills at the time between the Bootcamp (57 percent on average) and the survey (74 percent). While the evidence suggested that the reported acquisition of skills was sustained beyond team member's participation in the programme, there was some decay in reported skill levels in two areas following the Options Roundabout: the market discovery and development skill (80 to 68 percent) and industry networking skill (86 to 75 percent), as illustrated below. Case study evidence provides examples of ECRs and PIs continuing to apply the commercial skills they accumulated during ICURe. For example, in one case, an ECR indicated that they still used a Business Model Canvas to organise their assessment of new commercial opportunities.
- **PIs report sustained skill perceptions:** Amongst PIs, the only skill area that was reported to decay between the time of the survey and the Options Roundabout was the ability to seek advice and support when appropriate (90 to 78 percent).

⁴⁹ Newbury (2016). ICURe Programme Evaluation.

⁵⁰ For ease of interpretation, reported scores were transformed into percentages. I.e. a score of 4 would be 57 percent ($4/7=0.571$).

⁵¹ Newbury (2016). ICURe Programme Evaluation.

⁵² The mode of data collection of the two data sources is different. As such results from this section should be taken with the caveat that respondents may have answered in a different manner during the survey than they would have done using self-complete questionnaires. In addition, the measure on 'Idea Identification' is dropped from the analysis as this variable was never actually collected in the Newbury study.

This result could suggest that PIs prefer to assimilate new knowledge independently and in a practical setting rather than in a typical 'learning' environment. In one case, a PI found the Bootcamp informative, but reported they developed their skills relatively more through completing the exercise and reflecting upon results rather than the workshops. For example, after seeing the ICURe model in practice, one PI indicated that he had planned to complete a similar internally-funded exercise for another technology.

Figure 6.1: Participant perceptions of their commercialisation skills



Source: Ipsos MORI analysis; Applicant Survey January 2017. Sample size: 53 participants.

6.1.2 Career Prospects

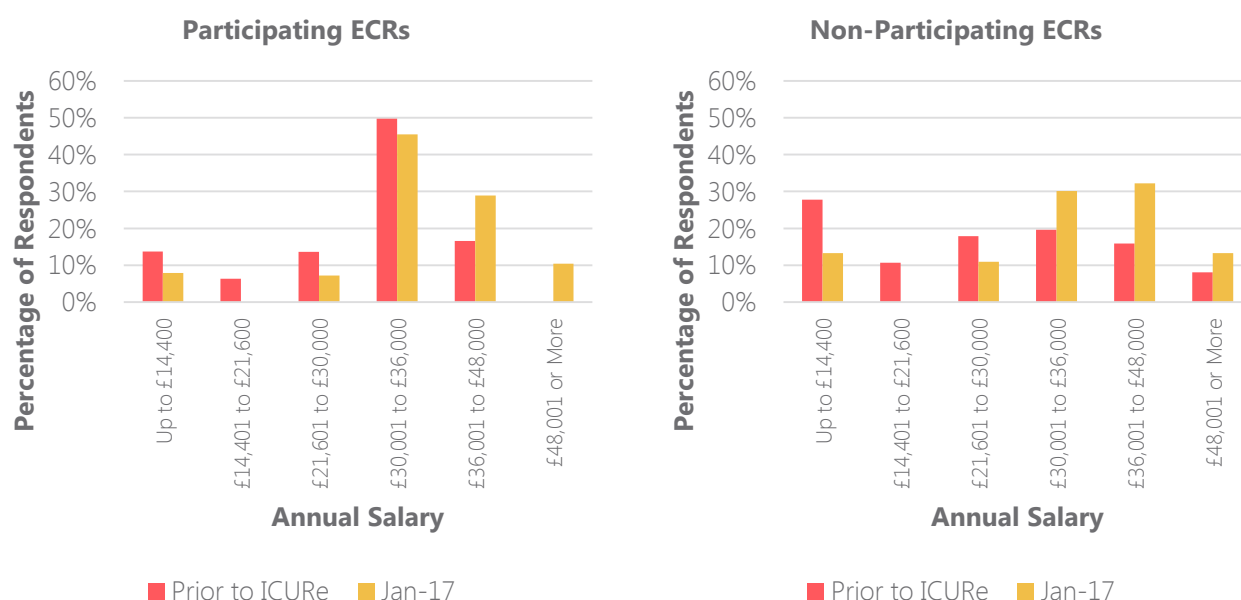
In terms of the career progression of ECRs:

- **Widened career opportunities:** Just under 80 percent of participating and non-participating ECR and PI respondents indicated that they were still employed at their HEI at the time of interview. However, 15 percent of participants indicated that they were now employed in a spin-out, mainly in executive management roles (in comparison to no non-participants). Stakeholders indicated ICURe revealed a new set of possible career options to ECRs as well as giving them commercialisation skills to compete for positions in industry more effectively. Case study evidence is supportive of this view, suggesting that academics were typically unaware of the set of possible commercialisation career opportunities available to them. ECRs securing new roles outside of academia, such as a research or scientific consultant position, often attributed their success, in part, to the skills gained during the programme. These broadened career opportunities have manifested in three key ways:
 - **Non-academic employment:** Five percent of survey respondents reported that they were employed in the private sector. In one case study, an ECR reported that completing ICURe revealed that while a career in technology transfer was not favourable, the programme enabled them to identify a career path they felt 'passionate' about. In addition, the skills gained during ICURe were reported to have been great preparation for their role as a research scientist. For example, completing interviews with customers and suppliers during the exercise greatly

correlate with current professional tasks that include regular meetings with clients and suppliers and analysis of industry context and demand.

- **New academic employment:** Case study evidence indicated that skills gained during ICURe enabled ECRs to pursue a career within an academic institution in a research support function. In one case, an ECR secured a new role based in a university, supporting academic staff, handle, share and analyse research data in an effective and efficient way. A key objective of the role is to enable academics to produce high quality research outputs that are reproducible, and in doing so, increase citations and collaboration opportunities. Experience gained on ICURe, specifically in relation to understanding how businesses value research, was indicated to have helped to secure future employment. The ECR also indicated that they still use a BMC to help researchers manage and share their data, and assess how far they are compliant with the institution's research guidelines.
- **Spin-out management role:** As indicated above, some ECRs entered management roles within the spin-outs established. In one case, both the ECR and PI took a directorship and equity stake in a newly formed spin-out developed after completing ICURe. This ECR reported that they had reduced the amount of academic research they undertook to take on more business development responsibilities. This role was described as a 'steep learning curve' but the ECR reported a keen interest in learning about entrepreneurship due to completing ICURe.
- **Wage Effects:** It is not clear from the evaluation evidence provided whether ECRs were able to fully exploit their new skills in labour markets, evidenced through higher wages. However, the distribution of wages in the figure below indicates to some extent that participating ECRs earned more than non-participating ECRs prior to the programme. The qualitative evidence did not identify any examples of increases wages because of participation in the ICURe programme.

Figure 6.2: ECR wages



Source: Ipsos MORI analysis, Applicant Survey January 2017. Base: 98 participants and 37 non-participants.

6.1.3 Research Agenda

- **New or improved reputation for impact:** Mixed views were held on the effect of being associated with projects that have resulted in spin-outs or other commercial outcomes. On the one hand, this association was reported during case study research to be especially useful for both PIs and ECRs because of the increasing acknowledgement of impact as a crucial component of the academic research process. This was reported to have resulted in better promotion prospects and validated to some extent by the views of PIs during case study research, who suggested that being involved in a commercial project was viewed favourably by promotion boards. On the other hand, it was suggested that senior academics, especially in STEM fields, are less concerned in commercialisation and would prefer the TTO function of an HEI to take ownership of this activity rather than academic staff.
- **Improved specification of research:** PIs with a clear and practical understanding of the market validation process were stated to be more successful in applying for funding opportunities because they were able to more effectively communicate the commercial viability of their research programmes. In one case, a project team submitted an Innovate UK application as part of a consortium. The project developed a relationship with the lead applicant directly through conducting a set of interviews with defence companies during the ICURe programme and much of the content of the application used evidence generated as a result of the ICURe programme.

6.1.4 Other Effects

Case study and stakeholder evidence indicated that a set of other wider effects were also produced by the programme:

- **Decreased TTO resource constraint:** Qualitative evidence indicated that the programme greatly reduced the demand for TTO resources to seek out and support commercial opportunities. This was mainly because the programme produced alumni, who are more proactive in identifying opportunities for consideration. For example, ICURe alumni, who would have usually waited to file for a patent, have instead raised new ideas with their TTO without filing at all, greatly reducing TTO search costs. In one case, a TTO manager reported that having ICURe as an additional support instrument reduced search costs involved in securing appropriate ECRs or PIs to lead on commercialisation projects. The TTO reported that they benefited from detailed exposure to ECRs who do not typically interact with the HEI TTO function.
- **Increased commercialisation effectiveness:** Stakeholder evidence reported that the programme has supported TTOs to become more effective in supporting commercialisation projects. Stakeholders indicated that the programme has revealed a very low commercial awareness among academic staff – this has resulted in some TTOs adapting their approach to accommodate this. In addition, case study evidence indicated that completing the ICURe programme improved the confidence of TTO staff in their ability to support future teams effectively through the programme, for example, through providing advice on how to deliver a pitch to the Options Roundabout. The programme was also suggested to have helped TTO staff apply more rigorous techniques to assess the commercial viability of projects. In one case, a TTO manager cited that they had become much more critical of academics making the case for a commercial opportunity for a technology they have. Through understanding the set of assessment criteria of ICURe during the application and programme delivery stages, the TTO manager function now demands that academics fully consider the prospective commercial aspects of their technology when requesting support from them. However, it was also reported that the TTO had a better understanding of how best to skew presentations to increase the likelihood of receiving a recommendation to apply for Aid for Start Ups.
- **Increased number of more efficient investment opportunity assessments:** Case study evidence indicated that the preparation and assessment of a technology exploitation plan backed up with research evidence could also be used at

investor pitches with only minor adjustments required. Stakeholder evidence substantiated this point indicating that investors will benefit through better formulated pitches from participants that have a stronger commercial emphasis, resulting in a higher proportion of viable investment opportunities for assessment.

6.2 Non-Participant Effects

While non-participating teams obviously did not directly benefit from taking part in the ICUR programme, they benefit from the provision of application feedback and signposting to relevant guidance and support. At the point of application, clarifying anticipated revenue streams, cost structure and establishing customer relationships were the most cited business model issues for non-participating teams. At the time of interview non-participants had improved in all these areas but reported a decrease in their ability to understand the key resources required to develop their project commercially (for example IP or human capital), perhaps through becoming more realistic or self-critical as a result of the experience. In terms of the feedback provided by ICUR, commercially-oriented recommendations to non-participating teams were not common (9 percent) and just under half (46 percent) were requested to resubmit and 12 percent to secure additional R&D funding, providing some suggestion that further development work was needed. Survey results indicated that non-participants did not tend to follow this feedback, suggesting instead a high level of appetite for independent development of their project. As an example, 20 percent of non-participants went on to pursue a commercial outcome and 40 percent sought additional R&D funding.

Of those not pursuing a commercial outcome, the key reasons indicated for not doing so was high commercialisation risk, a low cost-benefit ratio and a worry that the process would be a distraction from completing further academic research. An analysis of outcomes realised to date by non-participants indicates that, while not as pronounced for participating teams, as indicated above, some commercialisation activity has been completed. Over half of non-participants had engaged with new potential contacts to refine their business model and just under a third had developed a business plan for their project.

6.3 Summary

- **Career Prospects:** All ECR applicants experienced an increase in median wages and a slightly higher proportion of participating ECRs had annual salaries above £42,000 at the time of the survey. 15 percent of participants were now employed in a spin-out, commonly in an executive management team role. Qualitative evidence indicated that where a project had been discontinued or put on hold ECRs gained employment in the private sector as a result of their experiences.
- **Research Agenda:** Mixed views were held relating to the reputational effect of ICUR. While some reported it had a positive effect, especially in light of the REF agenda, others, especially PIs, indicated that academics are more likely to improve their reputation through academic research rather than commercialisation. That said, strong evidence provided during the case study research indicated that the programme activities guided future R&D, especially translational R&D.
- **Other effects:** The programme was suggested to reduce TTO resourcing issues and increase their effectiveness in delivering commercialisation activity. In addition, the programme was reported to produce a set of project teams that were more capable in pitching to investors, producing a larger number of viable investment opportunities for assessment.
- **Non-participants:** 20 percent of non-participants went on to pursue a commercial outcome (despite only 9 percent receiving a recommendation from ICUR to do so) and 40 percent looked to seek additional R&D funding (despite only receiving a recommendation of 12 percent). Over half of non-participants had engaged with new potential contacts to refine their business model and just under a third had developed a business plan for their project at the time of interview,

although high commercialisation risk and fears of being distracted from academic commitments were key challenges cited when progressing commercial development.

7 Conclusions and Implications

7.1 Conclusions

This subsection contains a set of conclusions and implications relating to the ICURe programme pilot:

- **Achievement of policy objectives:** The evaluation provides encouraging pilot data to suggest that ICURe is an effective and an economical instrument for accelerating the commercialisation of academic research and producing a range of wider benefits in strengthening links with industry and enhancing the entrepreneurial skills of early career researcher. The programme achieved all of its objectives, there was a high rate additionality associated with its results (81 percent), and its benefits exceeded its costs. The findings are supportive of a case for a wider roll out of the programme. The key impacts of the programme are summarised in the box below.
- **Spin-outs:** Evaluation evidence indicates that the ICURe programme has increased the number of additional spin-outs produced. 30 new spin-out companies by January 2017 of which approximately 24 would not have been created in the absence of the programme. Participants indicated that they committed more time to developing a spin-out, and allocated the majority of their time to developing a management team. The most common challenge encountered by all applicants was raising equity or other private investment. Around 40 percent of participants (especially those receiving Aid for Start Ups) reported their spin-out received private investment and spin-out employment grew faster for participants (with even faster employment growth for Aid for Start Ups spin-outs).
- **Licensing:** Eighteen percent of participants had secured a licensing agreement (with an average value and duration of £145,000 and seven years) at February 2017 (implying 14 licensing agreements had been signed by teams participating in ICURe, resulting in a total present value of future licensing income of £11m, £9m of which wouldn't have been realised in the absence of ICURe). A further 41 percent were in discussions with third parties about licensing the IP associated with their project. The majority of this activity was completed by teams that had developed a spin-out.
- **Business Model Development:** Participating teams made more rapid progress in resolving business model development issues than those that did not. The econometric modelling indicates that participating teams progressed further against the set of common business model issues presented to them in the survey (a 16-21-point increase in the business model index constructed by the study team).
- **Technology Development:** Evidence suggests that participating teams double their technology progress (approximated using TRLs) and all applicants completed additional private and publically funded R&D. Private and public research contracts were secured by participants at an average amount of £90,000 and £360,000 respectively.
- **Wider Effects:** Evaluation evidence provides some indication that the programme was associated with wage increases and broadened career opportunities for ECRs and provided evidence that was used to guide previous and future basic and translational R&D completed at participating HEIs. Finally, 20 percent of non-participants also indicated that they went on to pursue a commercial outcome and secure funding to complete R&D after submitting their application.

ICURe: Headline Impacts

- 78 teams benefitted from the first six rounds of ICURe at an approximate cost of £8.9m (of which £6.5m was awarded to 13 teams as Aid for Start Ups seed funding).
- Participation in the programme **increased and deepened links** between participating **academics** and **industry**, accelerating the commercialisation and the technology development process.
- An estimated 24 additional spin-outs were created, with an average age of one year at the time of this evaluation, raising a total of **£6.9m** in private equity finance. This valued the firms at a total of **£35m**. A larger proportion of Aid for Start Ups recipients reported they had secured private equity investment than those spinning-out privately (74 versus 31 percent).
- Spin-outs employed an average of three workers and were generating an average of **£86,000** in revenues by January 2017. Spin-outs taken forward with Aid for Start Ups funding grew more rapidly, reporting an average of six FTEs employed and average turnover of £145,000. The total present value of licensing agreements signed as a result of the programme was **£8.7m**.
- The ICURe programme is estimated to have created **£3.94 of economic benefits for every £1 invested** to date. There are unobserved factors that may result in the estimate over or under-statement of the effects of the scheme (and ambiguity as to which of these factors are likely to dominate)

7.2 Lessons

This subsection contains a set of broad implications for considerations relating to a national version of the programme:

- **Suitability of teams:** The evaluation suggested that the effectiveness of ICURe was linked to the suitability of teams that were put forward for the programme. Those that were further ahead with their commercialisation plans derived less in the way of benefit from the programme, and found aspects of the programme (such as the market validation process) to be repeating work that had already been completed (and those further behind were filtered at the application stage). TTOs played a key mediating role in putting forward the right types of candidates for the programme and significant engagement was needed in making sure that the aims and objectives of the programme are well understood at a local level.
- **Depth of suitable teams:** There was an apparent decline in the suitability of the projects for commercialisation outcomes over the first six rounds of the programme, raising some questions regarding the depth of suitable projects across the academic institutions in question. Questions were also raised by stakeholders as to how far the programme would be appropriate for all academic institutions. Leading institutions already have the infrastructure in place to commercialise research effectively and may not derive any additional benefit. At the same time, there were thought to be other institutions that lacked the infrastructure to effectively support the commercialisation of research (and the evaluation uncovered instances where the IP ownership policy of the institution acted as a barrier to the commercialisation ambitions of participating teams). As such it cannot be assumed that the programme would necessarily deliver similar effects in institutions with weaker commercialisation capabilities without complementary support for the TTO.
- **Business Advisors:** The evaluation provided evidence that business advisors played an important contributory role in the achievement of the results of the programme. The findings support the conclusions of other studies investigating the critical qualities of business mentors in supporting start-up activity that positive outcomes were more likely where the business advisor was more experienced.

- **Tacit qualities:** There was evidence that the success of the programme was at least partly linked to the tacit qualities of the team delivering the programme (particularly in terms of energising teams to commit to the market validation exercise). These aspects may be difficult to replicate or transpose to other programmes.
- **Alignment of expertise:** The evaluation evidence suggested that ICURe was most effective when the technical fields of the teams were aligned with speakers at Bootcamp, the Business Advisor, and the Options Roundabout panellist. A sector aligned programme could have raised effectiveness of the programme - though cross-fertilisation of ideas across technical fields at the Bootcamp appears beneficial and may be at risk under such an approach.
- **Licensing:** Most the programme's commercialisation impacts were achieved through spin-outs. Teams generally approached the programme with the idea that they wanted to start a business, and were not open to alternative commercialisation paths involving the licensing of IP (resulting in a loss of momentum when the Options Roundabout recommendation diverged from these expectations), despite the principle embedded into ICURe that there is no 'wrong outcome.'
- **Aid for Start Ups:** The availability of seed capital appears to accelerate the realisation of commercialisation outcomes, primarily by endowing the business with the resources needed to pursue immediate objectives around securing equity investment and putting in place a commercial management teams. However, it also appeared to have a distortionary effect on the approach of teams to the Options Roundabout. Additionally, the evaluation can offer no evidence on how far Aid for Start Ups was offered at the right level, or if similar outcomes could have been achieved at lower cost with smaller capital investments or alternative staged release of funds (i.e. commitment of smaller sums to enable the spin-out to progress rather than in the form of a £0.5m commitment).
- **Diminishing marginal returns:** There was evidence of diminishing marginal returns to complementary programmes (with those previously participating in the Researcher to Innovator programme deriving less in the way of additional benefit from ICURe than those that had not).

Chris Hale

Director, Ipsos MORI
chris.hale@ipsos.com

Nick Moore

Economist, Ipsos MORI
nicholas.moore@ipsos.com

For more information

3 Thomas More Square
London
E1W 1YW

t: +44 (0)20 3059 5000

www.ipsos-mori.com

<http://twitter.com/IpsosMORI>

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