TSB Feasibility Studies Programme Evaluation Findings

February 2013

A Report for

Technology Strategy Board
Driving Innovation

Acknowledgements

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ABBREVIATIONS

AMM2FERT – SERE-Tech's nitrogen fertiliser production project
CO_2 – Carbon Dioxide
CR&D – Collaborative Research & Development
EU – European Union
FP7 – Framework Programme 7
FPME – Food Processing and Manufacturing Efficiency
FS – Feasibility Study
FSP – Feasibility Studies Programme
GVA – Gross Value Added
HEI – Higher Education Institution
hES – human Embryo Stem cells
HTS – High-Throughout Screening
HTST – High Temperature Short Time
HVM – High Value Manufacturing
NANO – Nanotechnology
NE – North East
QCD – Quality, Cost, Delivery
QMUL – Queen Mary University London
R&D – Research and Development
R&D&T – Research and Development and Technology
SIF – Strategic Investment Fund
SOFC – Solid Oxide Fuel Cells
TSB – Technology Strategy Board
UHT – Ultra High Temperature
ZFN – Zinc Finger Nuclease Technology

EXECUTIVE SUMMARY

This report summarises the results of an evaluation of the impact of a group of Feasibility Study projects supported by the Technology Strategy Board in the last three years.

The Technology Strategy Board is the UK's innovation agency. Its goal is to accelerate economic growth by stimulating and supporting business-led innovation. Sponsored by the Department for Business, Innovation and Skills (BIS), the Technology Strategy Board brings together business, research and the public sector, supporting and accelerating the development of innovative products and services to meet market needs, tackle major societal challenges and help build the future economy. For more information please visit **www.innovateuk.org**.

The **Feasibility Studies Programme (FSP)** is a single-company or collaborative business-led R&D grant scheme that allows businesses the opportunity to test an innovative idea on its feasibility to be developed and eventually taken to market in specific technology areas that meet particular challenges identified as a priority for the UK.

Financial support for Collaborative R&D projects proposed by businesses has formed a major element of the Technology Strategy Board (TSB) activities since it was formed in 2007. These projects have covered to date a wide range of sizes and duration, from small collaborations lasting less than a year to large projects involving many partners and running up to four or more years. FSP represents a new initiative for relatively low cost projects lasting up to a year and aims to incentivise and support businesses to carry out exploratory studies. These studies may (or may not) lead to the development of new products, processes, models, or services and may eventually be supported through the main Collaborative R&D programme.

The key objectives of this evaluation were:

- To establish the extent to which projects funded under FSP have met their objectives and have assisted businesses in bringing to market new products, services or in using new processes that could potentially contribute to improved business performance.
- To assess to what extent the projects have encouraged other beneficial changes in participating businesses e.g. further R&D projects carried out with or without the TSB funding, activities pursued or going to pursue, raising investment and, increased employment, profitability or productivity.
- To quantify, if/where possible, economic impacts such as Gross Value Added (GVA) and employment, but also social and environmental impacts.
- To assess the additional value of this investment.
- Where possible, to establish cost benefit ratios and cost per job for the support provided.
- To explore the impact of various factors on impact generated e.g. sector or technology area, company size, type of collaboration and structure.

The evaluation of FSP commenced in August 2012 and was completed in January 2013. The focus has been on 325 projects funded under the Programme and completed between 2010 and 2011. The study also reviewed some pilot Programme activity that took place in 2009/10.

The approach adopted to meet the objectives of the evaluation combined a wide range of qualitative and quantitative methods including a descriptive analysis of management and financial information, surveys of winners and non-winners of grants, detailed review of selected projects and econometric modelling.

KEY FINDINGS

The evaluation has shown that **FSP has been a highly effective Programme, acting as a stepping-**

stone for further R&D, technological and commercial activities. The Programme has met the expectations of the vast majority of participating businesses and stimulated significant innovation activity by not only enabling investigation of the feasibility of new ideas but also developing new products and testing their application.

FSP has also contributed to business performance improvements and job creation. It has yielded notable immediate improvements in increasing the value of businesses in the market and leveraging their profile but also improving the quality of products, processes and services.

In comparison with non-winners, winners of a FSP grant experienced a higher average growth in R&D related employment within the last two years. For example, winners saw an average growth in R&D employment of around 51%; the equivalent figure for non-winners was 20%. Furthermore, over two thirds of winners (79%) already saw or were expecting to see an increase in employment as a result of their FSP funded project. In fact, job creation was strongly identified by winners of a FSP grant as one of the wider economic benefits that had been, or would be, generated by the FSP projects.

The key aim of the Programme has been to enable testing the feasibility of a mainly technological idea/process; therefore, it should not be surprising that it has attracted organisations that are mainly R&D focused. Nevertheless, it has offered a platform for organisations to test the commercial feasibility of their project, **with nine in ten FSP winners having improved their market position or expected to do so in the future.**

The evaluation has also shown that a typical FSP winner would be an organisation:

- Whose main business activity is in R&D and/or Production rather than the Services sector;
- Is a relatively small business (but not a micro);
- Is more likely to be less than 10 years old;
- Is an independent company rather than a subsidiary;
- Is a regular visitor to the TSB website; and,
- Is more likely than a non-winner to have asked for clarifications from TSB before completing the application form.

The Programme has been highly valued by all participating organisations, winners and non-winners. Businesses identified two main obstacles in accessing private sector finance: unwillingness of the potential end users/beneficiaries to acknowledge the benefits of the project for their business (and hence unwillingness to contribute resources to project development) and lack of knowledge to appreciate the extent of benefits to emerge from a project. Both winners and non-winners have regarded FSP as the main trusted source of finance support for testing new things.

For smaller firms in particular, it has proved to be a very important form of assistance for delivering results and minimising financial risk. Just under a third of FSP winners also benefited from easier access to finance as a result of the FSP project, compared to none of the non-winners.

FSP has helped to deliver results that would **definitely not have happened without its assistance for nearly six in ten projects.** For another three in ten projects, it **speeded up the delivery of results** that would have taken longer to materialise. The latter is highly important as timing of achieving competitive advantage matters in a global competitive market with uneven access to resources and information.

It needs to be recognised that the Programme has been delivered within one of the worst economic recessions experienced by the UK. Nonetheless, the evaluation has shown, that the modest allocations of FSP grants i.e. on average £40,000 per project, have managed to provide considerable leverage to the profile of a business and its value. The Cost Benefit Ratio (CBR) of the public

investment to date and assuming that benefits generated would last up to five years is estimated to be 1:2.72. The future potential benefits to be generated by FSP would also add considerable value to the economy, were they to materialise. These benefits would, for example, mean that for every £1 spent by TSB, Gross Value Added (GVA) could increase by around £9 in the future.

In the future, further research would be beneficial to identify the **success factors** in taking ideas to market among these feasibilities studies and exploring how 'success' is defined by organisations that have been involved in these R&D activities; whether policy and business aspirations are attuned; and, the future role of government interventions in the 'technology push – market pull' spectrum.

1. Introduction

Background

1.1 The **Feasibility Studies Programme (FSP)** is a single-company or collaborative business-led R&D grant scheme that allows businesses the opportunity to test an innovative idea on its feasibility to be developed and eventually taken to market in specific technology areas or to meet particular challenges identified as a priority for the UK. The funding support is provided by the Technology Strategy Board (TSB) for relatively low cost projects lasting up to a year; it is essentially, a way/incentive for companies to carry out exploratory studies, which may (or may not) lead to the development of new products, processes, models, experiences or services before or while they are seeking new partners.

1.2 Since the publication of TSB's first strategy under the title *Connect and Catalyse*[1] in 2008, feasibility studies represent one of the mechanisms that TSB has put in place to deliver its vision and help businesses on their innovation journey. Feasibility studies also feature in the latest TSB strategy, *Concept to Commercialisation*[2], with funding for Research, Development and Demonstration projects including funding for feasibility studies alongside small proof-of-concept grants and large multi-partner collaborative R&D and demonstration projects. The aim of the funding is to support businesses, specifically in accelerating their journey between concept and commercialization by, as stated in the strategy, '*...helping businesses of every size to transform great ideas into the growth products and services of tomorrow'.*

1.3 As part of the programme, around £13million was awarded between 2009 and early 2011 to support businesses wishing to develop proposals for new products or services that might eventually be supported through the main TSB Collaborative R&D programme (CR&D).

1.4 The rationale for public sector funding and support is based on the recognition that:

- Businesses represent the source and the delivery agent of innovation; and,
- The route from innovation to economic growth is not straightforward and therefore letting businesses and the market operate without public sector intervention may not lead to policy/socially desirable outcomes within the preferred time period i.e. market failures would occur that in this instance would have a significant impact on the UK's ambition and ability to be a key knowledge hub in the global economy, with a reputation not only for outstanding research but also for turning that knowledge into new products/services and improved public services/quality of life for UK residents.

1.5 Market failures would arise from a combination of different perceptions of the positive externalities of innovation and the willingness to finance it, risk aversion and lack of relevant resources among the various agents involved on the route that takes a new idea from concept to market. For example, the private sector – firms and financiers, may be reluctant to invest in new ideas testing and new technologies when the pricing of the potential product (if any) may not reflect the costs incurred in the first place and/or returns on investment may be uncertain or occur at a different time period (i.e. in the long-term). Risk aversion and economic downturns would accentuate such behaviours.

1.6 Moreover, the private sector, and in particular micro and small businesses, may lack the capabilities and capacity to take a leading/competitive position in the market as fast and effectively as it is desired by policy and government objectives. Businesses may therefore need additional finance but they may also need additional skills, technologies, organisational structures and systems that would accelerate the whole process. Collaborations with others –

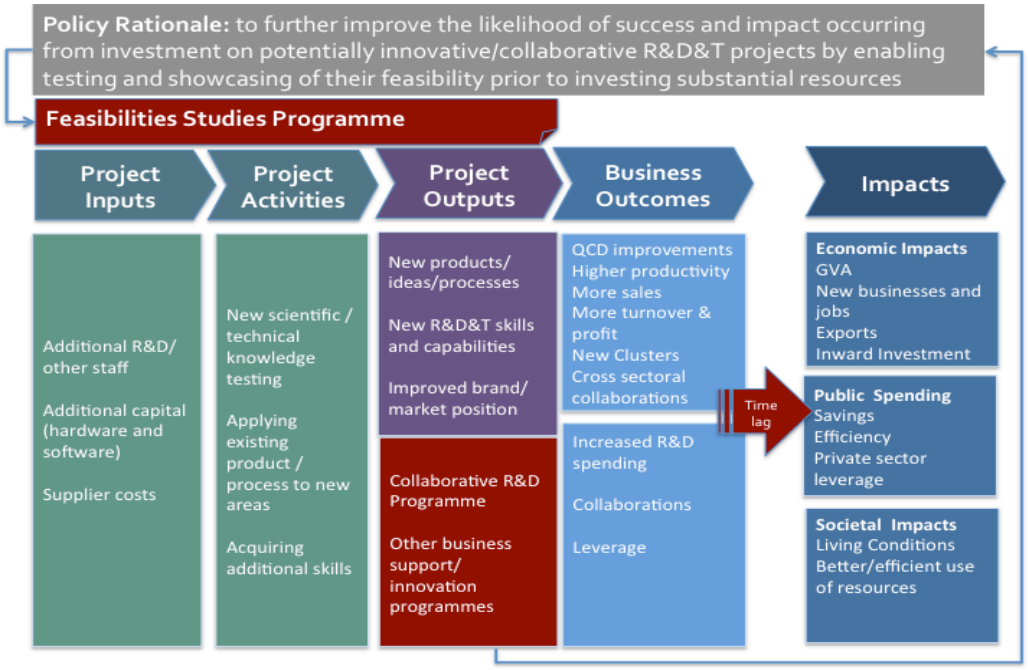
[1] Connect and Catalyse. A Strategy for Business Innovation 2008-11.
[2] Concept to Commercialisation. A Strategy for Business Innovation, 2011-15

businesses or the academia, have in general been encouraged by government policies in order to acquire these additional capabilities and improve expertise but also share/decrease technical and commercial risk and reduce performance and competitive barriers by, for example, partnering with a specialist. Within this context, TSB's CR&D Programme is designed to assist the industrial and research communities to work together on R&D projects in strategically important areas of science, engineering and technology, from which successful new products, processes and services can emerge. Indeed, an evaluation of 396 Collaborative R&D projects conducted in late 2010 found that for 67% of businesses, collaborative projects provided access to further technical & R&D skills; for 85% of businesses they helped spread the risk of investment; and, for 74% the projects helped leveraging in finance.

1.7 At the same time and in recognition of the challenges that surround identification of the right partners and the time involved in establishing working/collaborative relationships, TSB has gone a step further with FSP in supporting businesses (and in particular smaller ones, spin outs and start ups) by giving the resources and option to test first the feasibility of their idea with or without partners, and identify partners in the process or subsequently/when showcasing their study findings.

1.8 Figure 1.1 summarises the rationale and policy objectives underpinning the Programme. These are presented in a form widely used in evaluations and economic impact assessments of government funding and intervention clearly setting out **inputs** (resources committed to the programme); **activities** undertaken with the funding; **project outputs**, which are the direct products from the different activities/projects being undertaken; **business outcomes** for the businesses directly involved in the feasibility study and covering a wide range of outcomes including key business performance indicators and organisational behavioural changes; and **impacts** potentially arising from the programme and including intentional and wider economic and societal impacts and efficiencies/savings for the public purse.

Figure 1.1: FSP Logic Chain



The Evaluation Brief

1.9 The objectives of this evaluation were specified as follows:

- To establish the extent to which projects funded under FSP have met their objectives and have assisted businesses in bringing to market new products, services or in using new processes

which could potentially contribute to improved business performance.

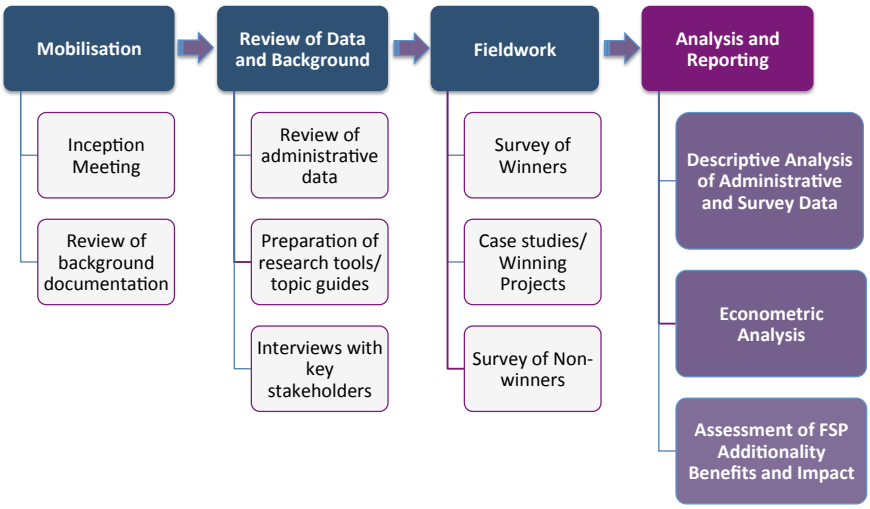
- To assess to which extent the projects have encouraged other beneficial changes in participating businesses e.g. further R&D projects carried out with or without the fund, activities pursued or going to pursue, raising investment and, increased employment, profitability or productivity.
- To quantify, if/where possible economic impacts such as Gross Value Added (GVA) and employment, but also social and environmental impacts.
- To assess the additional value of this investment.
- Where possible, to establish cost benefit ratios and cost per job for the support provided.
- To explore the impact of various factors on impact generated e.g. sector or technology area, company size, type of collaboration and structure.

Evaluation Approach and Methodology

1.10 The evaluation work commenced in August 2012 and was completed in December 2012. The focus of the evaluation has been on the 325 projects funded under the Programme and completed in 2010 and 2011. The study also reviewed some pilot activity that took place in 2009/10; this was undertaken to test the take up of the Programme and the process adopted for its delivery and involved 104 projects. On the other hand, the evaluation has not included 69 feasibility study projects that were still under way at the time of the evaluation.

1.11 The approach adopted to meet the objectives of the evaluation combined a wide range of qualitative and quantitative methods and is depicted in Figure 1.2.

Figure 1.2: Evaluation Stages and Methods



1.12 The key features of the methodology are described below:

- A **thorough desk-based review of all background data and information to produce** a comprehensive database of applicants that were successful in securing funding to support their feasibility studies (winners) and applicants who were unsuccessful (non-winners). Based on this database, a descriptive analysis of the Feasibilities Studies Programme was undertaken and this is presented in Section 2 of the report.
- A **survey of winners to the 2010-11 FSP programme** including non-winners who either did not go ahead with the project or went ahead with funding/support from other bodies in order to establish benefits generated, emerging impact and future plans. There were 228

respondents to the winners' survey (out of 325 projects funded and completed between 2010-2011)[3].

- A **survey of non-winners to the 2010-11 FSP programme.** There were 212 respondents to the non-winners' survey. Of these, 128 abandoned the project; 30 went ahead with the project funding it through alternative finances (12 of these undertook the same project and another 18 went ahead with a smaller scale project); and 54 stated that they would go ahead with the project in the future.
- A **survey of the 104 organisations that participated in the early pilot stages of the Programme in 2008/09**. There were 56 respondents to this survey[4]. The purpose of these interviews was to explore any differences in the experiences and impact of the programme for companies that received the grant earlier.
- Copies of the questionnaires used in the surveys are provided in **Annex A.**
- **Case studies** i.e. more in-depth reviews of 11 FSP funded projects, summaries of which are presented throughout the report.
- **Descriptive analyses and comparisons of the survey results**. These shine a light on where and how FSP projects appear to affect firms' business performance and R&D capabilities. Descriptive analysis is particularly valuable in: setting the context ('participants in the Feasibility Study projects were typically small to medium-sized firms'); summarising the feedback provided by winners and non-winners; and, highlighting relationships/bilateral associations between variables through cross-tabulations e.g. an association between the overall cost of the funded project and a firm's size. The survey results therefore, while they do not indicate causality, they do provide valid observations that indicate some avenues for further investigation and monitoring in the future.
- **Econometric analysis.** This analysis has been undertaken to complement the survey findings and has been designed to make best use of both the survey and administrative data in order to provide additional analysis to inform the evaluation findings in response to the following evaluation questions:
  - What are the impacts of the FSP funding on the business R&D capabilities and business performance indicators controlling for business characteristics such as sector or firm size?
  - What factors influence the extent and nature of the impacts? Are differences in impacts dependent upon factors such as sector or firm size?
  - In addition, the econometric models provide further insights into which factors contribute to the probability of a firm's application being successful (being a winner) i.e. what may factors influence the outcome of the funding application?

  This method has not been used previously and provides a cohesive framework that can be refined and developed further in the future in assessing the impact of business focused innovation support programmes. A brief description of the approach tested as par of this study is provided below and a comprehensive note is provided in **Annex B**. The general approach to the econometric analysis involves seeking to explain the variation in the dependent variable (y) between different firms (i) in terms of variation in a vector of explanatory variables (x). Conceptually, this can be presented as (the explanatory variables listed are examples for presentation purposes only):

[3] Representing 70% response rate with results subjects to 4.2% margin of error and 98% level of confidence.
[4] Representing 95% level of confidence and just under 10% margin of error. **Annex C** presents key comparative findings between pilot beneficiaries and 2010/11 winners.

More specifically, the analysis involves testing econometric models of the following form:

$y_i = \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \ldots + \beta_n x_{im} + u_i$, $i = 1....n$ where,

- across $i = 1.....n$ firms;
- y_i = the dependent variable;
- x_{i1}, x_{i2}, x_{i3}, x_{im} = the m explanatory variables identified as potentially important in explaining changes in y_i (e.g. firm size, main activity);
- β_1, β_2, β_3, β_n = the parameters on the corresponding explanatory variables, which measure the effect of a change in x_{im} on y_i; and,
- u_i = the residual term and captures that part of the variation that cannot be attributed to the explanatory variables.

The estimated β values are what are of most interest to us. The statistical significance and value of each β will tell us 1) whether or not the associated explanatory variable influences the dependent variable (y_i); and, if so, 2) the size and direction (positive or negative) of that influence. In actual fact, a two-step estimation process is applied in order to adjust for selection bias.

- In defining the dependent variable, 'R&D intensity' has been used as the key behavioural outcome based on the logic chain presented in Figure 1.1. As set out in the logic chain and confirmed by the survey findings, no immediate changes in business performance indicators were expected as a result of the FSP grants. In the relatively short time since the FSP funding was granted, either there appears to be very little impact on business performance indicators such as turnover or profitability or data is rather limited. Nevertheless, a modelling exercise to assess the impact of FSP support on reported turnover was undertaken in an attempt to investigate this and the results are reported in Section 4 of the report.
- Two alternative measures of R&D intensity have been defined and tested.
  - The first dependent variable to be used is **R&D spending per employee**. This is calculated by dividing the current R&D budget provided by the survey respondents by the current total number of employees. A measure per employee was used to consider R&D spending while taking into account the size of the firm. It was not possible to calculate measures of R&D spending as a proportion of revenue or profit because the data for revenue and profit were expressed in broad bands rather than specific figures.
  - The second dependent variable used is **the proportion of total employees that are involved in R&D.** This was calculated by dividing the current total number of employees engaged in R&D as stated by the respondent companies by the current total number of employees.
- In terms of **explanatory variables**, these were defined as follows:
  - **Competition/sector**: Indicators for sector are included in the regression equation. The sectors are Biotechnology, Digital, Energy, Health and medical, Nanotechnology and materials, Nuclear, Nutrition for Life, and Space. This analysis assesses the statistical difference in the impact of TSB funding for different sectors especially as some sectors account for a much higher proportion of respondents than others (e.g. Nanotechnology).

- **Use of Funding**: There are several further dummy variables based on what the firms indicated the FSP funding was intended for. The most relevant categories appeared to be for producing new scientific/technological knowledge, for investigating the feasibility of applying an existing product/process to a new area and for acquiring additional skills.
- **Other funding**: The equation has also tested the impact of other funding that a firm may have received so that any costs/benefits from this funding are not attributed to the FSP funding.
- **Firm Size:** In order to take into account firm size as an explanatory variable total employment and turnover have been used.
- **Number of patents held:** The number of patents held by the respondents (as reported in their responses to the survey) has been included as explanatory variable to control for any impact on the dependent variable.
- **Main activity of the firm:** The survey asked respondents to state the main activity of their business (allowing for more than one areas to be selected) with the possible areas being production, R&D, services, education, and other.

- **Winners compared with Non-Winners.** The analysis includes only firms that applied for funding and it seeks to compare the outcomes for winners and non-winners. But it is possible that firms that applied for funding are different to those that did not. To test and account for this potential selection bias, the econometric models include a selection equation to estimate the probability that the application was successful (i.e. the firm was funded).
- **Estimates of Additional, Impact and Cost Benefit Analysis**. In assessing the impact of the programme the study has been guided by H.M. Treasury's Green Book approach according to which an impact arising from an intervention/support is additional if it would not have occurred in the absence of the intervention/support (i.e. assessing deadweight and the counterfactual). The additional/net impact of an intervention is therefore the difference between the reference case position (what would happen anyway) and the position if the intervention option was implemented. The survey has asked companies to state whether benefits would have materialised without FSP and to what extent, and the responses have been taken into account to provide estimates of *net* benefits and impact, where possible. Responses of winners have also been compared with those of non-winners.

Report Structure

1.13 The remainder of the document is structured as follows:

- **Section 2** presents an overview of the Feasibility Studies Programme and the profile of the projects and businesses applying and participating in the Programme. It also provides feedback from businesses in relation to the application process and other programme management and delivery elements. Where possible, it also provides comparison with the findings of the review of the Collaborative R&D Programme.
- **Section 3** presents the findings of the surveys in relation to benefits and impact arising from the projects funded as part of FSP.
- **Section 4** focuses on the contribution of FSP and provides estimates of the Programme's additionality.
- **Section 5** provides estimates of return on investment to date.
- **Section 6** summarises key findings, provides an overall assessment of the Programme and highlights issues for future consideration.

2. Profile and Delivery of FSP

2.1 This section presents an overview of the Programme to date drawing upon the review of the relevant administrative data held by TSB and the survey findings.

KEY EMERGING POINTS

- The **2010/11 FSP represents a £13million investment by TSB that supported 325 industry-led feasibility studies that were completed in 2011**. This investment accounts for a contribution of approximately 72% public funding to the overall costs of these projects.
- The feasibility studies cover areas of work in seven key sectors: Health and Medical (including Nutrition for Life), Biotechnology, Digital, Energy, Nanotechnologies, Nuclear and Space.
- In total, 974 applications were received meaning that approximately a third of the applications were successful. The success rate, however, ranged from 20% to 59% depending on the sector – 20% in Nutrition for Life and 60% in Nanotechnology and Materials related studies. The largest group of winning projects were in Nanotechnologies and Materials followed by projects in Digital and Space technologies.
- **The average FSP project grant was £40,174.** The project values, however, varied greatly from £31,000 to £193,000, with the largest projects found in Health & Medical & Biotechnology. In fact, the largest share of the total grant (31%) went to the Health and Medical sector.
- 483 organisations were involved in the 325 winning projects. This represents 325 organisations leading and 158 acting as partners/collaborators. Out of the 158 collaborators, 115 were from the industry and 43 were academic institutions. Overall, there seems to be no distinct relationship between the size of the project and the size of collaboration/number of partners involved.
- **Proving a concept/feasibility of an idea was by far the most commonly cited intended use of the funding,** with 94% of winners and 85% of non-winners intending to spend any funding received on proving a concept or the feasibility of an idea. 'Investigating taking a product to market/commercialising an idea', was more popular among non-winners than winners as an option for how funding might be spent.
- With regard to the size of the organisation (by employment) interested in FSP, across all organisations that applied for a grant under the 2010-11 Programme, the average number of employees was 53 employees. But there was a marked variation between winners and non-winners. **Average organisation size among winners was 38 employees, whereas among non-winners it was 70 employees.**
- The most common method through which **winners found out about the competitions was word of mouth (40%), with the next most common mediums being TSB email (27%) and the TSB website (22%).**
- In terms of the application process, two thirds of all applicants (winners and non-winners) scored the process a four or five (on a scale of 1 to 5 where one equals confusing and five straightforward). So **overall, two thirds of applicants scored the process as more or less straightforward.** At the other end, around **just 5% of all applicants felt the process was confusing (score=1).** Downloading the application forms was perceived as relatively more straightforward than uploading them.
- Review of the profiles of winning and non-winning organisations indicates that **a *typical* FSP winner would be** an organisation: whose main business activity is mainly in R&D (and most likely in Production rather than Services); that is a relatively small business, but not a micro, and more likely to be less than 10 years old; and, which is an independent company rather than a subsidiary. A typical winner is also a regular visitor to the TSB website and is more likely than a non-winner to have asked for clarifications from TSB before completing the application form. Furthermore, it would be rather unlikely for a typical winner to have received any external assistance for completing the application form; and if they did receive assistance, they most probably did not pay anything for it.

The Programme – Headline Facts & Figures

2.2 FSP funding was awarded to companies through a process of competition calls i.e. TSB inviting interested parties to submit proposals outlining their proposed project, its potential impact and collaborators in 11 different technology and challenge led areas falling under the key TSB priority sectors, as presented in Figure 2.1.

Figure 2.1: 2010/11 FSP Competition Themes

Sector	Competition for Feasibility Studies
BIOTECHNOLOGY	Manufacturing High Value Chemicals Through Industrial Biotechnology
DIGITAL	Disruptive Solutions, Digital Problems
	Feasibility Study in Digital Services
ENERGY	Disruptive Solutions for Energy Problems
HEALTH AND MEDICAL RELATED	Fighting Infection Through Detection
	Regenerative Medicine – Tools and Technologies
	Nutrition for life
NANOTECHNOLOGY & MATERIALS	Technology Inspired NANO
	Responsible Development of Nano scale Technologies
NUCLEAR	Nuclear R&D Feasibility Studies
SPACE	Innovation in Space

2.3 In total, 974 applications were received and 325 projects were funded in 2010/11. Figure 2.2 presents the profile of all applicants and results by sector. In summary:

- Overall, approximately a third of the applications were successful. The success rate, however, ranged from 20% to 60% depending on the sector.
- The largest volume of applications came from the Digital sector, with 342 applications. Nearly 1 in 3 (23%) were successful. The largest group of successful applicants with 92 winners was from the Nanotechnology and Materials sector, with the sector also demonstrating the highest success ratio (winners vs. applicants) at just below 60%.
- The estimate total cost of the 325 2010/11 successful projects was £18,080,564. It is worth noting that the estimated cost of the individual projects was provided in the application form by the applicants and was based on their own assessment. The total value of winning projects represents 55% of the value of all projects that applied for a grant.

Figure 2.2: Applicants - successful and unsuccessful applications by sector

Sector	Winners (No)	Winners[5] %	Non-Winners (no)	Total (No)	Success Rate %
Health and Medical	38	12%	67	105	36%
Nuclear	17	5%	75	92	18.5%
Energy	8	2.5%	11	19	42%
Biotechnology	8	2.5%	8	16	50 %
Digital	79	24%	263	342	23 %
Nanotechnology and Materials	92	28%	63	155	59 %
Space	77	24%	138	215	36%
Nutrition for Life	6	2%	24	30	20%
Total no of projects	**325**	**100%**	**649**	**974**	**33%**
Total cost of projects (based on applicants' own estimates)	**£18,080,564**		**£32,910,000**		**55%**
Total FSP Grant	**£13,056,530**				

[5] The respondents to the survey also reflected this distribution with a third of responses from the nanotechnology and material sector, followed by 23% in and 21% in Space, 11% in Health, 6% in Nuclear, 2% in Energy and Biotechnology and 1% in Nutrition for Life.

2.4 On average, across all winning projects, FSP provided 72% of the funding i.e. £13,056,530. However, as shown in Figure 2.3, the amount of TSB grant funding varied by sector from 53% to 85%. The Health and Medical technologies/sector has been the main beneficiary, with a third of the overall FSP grant received by projects in this sector.

Figure 2.3: All Winning Projects – Total Project Costs and Overall Grant by sector

Sector	Total Project Costs (£) –	FSP Grant (£) – projects	FSP as % of Total Project Value	% Of Overall Grant received by Sector
Health and Medical	5,677,605	4,033,458	71%	31%
Nuclear	2,196,890	1,643,701	75%	13%
Energy	526,419	449,416	85%	3%
Biotechnology	1,543,957	825,234	53.5%	6 %
Digital	2,554,896	1,952,473	76%	15%
Nanotechnology and Materials	2,940,196	2,205,656	75%	17%
Space	2,442,032	1,797,665	74%	14%
Nutrition for Life	198,569	148,927	75%	1%
Total	**£18,080,564**	**£13,056,530**	**72.2%**	**100.0**

2.5 In terms of individual project values, the project values vary greatly from £31,000 to £193,000, with the largest projects found in Biotechnology and Health and Medical. Figures 2.4 and 2.5 present average project values per sector.

Figure 2.4: Average project cost and project grant by sector

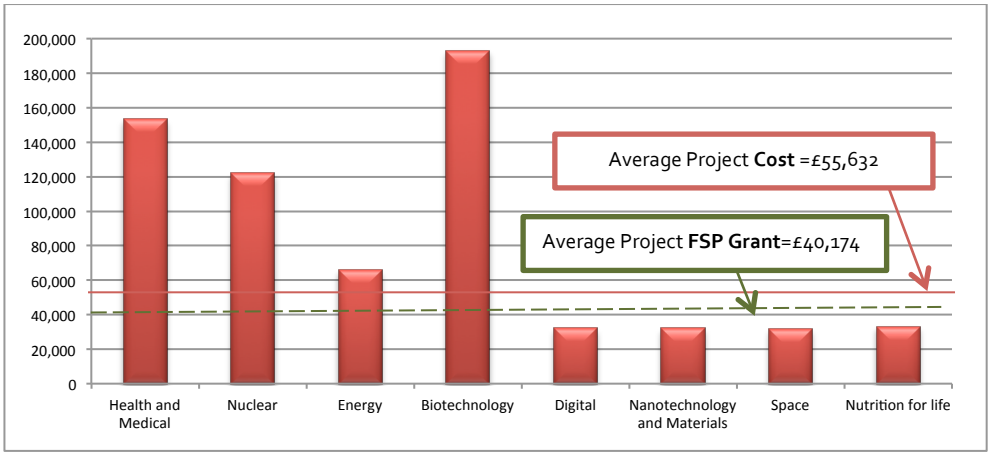


Figure 2.5: Average Project Cost and Grant per Project

Sector	Average Project Cost (£)	Average Project Grant (£)	Average Grant (%)
Health and Medical	153,449	109,002	71%
Nuclear	122,049	91,316	75%
Energy	65,802	56,177	85%
Biotechnology	192,995	103,154	53.5%
Digital	32,340	24,715	76%
Nanotechnology and Materials	31,959	23,974	75%
Space	31,715	23,346	74%
Nutrition for Life	33,095	24,821	75%
Average all	**55,632**	**40,174**	**72%**

2.6 It is worth noting that:

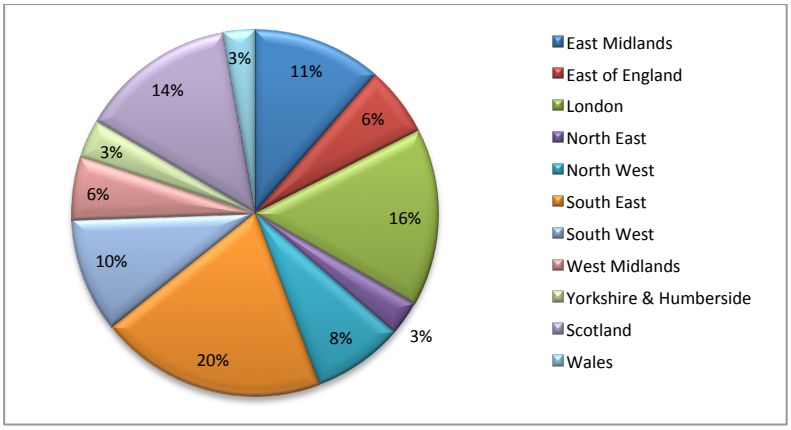
- In the Energy sector, on average, the FSP grant covered 85% of the estimated project costs. In fact, a detailed review of the projects and grant approved showed that in Energy it was more likely than in other sectors for the projects to have been funded up to 100%.
- The Biotechnology sector had the lowest grant value vs. project value ratio, with an average grant percentage of just below 54%[6].

2.7 The region with the most competition winners was the South East with 20% of all winning projects being there[7]. This was followed by London on 16% and Scotland on 14% each. Wales, the North East and Yorkshire & Humberside each accounted for around 3% of winners.

Figure 2.6: Distribution of FSP Projects by region and sector

Sector	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire & Humberside	Scotland	Wales
Health and Medical	2	3	7	2	5	10	1	0	1	6	1
Nuclear	3	3	1	0	1	2	4	0	1	2	0
Biotechnology	0	1	1	1	0	1	1	1	0	1	1
Digital	11	5	15	0	12	13	7	6	1	6	3
Nanotechnology and Materials	14	6	14	5	4	11	9	5	6	15	3
Space	6	1	10	2	3	25	11	4	2	12	1
Energy	0	1	2	0	1	3	0	1	0	0	0
Nutrition for Life	1	0	1	0	0	0	0	1	0	3	0
Total	37	20	51	10	26	65	33	18	11	45	9

Figure 2.7: % Distribution of Winning Projects by region



Profile of Organisations interested and involved in FSP

2.8 The survey results provided further information to enable a more detailed profiling of the organisations interested and involved in FSP.

2.9 In relation to the organisations main business activity of the organisations involved in FSP, and indicated that:

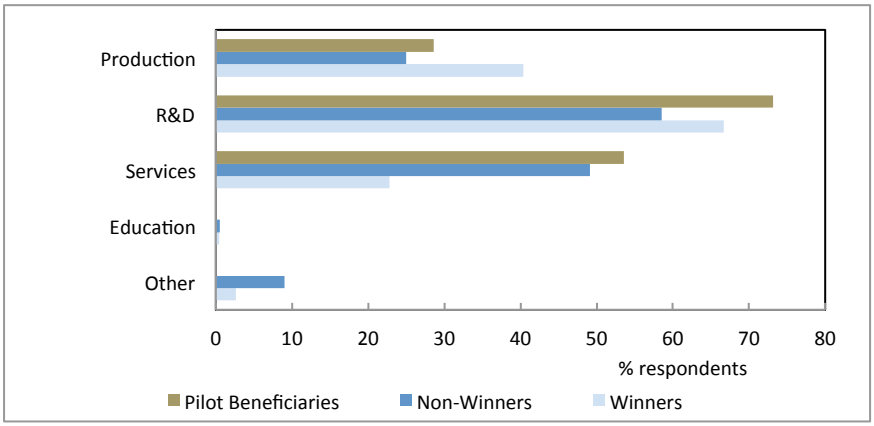
- **For two-thirds of winners (67%) and nearly three-quarters of the earlier pilot beneficiaries (75%), R&D was the main activity of their business**. With around 59%, non-winners had the lowest proportion involved primarily in R&D.
- On the other hand, the proportion of businesses who indicated Education as their main activity was very small or zero.

[6] A summary of key findings by sector is provided in **Annex D.**

[7] Additional analysis has shown that the industry distribution reflects the SE/London focus for most of the sectors/competition themes. Relevant information by sector (number of businesses and employees) is provided in **Annex E**.

- A noticeably higher proportion of winners (40%) indicated Production as their main activity compared to non-winners (25%), whilst a markedly lower proportion of winners (23%) reported Services as their main business activity compared to non-winners (49%).

Figure 2.8: Main activity of organisations[8] (% of respondents)



- As shown in Figure 2.9, in comparison with the Collaborative R&D programmes, FSP appears to have attracted and provided grants to relatively more organisations involved in R&D – where either R&D is the only business activity or it is part of other business activities undertaken by the organisation.

Figure 2.9: Main activity of organisations in FSP and Collaborative R&D (% Of survey respondents)[9]

		Winners		Non-winners	
		C R&D	FSP	C R&D	FSP
Production	**All respondents**	**42%**	**40%**	**41%**	**25%**
	% of respondents where production is the only business activity		16%		10%
	% where production is one of many activities		24%		15%
R&D	**All respondents**	**30%**	**67%**	**36%**	**58%**
	The only business activity		36%		23%
	One of many activities		31%		35%
Education	**All respondents**	**11%**	**23%**	**3%**	**26%**
	The only business activity		14%		
	One of many activities		9%		26%
Services	**All respondents**	**18%**	**23%**	**21%**	**49%**
	The only business activity				
	One of many activities		23%		49%
No of respondents		282	228	91	212

2.10 With regard to the size of the organisation (by employment), across all organisations that applied for a grant under the 2010-11 Programme, the average number of employees was 53 employees. But there was a marked variation between winners and non-winners. Average organisation size among winners was 38 employees, whereas among non-winners it was 70 employees. Interesting to note that the pilot beneficiaries were relatively smaller organisations, with the average

[8] Survey respondents were able to provide more than one answer, so the sum of responses for each survey group will not add up to 100%.
[9] The FSP surveys asked businesses to identify one or more as their main business activity. The C R&D survey allowed only for one activity to be included as the main activity.

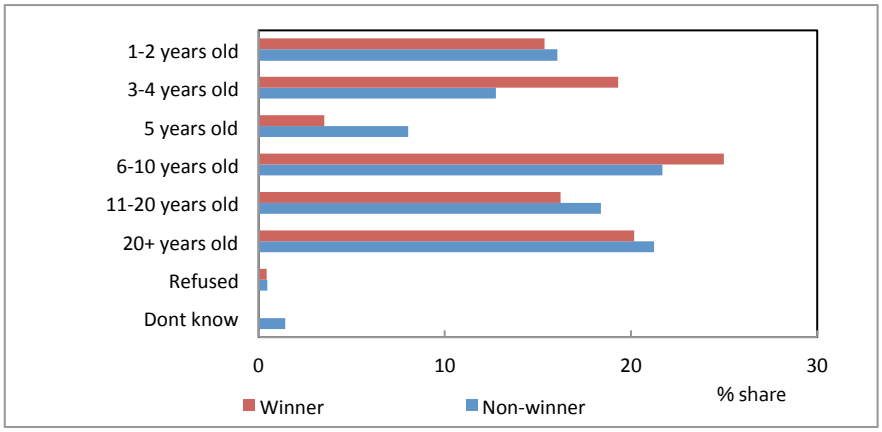
organisational size being nine employees.

2.11 In terms of the age of organisations involved in FSP, the distribution is similar for winners and non-winners. In both cases:

- Around 15% of firms were less than three years old.
- Just under 40% (37%-38%) were five years old or younger.
- Around 60% of firms are ten years old or younger.
- Around 20% of firms are 20 years old or older.

2.12 Noticeably, however, a higher proportion of winners (compared to non-winners) were either 3-4 years old or 6-10 years old. Very slightly higher proportions of non-winners were more than ten years old or more than 20 years old.

Figure 2.10: Distribution of winners and non-winners by firm age



2.13 Just under 91% of winners from the 2010-11 programme were independent before receiving the grant; only 9% were subsidiaries of another company. In the case of beneficiaries from the 2008-09 programme, around 96% were independent before receiving the grant, with just 4% subsidiaries of another company.

2.14 A similar proportion (89%) of non-winners from the 2010-11 Programme were independent before applying for a grant, with 11% of non-winners being subsidiaries of another company.

2.15 Figure 2.11 summarises some of the key characteristics of the FSP average applicants before and after/at completion of their feasibility studies i.e. in 2009 and 2012. In summary:

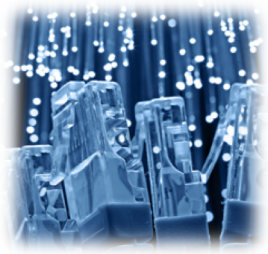
- Both non-winners and winners appear to have experienced similar increases in both turnover and profit ranges but also overall employment figures.
- The average number of employees in R&D has increased noticeably for the winners (58%) but has increased only slightly for the non-winners (7%).
- In average terms, both winners and non-winners appear to be heavily R&D focus – with winners employing nearly a third of their workforce in R&D.

Figure 2.11: Comparing non-winners with 2010/11 winners

	Non-Winners		Winners	
	2009	2011/12	2009	2011/12
Median Turnover Range	£50,001 – £150,000	£150,001 - £300,000	£50,001 - £150,000	£150,001 - £300,000
Median Profit Range	Zero/Nothing	Up to £50,000	Zero/Nothing	Up to £50,000
Average Employment	70	111	38	60
Average Employees in R&D	14	15	12	19

2.16 It needs to be recognised that the figures above present the average picture and do not fully capture the wide range of organisations that have benefited from the FSP assistance including spin-outs but also public listed companies and global players as the following two case studies indicate. In fact, **analysis of the relevant TSB Administrative/Management data in relation to the FSP assistance indicates that 31% of FSP funding has gone to micro businesses, 30% to small businesses, 9% to medium sized organisations, 13% to academic institutions and 17% to large companies.**

CLARESYS LTD. is a limited company specialising in surveillance optics and formed in 2007 as a spin out company set up by Ploughshare Innovations (manages the commercial licensing to industry of defense technology developed by the Defence Science & Technology Laboratory - DSTL). It was formed to exploit the on-going research into novel optical solutions by some of the UK's leading scientists working in the defense sector.



The company was successful in securing TSB funding for a feasibility study along with Mirion ISD, the world leader in supply of imaging systems and CCTV to the nuclear industry. The project aimed to apply Claresys' patented optical technology from the defense field - Claresys' COSE (Compact Optically Scanning Enhanced) lens, to a new range of optical devices for the nuclear environment using the expertise of Mirion ISD.

This could improve imaging quality, reduce initial costs, increase reliability and reduce complexity of installation. In turn such devices could enhance the ability to supervise nuclear decommissioning or fuel handling activities. It would help to improve safety, reduce operator exposure, and help speed up decommissioning activity with consequent environmental benefits. Confirming technical feasibility of design would also allow the partners to start discussions with potential customers. It is expected that the new product will be commercialised in the next 1-2 years. Some benefits have already materialised such as technical feasibility and enhanced knowledge and skills. Claresys has also been able to enter the nuclear sector while Mirion ISD has increased its understanding of the optics market. Financial benefits of £500k would accrue to both partners. Claresys expects to create 2 jobs and Mirion ISD to create 5 jobs.

AVANTI COMMUNICATIONS LTD. is a company specialising in satellite communications. It is part of Avanti Communications PLC, which was incorporated in 2007 as a public limited company, listed on the Alternative Investment Market (AIM). Avanti plc. has its headquarters in London with 120 full time employees but it also has substantial operations in Cornwall, Cyprus, Germany and the USA. 15 employees are engaged in R&D. Turnover of the Group in 2012 was £12.5m with a loss of £13.9m (Annual Report and Accounts 2011/12).

Avanti was successful in securing TSB funding for a feasibility study to develop a software based tool to reduce the high installation cost of broadband satellite antennae, in particular labour costs – Smartphone Application for SaTellite Broadband InstallS (SATBIS). 100% of FSP went to staff costs and the key output would be the development of a prototype of applications that could be run on smart phone or tablet PC.

There is potential gross impact of £20m over the next 5 years based on an anticipated one million installations by Avanti and partners, and estimated cost savings per installation using SATBIS of at least £20 based on increased productivity. SATBIS would also allow upskilling and recruitment of less skilled installation engineers, quicker service roll-out and reduced training.

The Application Process

2.17 According to the survey respondents, **the most common method through which winners discovered the TSB competition was word of mouth (40%),** with the next most common mediums being TSB email (27%) and the TSB website (22%). The popularity of these three methods is essentially the same for non-winners (proportions of 39%, 24% and 23% respectively).

2.18 As it is probably expected, given the nature of a pilot programme, a noticeably larger proportion of organisations participating in the pilot found out through email (36%), with the pattern repeated for word of mouth (38%) and the TSB website (23%).

2.19 The majority of winners felt that downloading relevant documentation **was very useful (51.4%); only 3.2% felt that this was not at all useful.** In terms of providing clear instructions for the completion of the application, **50.9% felt this to be very useful with 2.8% feeling it to be not at all useful.**

2.20 **A slight shift is noticeable in terms of uploading relevant documentation: 47.2% felt this to be very useful with 4.6% finding this not at all useful**.

2.21 The majority non-winners found downloading the information either very useful or useful, with 30% stating that downloading the information was very useful and another 38% finding it useful. Only 4% found it not useful at all.

2.22 Applicants were also asked to rate their experience of the overall application process by giving it **a score between one (confusing) and five (straightforward).**

- Overall, just over a third of applicants (winners and non-winners) gave the application process a score of five, while just under a third gave a score of four. So **overall, two thirds of applicants scored the process as more or less straightforward.**
- At the other end, around **just 5% of all applicants felt the process was confusing (score=1). Another 9% gave the overall application process a score of two.**
- Just fewer than 20% of all applicants gave the process a score of three.
- Two thirds of applicants scored the process a four or five.

2.23 A much lower proportion of winners score the overall application process a one or two (8% for winners compared to 19% for non-winners), while a lower proportion of winners give the process a three (14% for winners compared to 23% for non-winners).

2.24 Overall, the distribution of scores is similar for winners and non-winners in that in both cases the majority of applicants rate the process a four or five, and the proportions scoring the process a three, two or one get progressively smaller. **The key difference is that among winners this distribution is more acutely skewed towards a score of four and five (and away from a one or two). For non-winners, the distribution is smoother.**

2.25 Around a **third of all applicants sought further clarification whilst trying to complete the application**, while just less than two-thirds did not. Breaking this down, however, indicates that a higher proportion of winners sought clarification in comparison with non-winners (40% compared to 27% for non-winners). And thus a lower proportion of winners did not seek clarification (59% compared to 72%) for non-winners.

2.26 Organisations were also asked whether they sought external advice when completing their application and, if so, did they pay for this. **It is worth noting that the large majority of organisations did not require external assistance (93% of winners and non-winners and 95% of pilot firms).** None of the pilot firms paid for any external assistance that they received. On the other hand, around 70% of all applicants to the 2010-11 Programme that received external assistance did not pay for it.

2.27 **Of those who sought external assistance a larger proportion of non-winners (38%) were paying for it compared to winners (24%).**

Use of the TSB Website

2.28 Applicants were also asked to state how often they visited the TSB/FSP website. The survey results showed that:

- Around half of all applicants visited the TSB website once a month, although there was a noticeable difference between winners and non-winners. Around just 41% of non-winners visited the website once a month, whereas nearly 60% of winners visited the website once a month.
- Around a quarter of all applicants visited the TSB website every couple of months, with similar rates for both winners and non-winners.
- Around 10% of all applicants visited the TSB website every six months, with similar rates for both winners and non-winners.
- **Compared to winners (7%), a much higher proportion of non-winners (nearly 22%) never looked at the TSB website or looked at it less than once a year.**
- As might be expected, **those that give the application process the lowest score (one) use the TSB website less frequently, whilst those that give it the highest score (five) use the TSB much more frequently**. For example, among those that score the application process a four or five, 79% look at the TSB website once a month or every couple of months, while around 10% never look at the website or do so less than once a year. On the other hand, among those that score the application process a one, just 48% look at the website once a month or every couple of months, while around 38% never look at the website or do so less than once a year.

Key Programme and Project Objectives

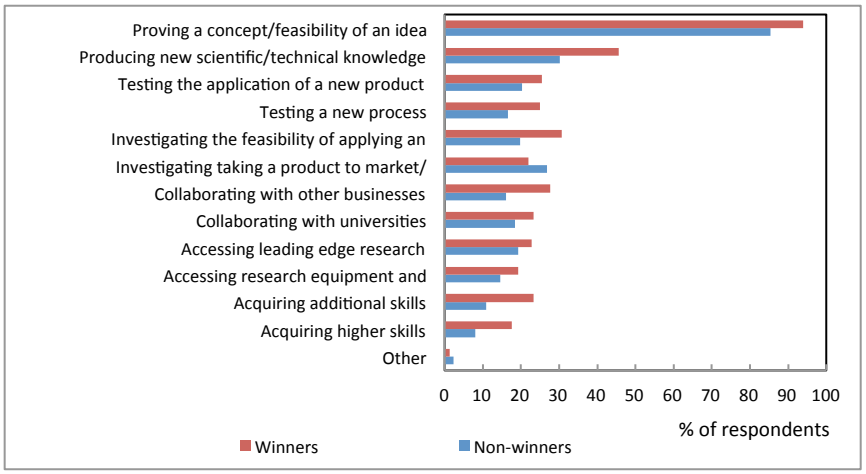
2.29 What applicants under the 2010-11 Programme *were expecting* from any funding received i.e. their immediate project objectives, is detailed in Figure 2.12[10]. In summary:

- Broadly speaking, the frequency of responses is similar across winners and non-winners: **'proving a concept/feasibility of an idea' was by far the most commonly cited intended objective from the funding,** with 94% of winners and 85% of non-winners intending to spend any funding received on proving a concept or the feasibility of an idea.
- The next most common purpose for the funding, among both winners and non-winners, was for producing new scientific or technical knowledge, but just 30% of non-winners and 45% of winners intended to spend any funding in this way.
- As a general rule, across all the options given for how the funding might be spent, a slightly higher proportion of winners responded affirmatively. The one exception to this **was 'investigating taking a product to market/commercialising an idea', which was more popular among non-winners than winners as an option for how funding might be spent.**
- There was a marked difference in the proportions of winners and non-winners intending to spend the funding on **acquiring additional or higher skills, with higher proportions of winners intending to use at least some of the funding for this purpose.**

[10] Note: respondents were able to indicate more than one purpose for the funding.

- A higher proportion of winners also intended to spend at least some of the funding on accessing leading edge research or accessing research equipment and infrastructure, but the difference was not so large.
- Similarly, **a higher proportion of winners intended to spend funding to support collaboration** (with other businesses or universities), but the difference was greater in the case of collaboration with other businesses.

Figure 2.12: Objectives/Expectations from Participating in FSP



2.30 It is worth noting that, broadly speaking, the activities supported through the pilot programme are similar to those seen across winners and non-winners from the 2010-11 Programme. 'Proving a concept/feasibility of an idea' was by far the most commonly cited purpose for the funding, followed much further behind by 'Producing new scientific/technical knowledge'. However, compared to winners and non-winners from the 2010-11 Programme, lower proportions of pilot beneficiaries intended to use the funding to access leading edge research or access research equipment and infrastructure; or, to investigate the feasibility of applying an existing product/process to a new area or taking a product to market. This would suggest that the 2010/11 Programme offered/opened up more avenues for businesses to access innovation and R&D and Technology support than the earlier programme.

2.31 Activities listed in Figure 2.12 have been grouped together to enable comparisons with the objectives of participants in the Collaborative R&D Programme. As shown in Figure 2.13, FSP applicants were clearly more likely than the participants in the Collaborative R&D Programme to intend to primarily use the funds for proving a concept/investigating the feasibility of technological idea.

Figure 2.13: Overall objectives for participating in the Programmes (%)

	Winners		Non-winners	
	C R&D	FSP	CR&D	FSP
Taking a product to market	80%	22%	79%	27%
R&D Collaboration	80%	43%	46%	32%
Innovation / R&D skills and processes	82%	32%	56%	25%
Proving a concept/investigating the feasibility of an idea	88%	96%	69%	88%
Testing a new product/ processes	89%	51%	77%	40%
Number of respondents	282	228	88	212

Delivery of FSP

Collaborative Activity

2.32 483 organisations were involved in the 325 winning projects. An overview of these collaborations is presented in Figures 2.14 and 2.15. Overall:

- Just over half of all winners (51%) collaborated with another partner, while just under half undertook the project alone.
- Companies in Digital related studies were more likely to have gone ahead alone; only 15% of winners had partners. On the other hand, all organisations in the Nuclear competition collaborated with another partner.

2.33 In terms of types of partners, of those projects that did have a partner:

- All winning projects were led by a business/the industry (as per requirements of FSP competitions).
- 47% indicated their partners were small businesses. Over half of these (56%) had worked together before.
- 20% worked with a large business (44% of these worked together before).
- 44% worked with an education institution, just two thirds of these (63%) had worked together before.
- The Health and Medical sector had the largest amount of academic collaborators whilst Energy and Nutrition for Life collaborators are the only ones to have all industrial companies working on the projects (albeit a small number).

Figure 2.14: Collaborative Activity by Sector for FSP Winners

Sector	No of all organisations involved	No of organisations leading all projects	No of partners/ collaborators across all projects
Health and Medical	66	38	28
Nuclear	43	18	25
Biotechnology	17	8	9
Digital Services	106	79	27
Nanotechnology and Materials	121	92	29
Space	114	77	37
Energy	9	8	1
Nutrition for Life	7	6	1
Total	483	325	158

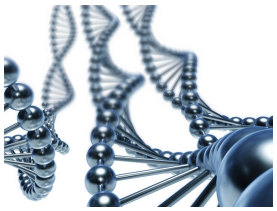
Figure 2.15: Type of Organisations by Sector for FSP Winners

Sector	No of Leaders		No of Collaborators	
	Industrial	Academia	Industrial	Academia
Health and Medical	38	0	9	19
Nuclear	18	0	24	2
Energy	8	0	1	0
Biotechnology	8	0	7	2
Digital	79	0	26	1
Nanotechnology and Materials	92	0	26	3
Space	77	0	21	16
Nutrition for Life	6	0	1	0
Total	325	0	115	43

2.34 As the following example indicates, it was also possible for a company to get involved in more than one projects partnering with various organisations as the following case study indicates.

RECOMBINASE POLYMERASE AMPLIFICATION (RPA) DIAGNOSTICS

TwistDx is a company specialising in developing and marketing DNA diagnostics using a patented technique known as Recombinase Polymerase Amplification (RPA). It was founded in 1999 and was incorporated in 2002 as a limited company. TwistDx is a multi-site organisation with headquarters on the Babraham Research Campus, Cambridge with 50 employees (Nov 2012 compared to 12 in 2009), 95% of which are full time.



The project involved development of rapid (15 minute) point of care (POC) diagnostic tests for three diseases. The project was seen to be risky and uncertain such that without TSB funding it would not happen. *'RPA is a wide platform and TwistDx has limited resources to exploit it. It is only the formation of this consortium funded by the TSB that makes the development of this diagnostic feasible'.* The company was successful in securing TSB funding along with several partners for feasibility studies for three projects as follows:

- Pneumonia rapid test: *Mycoplasma pneumoniae*, a major cause of community-acquired pneumonia (CAP) is identified by the Department of Health as a priority area. Correct diagnosis of *M pneumoniae* will reduce prescription of ineffective antibiotics thus reducing the likelihood of antibiotic resistance. The costs of each test will be less than £20 so there is a possibility if substantial socio-economic impact for the UK. For example, a 1% reduction in pneumonia as a result of tests would be worth £4.4m per year. **AHVLA (formerly known as Veterinary Laboratory Agency) and Kingston University London were partners in the project.**

- Tuberculosis rapid test: *Mycobacterium Tuberculosis*, the causative agent of tuberculosis (TB) is identified by the Department of Health as a priority area. At present there are no rapid POC tests for *M. tuberculosis*. Traditional microbiological approaches are slow and cumbersome and molecular methods based on PCR are not ideal for POC application. The global economic burden of TB is huge globally with World Health Organisation estimates suggesting patients lose 9.5 months of work time and 30% of income. There are 9m new cases of TB each year and 1.6m deaths with 4m undiagnosed cases each year. It has been estimated that a rapid test could avert 400,000 deaths each year. **The London School of Hygiene and Tropical Medicine was a partner in this project.**

- Veterinary targets – for 3 notifiable viral diseases namely, *Classical Swine Fever, African Swine Fever and Avian Influenza:* Current control measures involve testing and rapidly "stamping out" disease by slaughter of animals on infected premises and as such increased decision making on site will reduce spread of disease. The CSF outbreak in 2000 cost £4.4m in compensation alone (Defra) and £17m in total (TwistDx). **AHVLA was a partner in this project.**

2.35 Additional analysis comparing the age bands the proportion of organisations that collaborated and the proportion that did not indicates that:

- Just 30% of firms aged 1-2 years old collaborated with partners, much lower than the proportion for all winners.
- Around half or just over half of firms aged 3-4 years old or five years old had partners working with them on the project, in line with the proportion for all winners.
- Just over 40% of firms aged 6-10 years old collaborated.

- Two thirds of firms aged 11-20 years old and just over 60% of firms aged over 20 years old had partners, well above the average for all winners.
- As a general rule, **older firms were more likely to collaborate, but this holds only weakly because the result for firms in the 6-10 years old age band contradicts this**.

2.36 Finally, there seems to be **no distinct relationship between the size of the project and the size of collaboration/number of collaborators.**

Organisational Resources Funded by FSP

2.37 Of the FSP funding they received, 2010-11 winners and 2008-09 pilot beneficiaries were asked what proportion was spent on:

- Additional staff costs;
- Supplier costs;
- Prototyping and testing;
- Market testing;
- Capital; or,
- In some other way.

2.38 Figure 2.16 indicates where funding received was spent on average. Figure 2.17 provides more detail. In the case of 2010-11 winners, across each option roughly 12% of respondents did not know while 1% or less refused to answer. In the case of 2008-09 beneficiaries, across each option roughly 5-7% of respondents did not know the answer. There were no refusals.

2.39 The key messages emerging from this analysis indicate that:

- The majority of winners have distributed the FSP grant across various capital and revenue needs (as opposed to using the whole grant on a single type of need).
- However, it is **more likely that some portion of FSP has been spent on additional staffing costs than other needs,** with 70% spending some proportion of the FSP grant on additional staff costs. In fact, a quarter of them (roughly 12% of all respondents) spent all FSP on additional staff costs. On average, however, over half the FSP grant has been spent on additional staffing costs.
- Just fewer than 50% of respondents stated that they spent some proportion of FSP on supplier costs. And of these, around a fifth (roughly 1% of all respondents) did spend all of the funding on supplier costs. On average, 18% of the grant has gone to expenditure relating to suppliers.
- Around 40% of winners spent some proportion of the funding on prototypes and testing, with around half of these (5% of all respondents) spending all of the funding on prototypes and testing. On average, 16% of the FSP grant has been used for prototypes and testing.
- Only 15% of winners spent some proportion of the funding on capital – hardware or software. Not one winner spent all of the funding on capital. Indeed, no winner spent more than half of the funding on capital, and less than 2% of respondents said they spent more than 25% of the funding on capital. Only 4% of the grant would go to capital expenditure.
- Only 10% of winners spent some proportion of the funding on market testing. On average this was not more than 3% of the grant received.
- The patterns of the allocation of the grant between 2010/11 winners and the pilot beneficiaries were very similar.

Figure 2.16: Average Resource Allocation of FSP (%)

Organisational Resource	Average Estimated Spent of Grant %
Additional Staff Costs	55%
Prototypes and Testing	18%
Supplier Costs	16%
Capital (hardware and software)	4%
Market Testing	3%
Other	5%

Figure 2.17: Detail of FSP Resource Allocation

Additional staff costs
Just over 15% of winners spent none of the funding on additional staff costs. **Over 70% spent some proportion of the funding on additional staff costs.** Of the winners who spent some proportion of the funding on additional staff costs: • Around two-thirds stated that they spent over half of the funding on additional staff costs, with around a quarter of them (roughly 12% of all respondents) spending all of the funding on additional staff costs; • Just over a quarter said they spent between 25% and 50% of the funding on additional staff costs, while just 6% said they spent 25% of the funding or less on additional staff costs.
Supplier costs
Around 40% of winners spent none of the funding on supplier costs. 12-13% refused to answer or did not know, with just under **50% of respondents stating that they spent some proportion of the funding on supplier costs.** Of the winners who spent some proportion of the funding on supplier costs: • A little fewer than 10% (around 4% of all respondents) said they spent over half of the funding on supplier costs, with around a fifth of them (roughly 1% of all respondents) spending all of the funding on supplier costs. • Around a third said they spent between 25% and 50% of the funding on supplier costs, while the remaining 60% (30% of all respondents) said they spent 25% of the funding or less on prototypes and testing.
Prototype and testing
Nearly 50% of winners spent none of the funding on prototypes and testing and 12-13% refused to answer or did not know. **Around 40% of winners spent some proportion of the funding on prototypes and testing.** Of the 40% of winners who spent some proportion of the funding on prototypes and testing: • Around a quarter (just over 10% of all respondents) said they spent over half of the funding on prototypes and testing, with around half of these (5% of all respondents) spending all of the funding on prototypes and testing. • Another quarter said they spent between 25% and 50% of the funding on prototypes and testing, while the remaining half (or 20% of all respondents) said they spent 25% of the funding or less on prototypes and testing.
Market testing
Over 75% of winners spent none of the funding on market testing, **with 10% of winners spending some proportion of the funding on testing**. • Some winners did spend more than half of the funding on market testing, but overall it was less than 1%. • Of the 10% of winners that spent some of the funding on market testing, the vast majority of

them (7.8% of all winners) spent 25% of the funding received or less on market testing.
Capital (hardware and software)
Over 70% of winners spent none of the funding on capital (hardware or software), **with around 15% of winners spending some proportion of the funding on capital.** Not one winner spent all of the funding on capital. Indeed, no winner spent more than half of the funding on capital, and less than 2% of respondents said they spent more than 25% of the funding on capital.
Other
Around 20% of winners spent some of the funding on something else than the above but less than 1% spent *all* the funding on something else. 'Something else' included travel, materials other than capital, and various overhead expenses. • Some winners did spend a high share of the funding (66-85%) on something else, but it was typically just one or two respondents (less than 1%) in each case, so in total less than 2% of winners spent more than half of the funding on something else. • Of the 20% of winners that spent some of the funding on something else, just over half of them (11.4% of all winners) spent between 5% and 20% of the funding on other items.

3. Benefits of FSP

3.1 This section reports actual and anticipated benefits and impacts generated by the FSP support as reported by the businesses participating in the survey. It also presents an overall comparison of achievements versus the original expectations of businesses from participating in the Programme. Benefits of FSP include those in relation to:

- **R&D Capacity and Capabilities** including direct results of the FSP support on technological improvements and development of new products but also strengthening of R&D capabilities through more/better access to commercialisation skills, leading edge research and strong collaborative activities.
- **Business performance indicators** such as turnover, profits, sales, productivity but also QCD related (i.e. Cost, Quality and Delivery), behavioural e.g. collaborations, attitudes towards R&D and technology, learning and awareness, and leverage (financial but also business profile).
- **Wider economic and societal benefits** including further job creation, use of energy, health, social care, education, transport and improvements in general living / quality of life conditions.

KEY EMERGING POINTS

- For the vast majority of winning organisations (94%), the main aim of the feasibility study was to prove a concept or investigate the feasibility of an idea. For 95% of these, the aim has been met or will be met in five years. Only 4% stated that their objective would not be met at all. In general, the FSP feasibility studies have met the expectations of the winning organisations.
- The only area where FSP was less effective was in relation to investigating the application of an existing product or a process in a new area.
- Comparing winners against non-winners who went ahead with their project, a much higher proportion of non-winners reported already having benefited from their project. However, **the impact of the project was expected to be more enduring for winners**: 45% of FSP supported organisations expected benefits to last indefinitely; only 25% of non-winners expected project benefits to last indefinitely.
- For most businesses, **the FSP support delivered *immediate* technological and R&D related benefits.** More specifically, over three quarters of all winners (78%) produced new technical knowledge while 88% explored the application of technologies. For the vast majority of winners, the FSP support also enhanced immediately both technical/R&D skills and technical understanding (80% and 90% respectively). It is noteworthy that only two thirds (66%) stated that the project gave them the opportunity to *access* new technical and R&D skills and only 45% gained access to leading edge research.
- Over half the winning organisations (53%) have already seen the value of their business increased as a result of FSP. Over two thirds (69%) also saw their business profile raised. Most businesses also expected to see improvements in other key business performance indicators e.g. employment, profit and turnover in the future.
- However, it is worth noting that none of the non-winners had benefited from easier access to finance as yet. On the other hand, **just under a third of winners had benefited.**
- In terms of collaborations and networking, collaborating proved challenging only for 10% of businesses. In fact, the FSP support helped over two thirds of winners (67%) **to improve their business networks.**
- On the other hand, for over half the winners (54%) the support had not led to enhanced networks in HEIs nor was expected to do so in the future. In relation to the latter, it needs to be noted that only under a quarter of winners (23%) were expecting to benefit from collaborating with HEIs as a result of FSP in the first place.

- **Job creation was strongly identified as a wider benefit that had been, or would be, generated by the projects.** However, **the impact of winners' projects on generating wider social benefits was generally weak.**
- Around **40% of all winners said benefits would *only* apply to the UK. Around 80% stated that these benefits would *also* apply to global economies.**

Benefits of FSP on R&D Capabilities

3.2 The winning organisations were asked to identify the benefits that materialised from participation in FSP and the support received. Figure 3.1 presents the FSP benefits related to technological and R&D capabilities.

Figure 3.1: FSP Benefits - Technological and R&D Capabilities

Benefits	Actual/has materialised	Will materialise in the future	Will not materialise
Products/Services			
Develop new product/service(s)/processes	58%	34%	8%
Improve existing product/service(s)/processes	46%	14%	40%
Technological			
Produce new scientific/technical knowledge	78%	7%	15%
Explore the feasibility/application of technologies	88%	7%	5%
Investigate the technical feasibility of an idea/ideas	90%	4%	6%
Investigate the commercial feasibility of an idea	58%	16%	26%
Improve technological readiness of the business	73%	10%	17%
R&D Capabilities			
Access commercialisation skills	23%	9%	68%
Access technical / R&D skills	66%	4%	30%
Access leading edge research	45%	3%	52%
Access equipment and research infrastructure	42%	5%	53%
Strengthen collaborative activity with other businesses	61%	4%	35%
Strengthen collaborative activity with HEIs	39%	3%	58%
Provide placements/sponsorship for research students	15%	8%	77%

3.3 The most notable results arising from these figures could be summarised as follows:

- FSP has helped around 90% of winners to actually investigate the technical feasibility of an idea and 78% to acquire new scientific/technological knowledge.
- For approximately three quarters of businesses (73%), FSP has helped to improve the technological readiness of their business.
- For over half the winning businesses (58%), FSP has helped to investigate the commercial feasibility of ideas.
- Over half of respondents (58%) of the respondents have developed new products/service(s) and 46% have improved existing products service(s) or processes.
- The large majority of winners (77%) did not expect to see any benefit in the provision of placements or sponsorship for placement for research students.

3.4 A more detailed analysis of each set of benefits is provided below including any sectoral/competition themes and differences between winners and non-winners.

Technological Knowledge and Capabilities

- **The FSP projects were associated with a large amount of immediate benefits in this area. Over three quarters of all winners (78%) have produced new technical knowledge while 88% have explored the application of technologies.** Winners were more likely to investigate technical rather than commercial ideas with 91% having investigated a technical idea – as example below. On the other hand, a lower proportion, 58%, explored the feasibility of a commercial idea (whilst an additional 26% stated that it would not materialise).

RF POWER SOLUTIONS - HIGH POWER ELECTRONIC SWITCH

The project was undertaken by **easel Technologies Ltd.** The principle aim of the study was the design of a high power (13.56 MHz) electronic switch together with the results of simulations showing the correlation between theory and practice. This was based on a PIN diode whose main application is in military communication systems but its 'rugged' characteristics were seen to make it ideal for the transient loads experienced during power matching.

Advanced semiconductors are made of materials deposited and etched using gas plasmas. The plasmas are generated with radio frequency power, which has to be coupled into the plasma using a device called an automatic matching unit (AMU). It is analogous to an engine and gearbox: the correct gear is selected to ensure smooth operation of the engine. The AMU adjusts itself to ensure the generator can deliver its power efficiently. All AMUs are electro-mechanical and are adjusted using motor driven variable capacitors. **The maximum speed of operation is a few seconds and this is limiting the performance of the entire equipment. Recent advances in a type of high frequency switching device mean that a digital solid-state version could be developed, potentially resulting in a step change in performance and reliability.**

The delivery of the PIN diodes was delayed by the US-based manufacturer and this limited the amount of work that could be completed within the timescale. The time available due to the delivery delay was put to good use to look at another aspect of the design (concerned with the controlling circuit) with interesting result, which may lead to another (initially unforeseen) patent application. At the end of the assistance, the design was completed and initial testing achieved good results. These need to be extended to verify its 'ruggedness'. The design of the controlling circuit was started and a 'breadboard' prototype was completed. To develop the complete product will require additional work split into a number of distinct phases.

The main market for advanced specification matching units is the equipment companies and is currently estimated at $ 44 million/year. **If the new design is successful, it is likely to supplant existing mechanical units in applications. The size of the matching unit market across all sectors is currently around $ 90 million/year. According to easel technologies, the study has allowed to prove the underlying principle that could be exploited in a new product that has the potential to be a disruptive technology in a global market estimated at $90 million per year.**

- It is worth noting that in terms of assessment of benefits by sector, Nanotechnology accounted for 35%-38% of firms that immediately felt these two knowledge benefits. Space accounted for most winners who felt that benefits would be of longer term. Nanotechnology and Health firms were more likely to have investigated commercial ideas with the support of FSP. On the other hand Space and Digital were more likely to have pursued technical ideas.

Developing products

- Almost half of winners (46%) have already seen a benefit in improving existing products while 58% have already seen this benefit with new products. **The development of new products seems to be more skewed towards benefits felt in 1-5 years whereas many of the improvements of existing products broadly appears to be felt immediately or not at all.**
- Nanotechnology firms accounted for 38-40% of the winners that have seen immediate benefits in terms of being able to develop new products as a result of FSP. Space and Digital were the next largest group of firms to immediately experience benefits but appeared to have greater proportions of winners believing that benefits would materialise in the longer term.

Access to R&D Capabilities (Skills, Infrastructure, Collaborations)

- **Most respondents who went ahead with a project experienced improved *access* to R&D capabilities. However, respondents appeared sceptical over *continuation* of this benefit in the future.**
- The large majority of winners (66%) reported that they benefitted from improved R&D capabilities. However, 30% of winners did suggest that they would not experience improved access to these capabilities through their project. Only 4% of winners expected any *further* benefit in the future.
- A large number of non-winners (87%) did not answer this question due to abandoning or postponing the project. For those who did answer the question, there was a similar pattern to the winners with around 8% suggesting that they had experienced improved R&D improvements while around 4% said that they would not.
- The pilot group follow a very similar pattern to that of the winners as 61% reported immediate benefits to R&D skills while 30% expected there to be no such benefit. However, it is interesting to note that a slightly higher proportion (compared to the winners) expected improvements in R&D skills between 6 months and 2 years' time.
- There was a **noticeable split between commercial and technical/R&D skills** with 68% of winners stating that they would not see improved access to commercial skills, yet 66% believed that they had already experienced improved access to R&D skills.
- The two main differences from the broad trend occurred with Digital and Space. Digital projects matched the R&D skills trend i.e. more likely to have seen access to R&D skills immediately. On the other hand, Space companies followed the broad commercial trend i.e. the majority of firms stating that they have not seen any commercial benefits as yet.
- With regards to **access to leading edge research, this was a benefit that was felt immediately or not at all;** 51% of winners not thinking that they would see improved access to research in the future and 53% stating that they would not access the related equipment and infrastructure.
- In terms of **collaborations, improvements seemed to have been immediate or non-existent. Furthermore, any collaboration seemed more likely to happen with other businesses rather than higher education authorities**. In fact, the FSP support helped over two thirds of winners (67%) **to immediately improve their business networks.** On the other hand, for over half the winners (54%) the support has not led to enhanced networks in HEIs nor is expected to do so in the future. In relation to the latter, it needs to be noted that only under a quarter of winners (23%) were expecting to benefit from collaborating with HEIs as a result of FSP in the first place.

Benefits of FSP on Key Business Performance Indicators

3.5 No business mentioned that their expectation from participation in FSP had to do with improving their key business performance indicators (see Figures 2.12 and 2.13). In contrast, however, to expectations, the FSP has delivered some notable business related results as shown in Figure 3.2.

Figure 3.2: FSP Benefits – Business Performance

Benefits	Actual/has materialised	Will materialise in the future	Will not materialise
Business Performance			
Enter new markets or increased market share	35%	55%	10%
Increase export sales (or start exporting)	16%	57%	27%
Increase income from intellectual property	22%	35%	43%
Increase turnover	30%	60%	10%
Increase profits	24%	64%	12%
Increase employment	31%	48%	21%
Improve productivity	21%	18%	61%
Increase values of business	53%	34%	13%
Easier to access finance	32%	16%	47%[11]
Lever additional funding	35%	28%	37%
Lever business profile	69%	15%	16%
QCD			
Reduce costs of production	11%	8%	81%
Reduce costs of business running	6%	6%	88%
More efficient use of resources	21%	9%	70%
Reduce waste	8%	7%	85%
Improve quality of products/processes/services	43%	16%	41%
Improve delivery times	11%	9%	80%
Skills and Capabilities			
Improve commercialisation skills	42%	6%	52%
Improve technical /R&D skills	80%	4%	16%
Improve technical knowledge / understanding	90%	5%	5%
Enhance equipment & research infrastructure	35%	7%	58%
Enhance networks in business	67%	6%	27%
Enhance networks in HE	40%	6%	54%

3.6 Unsurprisingly, it seems that on average, only one in three businesses saw some improvement in one or more key business performance indicators. However, the value of the business and leverage of business profile increased for a relatively large group of businesses:

- 53% of businesses stated that they have seen an increased value of their businesses; and,
- 69% have been able to lever their business profile (although **most** respondents have not seen easier access to finance as yet nor have managed to leverage additional funding).

3.7 In relation to other operational and human capital business indicators, interpretation of the results should consider the following:

- Quality, Cost and Delivery (QCD) indicators are only relevant where the objective is to improve *existing* products, services or processes (as opposed to testing or developing a new product as

[11] 5% stated that they did not know. In all other instances 'do not know' responses were around 0.5% only.

it is too early to apply/assess these indicators in those areas). Only a third of all winners (31%) stated that their objective was to test/improve existing products or processes.

- TSB/FSP support did not, or was not expected to, have impact on reducing costs (business costs or production costs) for winners (as per expectations presented in Figures 2.12 and 2.13).

3.8 Detailed analysis of the key areas of business performance is provided below.

Market and Financial Benefits

3.9 **Entering new markets:** Comparing winners against non-winners who went ahead with their project, a much higher proportion of non-winners (73% compared to 34%) reported already having benefited from the project through entering new markets or increasing market share. However, the impact of projects targeting increase in market share appears to come in the long-term for winners: non-winners do not expect to benefit after two years, but around 55% of winners expect to benefit over the next 2-5 years and beyond by potentially entering new markets and subsequently increasing their sales and turnovers as the following case demonstrates.

GAS SENSING SOLUTIONS

OptoSci Ltd., Founded in 1994, is a leading producer of photonics instrumentation systems for the international academic and research markets and has extensive expertise in the development and manufacture of optoelectronic and fibre optic instrumentation.

Previous research with the University of Strathclyde and Rolls Royce Fuel Cell Systems (RRFCS) was done to test the sensor system on solid oxide fuel cells (SOFC). During this testing the results showed significant market opportunities for a system that could be readily embedded into a complete process control and monitoring solution or as a stand-alone instrument for scientists. The money was sought from TSB to produce a new prototype that was compact, capable of long-term, remote operation, and would offer the potential for multi-gas analysis and / or multi-sensor detection. The project has been successfully completed resulting in a compact laser-based dual gas analyser for remote, long-term process control of solid oxide fuel cells.

This feasibility study has enabled OptoSci to prove the instrument's value. This should enable a full further collaboration with RRFCS, with a view to lead to some direct sales by RRFCS for evaluation systems with considerable market share benefits in the long-term. The global SOFC market is expanding rapidly, is conservatively estimated at £750m+ and has demonstrated 20% year-on-year growth for the past decade. A typical 250kW SOFC costs around £0.5m, hence £227m revenue equates to 590 SOFC units sold per annual, of each of which would potentially require a gas monitoring system. At an estimated £25k sales price for a fuel cell gas monitoring system, this yields a potential annual market opportunity of around £15m.

3.10 **Turnover**: The largest group of winners (20%) estimated their annual turnover (or sales) as equating to zero in 2009 (the next largest group at 14% was between £50k and £150k). The majority estimated their current turnover at £50k and £150k (16.7%)

3.11 **Profits:** It is worth noting that non-winners who went ahead with their project made up a very small survey group (30 respondents). Nevertheless, looking at the potential of the project to generate increased profits, the vast majority of winners and all non-winners had realised or expected to realise increased profits as a result of the project/FSP support. A noticeably higher proportion of the earlier pilot beneficiaries had not or did not expect to benefit from increased profits. Between winners and non-winners, the key difference was in the timing. All non-winners had already benefited or expected to benefit within the next two years. Among winners, only

about 60% had already benefited or expected to benefit within the next two years; nearly 30% expected the project lead to increased profits in the next 2-5 years or beyond.

3.12 In terms of **productivity:** The impact of projects on productivity was broadly similar for winners and non-winners except that a far higher proportion of non-winners expected to see improved productivity in the next 6-12 months. In both cases, a high proportion had not benefited from improved productivity and did not expect to do so in future. For example, just over 60% of winners and 45% of non-winners who went ahead with their project indicated that the project/assistance had neither led nor was expected to lead to improved productivity.

3.13 **Employment**: While 20% of winners indicated that their project had not or would not lead to an increase in employment, all non-winners that went ahead with their project had experienced or expected an increase in employment as a result. Non-winner projects appear to have a stronger impact on employment, but as with other features of business performance the benefits to non-winners expected to materialise mostly within one to two years, with very little expected thereafter.

3.14 **Access to finance:** The experiences of winners and non-winners with regard to how the project affected their abilities to access finance were mixed. They were similar in that in each case over half of respondents were unable to indicate a positive impact. **However, although none of the non-winners benefited from easier access to finance to date, just under a third of winners had done so**. One of the main obstacles cited for accessing finance appears to be the unwillingness of the end user/beneficiary to acknowledge the potential benefits of the project for their business, as the following example highlights.

SMART DEVICE DELIVERY OF MULTI-MODAL REAL-TIME PASSENGER INFORMATION

The project aimed to deliver a tool that would provide accurate and timely information to public transport passengers identifying delay and disruption and identifying alternate routing options over the same and alternate modes of travel. **Broadband Access Strategies LLP (BASLLP)** a technology and business consultancy specialising in broadband, transport and wireless issues and with particular interest and experience in solutions for the travelling public partnered with **Agant Ltd., a mobile applications agency.** For each respective party 97% of the fund was spent on labour and the remaining 3% was spent on travel and subsistence.

The funding was primarily for investigating the feasibility idea of using smart devices such as phones and tablets to ease the process of finding alternative routes and modes of transport to lessen the discomfort and disruption to passengers. FSP was the only additional finance available for testing the feasibility of an idea. Prior to TSB, funding was requested to no avail from service providers and train operating groups.

According to the companies, the major problem arising in implementing the research and getting other forms of funding was that *"The operators **do not yet recognise that it is in their best interest to undertake this work**; 'ticket sellers' understand the complexity of the task but are awaiting for the operators to demand a new solution."*

The project successfully identified the opportunities and barriers for creating a real-time multi-modal journey-planning app based on a smartphone device. A working prototype app was created based upon the Transport Direct UK-wide journey planner, integrated with existing real-time services. However, it was not possible to implement dynamic real-time journey adjustment based on known disruptions, due to limitations in existing data. An alternative approach was identified to assist the user with amending and refining their journey plans as they unfold, with more of a focus on dynamic re-planning based on the user's current position in a scheduled journey.

This project, and the prototype app it has created, has demonstrated the value of a mobile enabled multi-modal journey planner app augmented by real-time data. The market potential for such an app includes both inter-city travellers and commuters. Its key impact is to enable travellers to take control of their multi-modal journey when disruptions occur. This has the dual benefit of both empowering travellers and reducing the load on transport staff in times of disruption.

Gaps were identified in the availability of local-scale real-time data, most notably for bus services. This data is not always available in a computer-accessible format, and is not aggregated across bus companies to provide a definitive source of data. Resolving this would require **numerous agreements with multiple providers, or would require the creation of a national aggregation service for this data.**

Quality, Costs and Delivery

3.16 At the headline level, **the impact of projects on quality improvements (to products, processes or services) is not too dissimilar for winners and non-winners that went ahead with the project**: around 60% of winners reported a benefit at some point in time, while roughly 70% of non-winners reported a benefit at some point in time. **The key difference is that the remaining share of non-winners expected benefits to materialise in the next 6-12 months, with nothing materialising in the time horizon thereafter, whereas winners expected quality improvements to materialise at each point over the next five years.**

3.17 A greater share of non-winners than winners who went ahead with a project expected to benefit from lower business or production costs at some point in time. Around 80% of winners reported that the FSP support had not helped to lower production costs and was not expected to.

3.18 The ability of the projects to deliver benefits in the form of reduced waste or more efficient resource use was generally assessed as low.

- Around 70% of winners (including the early pilot beneficiaries) stated that the FSP support had not led, and would not lead, to more efficient resource use.
- 21% of winners stated that FSP support had already resulted in them making more efficient use of resources.

Acquisition of New Resources (Skills, Infrastructure and Collaborations)

3.19 For the vast majority of winners, the FSP support meant improvements in both technical/R&D skills and technical knowledge and better understanding (80% and 90% respectively). In addition:

- As it would be expected given the reported limited access to equipment and research infrastructure (45% as shown in Figure 3.1), just over a third of winners (35%) reported that the FSP support enhanced their research infrastructure.

Next Steps

3.20 Respondents were also asked specify any challenges they may have faced in undertaking the study. Overall, 60% confirmed that they faced some challenges during the project. Of those that cited experiencing challenges, issues faced during the project:

- Almost half (45%) were technological
- Around 10% were funding related
- A further 10% were related to skills resources
- Just over 10% arose from the collaboration
- Just under 4% were related to equipment resources
- A fifth arose for some other reason.

3.21 15% of the companies stated they had not decided as yet what next as they were waiting further funding either from TSB, Smart Award, European funding or the UK Space Agency, or the private sector, as per example below.

FREEZE-THAW TREATMENT PROCESS FOR FRUIT

Asymptote Limited specialises in controlled solidification research and product development. It builds equipment for use in regenerative medicine and biotechnology. The company is based in St John's Innovation Centre in Cambridge. Its expertise in freezing and crystallisation covers a wide variety of applications including cryopreservation, freeze-drying and scale control. Asymptote's products and process technologies are tailored to its customer's requirements and have resulted in significant advances in disciplines ranging from cell therapy to the food and pharmaceutical industry.

Asymptote was successful in securing TSB funding for a feasibility study to work with the University of Cambridge on developing a freeze-thaw treatment process for fruit. The project aimed to address a major barrier to the purchase and consumption of fruit, namely the rapid deterioration in quality during storage by developing a rapid freeze treatment to disable the biological 'engine' (the mitochondrion) of the cell. If successful, the project was seen to have potential for wider impact, in particular:

- It has application to other high value plant tissues such as leaf salad, vegetables and flowers;
- It may open up markets for high value produce currently with limited shelf life without the reliance on airfreight; and,
- Extending the shelf life has the potential benefit of reducing waste. The level of fruit and vegetables in household waste in the UK is 6.7 million tonnes per year, so there is scope for a high environmental impact.

The typical shelf life is now 1 – 7 days refrigerated. The initial goal is doubling of the shelf life for any product or the ability to store in non-refrigerated temperature and in summary, the findings of the feasibility study are seen as very encouraging and indicate that an industrial process could be developed to allow the extension of shelf life of a range of commercially important fruit. **Asymptote has outlined possible next steps but in order to pursue them it requires additional R&D funding or a strategic partnership with a major customer i.e. a manufacturing partner in the food sector**. A number of exploitation routes are seen as possible:

- Apply for additional funding to take the project forward with fruit and vegetables. A possible route is the upcoming TSB Food Processing and Manufacturing Efficiency Programme. Ideally, this application would in collaboration with an end user.
- Approach potential end users of the technology. These could include fruit and vegetable processors, supermarkets and food manufacturers.

3.22 The largest proportion of winners, however, stated that the next step for their project was making a prototype (23%), closely followed by the companies who wanted to market/commercialise their product (22%) and 14% that would now go ahead developing their products.

3.23 A small proportion would also continue with more trials and testing of their processes/products/ideas (7%) in the future, with some of the survey respondents' statements presented below.

"It isn't going anywhere directly but indirectly there is knowledge that came out of the project that can be applied in other areas."

"This fed into a larger TSB collaboration project we are undertaking."

"One of the technologies we developed is useful in a different area which we are now looking to developing further."

3.24 Only 3% of the award winners had to halt their project due to not getting the results they anticipated. Some of the quotes received by the interviewed companies are presented below.

"We were going to move forward but the company was bought by the Chinese and they didn't want this product."

"Someone in Canada published a patent in 5 weeks after completion. This effectively killed our product"

Duration of FSP Benefits

3.25 With regard to the duration of any benefits, winners were asked how long they expected these benefits would last on average. Their responses are presented in Figure 3.3. In summary:

- There is no difference between the estimated duration of benefits for technological/R&D benefits and business related benefits.
- For just under a quarter of businesses (24%), FSP benefits would be short-lived i.e. would last for up to 3 years.
- For the largest group of responses (45%) benefits were expected to last indefinitely. Notable exceptions at sector level included Energy (80%), Nuclear (29%) and Nutrition for Life (0%).
- In comparison, non-winners are more likely to expect benefits from their project lasting for either a relatively short time period (up to 3 years) or be of longer but definite (over 5 years).

Figure 3.3: Estimated Duration of FSP Benefits

	Winners		Non-winners going ahead with the/a project (30 businesses)	
	Technological and R&D related	Business Related	Technological and R&D related	Business related
Duration				
Less than a year	1%	1%	4%	0%
1-3 years	23%	20%	21%	28%
4-5 years	12%	13%	4%	0%
More than 5 years	17%	18%	32%	0%
Indefinitely	45%	45%	25%	27%
Do not know	2%	4%	14%	45%

Benefits vs. Costs

3.26 Most of the winners (47%) stated that, to date, the benefits of the projects outweighed the costs (24% thought it was too early to tell).

- By far the majority of the respondents, 82%, expected the overall benefits (including future benefits) to outweigh the costs.
- Of those who considered the benefits to outweigh the costs, most could not quantify the financial returns; 15.2% valued the returns between £50k and £100k and 15.7% placed a value of between £100k and £500k.

Wider Benefits and Impact

3.27 Interviewees were asked to assess whether they thought the project they undertook had led to a set of wider benefits or would do so in future. Respondents gave a yes/no/don't know answer. They were not asked to give an indication of when any benefits might be realised. The potential benefits identified were:

- Further job creation
- More efficient use of energy
- Health improvements
- Social care improvements
- Educational improvements
- Transport improvements
- Housing improvements
- General living / quality of life conditions

3.28 Among winners, **only job creation was strongly identified as a benefit that had been, or would be, generated by the projects, with over 80% of interviewees indicating a benefit had accrued or would accrue in the future.**

3.29 The areas where the project was least likely to generate benefits were: Social care improvements, Transport improvements, Housing improvements, or any other kind benefits (not already identified), with around 80% or more indicating a benefit had not accrued or would not accrue in the future in these areas. While smaller proportions (60-70%) of respondents indicated that the project had not generated benefits in the other areas (General Living/ Quality of Life, Health improvements, Educational improvements, Energy efficiency) and was not expected to do so in future, **relatively larger shares of respondents (27-40%) also indicated a benefit had accrued or would accrue in the future in these areas,** with one of the examples provided below.

HEALTH CARE WIRELESS DIAGNOSTICS

OJ-Bio Limited, Founded in 2009, is a joint venture between Orla Protein Technologies Ltd and Japan Radio Company Ltd (JRC). The Company's diagnostic platform allows rapid measurement of disease markers and the electronic storage and wireless transmission of results. OJ-Bio Limited also assist with support for intellectual property, technology and productd development to trial stage, as well as manufacturing facilities (for trial batches, process optimisation or manufacture of the final device).

Through this FSP feasibility study, OJ-Bio sought to develop further its Surface Acoustic Wave biosensor platform, enabling prototype wireless diagnostic devices for the detection of Chlamydia. The market for rapid detection of infectious agents is currently dominated by immunoassay and nucleic acid detection. These are of limited convenience and accessibility. The proposed **solution would have a significant impact on health improvements and the UK health care system** as the disease is costing the UK £100m per annum**. At commercial level,** revenues from rapid, non-instrument-based professional POC market are estimated at £2.7 billion worldwide in 2008. This opportunity extends beyond traditional diagnostics suppliers, the wireless home health market in 2010/11 was £190 million and this market is expected to grow to £2.8 billion.

3.30 Around **40% of all winners stated that wider social benefits would apply to the UK. Around 80% of all winners stated that these benefits would apply to global economies.**

Overall FSP Achievements

3.31 Comparing the benefits arising from the FSP support against original expectations reveals some interesting results. Some reference has been made to some of these in the previous paragraphs but the overall comparisons are presented in Figure 3.4. It should be noted that expectations were not reported in the same way as benefits, with benefits reported in more detail. Therefore, responses on benefits have been grouped to match as close as possible headline expectation statements. In summary:

- By **far the most cited aim for a feasibility study was for proving a concept/investigating the feasibility of an idea (94% of survey respondents). Only 4% stated that this aim has not been already met nor it will do so in the future.**
- In relation to the other aims and objectives, the FSP support has been **highly effective** (objectives have been met or will be met in the next five years by 90%-100% of respondents) in the following areas:
  - Testing the application of new products
  - Producing new scientific/technical knowledge
  - Collaborating with other businesses
- The studies have been **effective** (with objectives achieved or to be achieved in the next five years by 75%-89% of respondents) in the following areas:
  - Testing a new process - of those respondents who stated that this objective will be met in the future, the vast majority estimate that this objective will be met in next 1-2 years
  - Investigating taking a product or an idea to market/commercialising
  - Accessing leading edge research infrastructure
  - Acquiring additional skills
  - Collaborating with universities – one in four of those who had stated this as their aim in participating in FSP, do not believe that this is an aim that will materialise in the future.
- Finally, the support appears to have been relatively **less effective** in one only area: Investigating the feasibility of applying an existing product/process to a new area. Unfortunately, it cannot be ascertained from the survey the reason for these responses. It could either be because the feasibility study showed that applying a new product or process to a new area is not feasible (and in a sense the study produced a positive result), or, the investigation did not materialise to date and is not expected to do so in the future for various reasons.

3.32 As shown in Figure 3.5, in comparison with the CR&D projects, broadly, FSP funded projects were more likely to 'investigate' and 'explore' ideas e.g. explore the application of technologies, or investigate the technical feasibility of ideas, or produce new scientific and technical knowledge. On the other hand, CR&D respondents were more likely than FSP winners to have strengthened/expect to strengthen in the future their collaborative activity with businesses and/or HEIs.

Figure 3.4: Achievements vs. Original Aims and Objectives[12]

OBJECTIVE/ EXPECTATION	% Of all winners	Achieved as % Of objective	Will materialise in the future				Would not materialise	% of all winners
			Next 6-12 months	Next 1-2 years	Next 2-5 years	After 5 years		
Proving a concept/ investigating the feasibility of an idea	**94%**	91%	1%	3%	1 %	0%	4%	**86%**
Producing new scientific/technical knowledge	**46%**	95%	1%	1%	0%	1%	2%	**38%**
Testing the application of a new product	**25%**	97%	0%	0%	0%	0%	3%	**24%**
Testing a new process	**25%**	74%	5 %	9%	5%	2%	5%	**24%**
Investigating the feasibility of applying an existing product/process to a new area	**31%**	57%	1 %	6%	3%	0%	33%	**18%**
Investigating taking a product to market/ Commercialising	**22%**	82%	4 %	2%	0%	0%	12%	**18%**
Collaborating with other businesses	**28%**	90%	0%	0%	0%	0%	10%	**25%**
Collaborating with universities	**23%**	73%	%	2%	0%	0%	25%	**17%**
Accessing leading edge research	**23%**	83%	0%	0%	0%	0%	17%	**19%**
Accessing research equipment and infrastructure	**19%**	82%	2%	0%	0%	0%	16%	**16%**
Acquiring higher skills	**18%**	85%	0%	5%	0%	0%	10%	**17%**

Figure 3.5: CR&D and FSP Winners – Comparison of Actual and Likely Benefits

	% of Respondents	
	CR&D Grant	FSP Grant
Develop new product/process/service(s)	65	92
Improve existing product/process/service(s)	47	60
Produce new scientific/ technical knowledge	73	86
Explore the application of technologies	78	95
Investigate the technical feasibility of an idea(s)	83	94
Investigate the commercial feasibility of an idea(s)	62	74
Access Commercialisation Skills	39	32
Access Technical/R&D skills	67	70
Access Leading Edge Research	59	48
Access Equipment and Research Infrastructure	56	46
Strengthen Collaborative Activity with Businesses	84	65
Strengthen Collaborative Activity with HEIs	73	42
Improve Commercialisation Skills	41	48
Improve Technical/R&D skills	74	84
Improve Technical Knowledge/ Understanding	84	94
Number of respondents	280	228

[12] Multiple responses were permitted.

4. Contribution of FSP and Additionality

4.1 This section discusses the contribution of FSP/TSB support to supporting businesses and impacting upon their technological and business related activities. Contribution of the Programme is presented using a number of dimensions and drawing upon the views of the survey respondents, detailed statistical and econometric analysis of responses and case study material.

KEY EMERGING POINTS

- With respect to its contribution and impact on technological capabilities, R&D and business performance, the winners' survey results indicate **that the FSP assistance did make a difference.**
- Around 72% of grant winners interviewed indicated they would not have achieved similar results without the FSP assistance**. Only less than 1% indicated that FSP made no contribution to the results they had achieved.** Just over a quarter (27%) stated that FSP made no difference to the final results they would have achieved in the future, but it did speed up the delivery of these results.
- Given the Programme's immediate emphasis on technological and R&D capabilities rather than business performance, it is worth noting that the Programme's perceived additionality is as high for business related benefits as for R&D and technology.
- There is a **marked difference in the contribution of FSP to technological capabilities and R&D between those businesses that worked alone and those that worked with partners**. For those that worked in collaboration, the full additionality of FSP was markedly higher than those that worked alone, 72% compared with 41%. Those who worked alone were more likely to have seen speeding up of the delivery of results that they would have otherwise achieved later on.
- The average size of firms that stated that they 'would definitely not have achieved' similar results was just 19 employees and well below the average for all winners, **suggesting that FSP has been more important to smaller firms.**
- Furthermore, FSP has been seen as **the market's key, if not the only, trusted source of finance support** for testing the feasibility of an idea or product for both, winners of the grant and non-winners.
- The survey results indicated that the **FSP winners were more likely to engage in more R&D work following completion of their FSP project compared to non-winners.** The most common source of further funding was through Collaborative R&D. Nanotechnology accounted for the majority of winners who have opted for this type of funding.
- Furthermore, **non-winners saw an average growth in R&D employment of around 20%. However, winners saw a far greater growth with an average rate of 51%.**

FSP: Trusted Access to Financing

4.2 The rationale for TSB's intervention through FSP rests on the premise that the private sector – firms and financiers, may be reluctant to invest in testing of new ideas and new technologies when the pricing of the potential product (if any) may not reflect the costs incurred in the first place and/or returns on investment may be uncertain or occur at a different time period (i.e. in the long-term). The survey participants were asked to specify why they approached TSB. Their responses are summarised below:

- For over half the winners (54%) and just over two thirds of non-winners (67%), TSB was considered to be the only additional finance available for testing the feasibility of an idea or

product. These results match the feedback received from businesses for the Collaborative R&D (CR&D) programme; 65% of those businesses would have to rely on their own finance to fund their project in the absence of CR&D.

- 17.5% of winners and 9% of non-winners perceived this method of funding involving fewer risks for financing the feasibility of an idea.
- 14% of both winners and non-winners stated that they consider TSB as a key source of R&D funding.
- 8% of both winners and non-winners stated that this funding offered more attractive terms and conditions of finance.

4.3 83% of winners did not seek alternative funding prior to approaching TSB. The equivalent figure for non-winners was 72%.

4.4 The vast majority of winners (94%) covered the remaining/full cost of their project using own resources. On the other hand, 60% of the non-winners abandoned the project when they did not get the FSP funding; 14% of non-winners went ahead with the project (either the same or more likely of a smaller scale); and 26% will go ahead with it in the future.

4.5 Of those non-winners who decided to go ahead with the project (either now or in the future), two thirds (65%) would use their own funding and a considerable 35% will be looking to other government funding. Although, it is not possible to establish the contribution of the FSP support in this area, the surveys also indicated that the winners of FSP were more likely than non-winners to be currently receiving other TSB or Government funding.

Figure 4.1: % of Businesses in receipt of other funds

	Winners		Non-Winners	
	Recipients	Not recipients	Recipients	Not recipients
Other TSB Funds	45%	55%	29%	71%
Other Government Funding	23%	77%	17%	83%

FSP: Pathway to follow on R&D Activity, Employment and Spending

4.6 The surveys revealed that **FSP winners were much more likely to engage in more R&D following completion of their project compared to non-winners.** 62% of winners reported that their project had led to additional R&D work. Once again, most non-winners did not answer this question. However, 8% said that their project had not led to any follow on R&D projects, which is greater than the 5% that had.

4.7 It is worth noting that a difference between the earlier pilot group and the winners is that 54% of the earlier participants reported that their project had not led to them engaging in further R&D work, which is higher than the 2011 winners.

4.8 Of the 141 winners that did engage in follow on R&D projects, one third of them were involved in collaborative R&D projects. Energy, Health, Nanotechnology, Nuclear and Nutrition all seemed to have higher proportions of firms engaging in follow on collaborative R&D. The largest sector, **Nanotechnology, accounted for around a third (33%) of those winners who did not engage in follow on R&D work, although this sector also accounted for a similar proportion (36%) of those who did engage.** There was a more noticeable divide for the Space sector as it accounts for 29% of those who did not engage in further R&D activity compared to only 16% of those that did.

4.9 Review of the sources of funding for the further R&D projects reveals that:

- The most common source of funding was through Collaborative R&D (a third of those engaging in more R&D work). Nanotechnology comfortably accounts for the majority of winners who have opted for this type of funding (45%) with the next closest sector being Health (15%).
- Nanotechnology accounts for the majority of many of the respondents indicating their funding sources. For example they account for 50% of respondents who will rely on another feasibility studies grant ahead of Digital (25%). However, there are a number of exceptions. Health accounts for the majority of those winners using private funding for further R&D (36%). Digital accounts for almost half the firms without any further funding (48%). Space accounts for 50% of winners who rely on other unspecified forms of funding for their future R&D.
- There is an even split for those winners who did and did not engage in further R&D when their collaborative activity is examined: those who did work with collaborators account for a slightly higher proportion of those who have not engaged in further R&D (54%) while those who did not work with collaborators account for a slightly higher proportion of those who have engaged in further R&D (51%).

Impact on R&D employment

4.10 In terms of change in persons employed in R&D between 2009 and the survey, both winner and non-winners experienced similar changes.

4.11 However, the percentage change in R&D employment presents more of a difference between winners and non-winners. **Non-winners saw an average growth in R&D employment of around 20%. However, winners saw a far greater growth with an average rate of 51%. Across all sectors, the growth rates experienced by winners were far greater than those experienced by non-winners**.

Average cost per R&D job (the grant amount per new R&D job)

4.12 Across the surveyed winners **the average cost for each new R&D job created between 2009 and 2012 was £12,280.** It should be noted that the average cost per R&D job created could produce a negative value for this measure if the participant has reduced R&D jobs. If negative values are excluded, **the average cost for each new R&D job created between 2009 and 2012 was £16,405.**

By region

- Cost per R&D job provided was calculated by dividing the offer grant by the change in the number of R&D employees between 2009 and the present, so it is cost per additional R&D job created. However, this included those cases where R&D employment fell, and thus generated negative values for cost per R&D job.
- On that basis, the North East generated the lowest cost per job, but there were falls in R&D employment for firms that had larger grants than most of the other North East firms, thus emphasising the negative values.
- When negative values are excluded from the average calculation**, the lowest cost per R&D job region is Scotland, at around £8,400, followed by the North West at just under £10,000 and then Wales and the North East at £11,300-11,500 (on the basis of grant offered). The most expensive region is London, at around £32,000 per additional R&D job.**

Figure 4.2: Cost per additional R&D job for grant offered by region

Region	Cost per additional R&D job for grant offered (£)
Scotland	8,491
North West	9,875
Wales	11,356
North East	11,588
East Midlands	13,100
South East	15,893
South West	16,430
West Midlands	17,995
East of England	18,513
Yorkshire & Humberside	21,821
London	32,977

By Sector

- The sector breakdown shows that there were three main sectors pulling the average cost per R&D job up. Both Health and Nuclear had averages of around £25,000 while Energy had the largest average of over £32,000. Many of the other sectors were below the average cost per R&D job. However, similarly, these values can be impacted by negative values in the average calculation.
- Therefore, as a result**, when negative values are excluded, the lowest cost per R&D job sector is in Space, at around £6,800, followed by Nutrition for Life at just under £8,000 and then Nanotechnology at around £9,300. The most expensive sectors are Energy and Health and Medical, at just over £32,000 per additional R&D job each.**

Figure 4.3: Cost per additional R&D job for grant offered by Sector

Sector	Cost per additional R&D job for grant offered (£)
Biotechnology	21,175
Digital	18,342
Energy	32,550
Health and medical	32,226
Nanotechnology and materials	9,300
Nuclear	30,952
Nutrition for life	7,894
Space	6,780
Average	16,405

Econometric Analysis

4.13 As mentioned in the introduction the statistical significance of various factors impacting upon the R&D activities of a business were also tested through econometric modelling and testing. R&D intensity was used as the dependent variable and four models were tested as follows:

- Change in R&D spending per employee as dependent variable, with size defined by turnover.
- Change in R&D spending per employee as dependent variable, with size defined by employment.
- Change in R&D employment as a proportion of total employment, with size defined by turnover.

- Change in R&D employment as a proportion of total employment, with size defined by employment.

4.14 The key findings of this analysis are as follows:

- The key result from the econometric estimations is that for both dependent variables (R&D spending per employee; R&D employment as % of total employment), **FSP funding has a positive influence on the outcome of interest: the regression results suggest that R&D spending per employee is around £7,000-9,000 higher among winners, while R&D employment as a proportion of total employment is around 11-14% higher among winners.** However, these results do not hold at the levels of significance commonly used (1%, 5% or, if we wish to relax the threshold a little, 10%) in econometric estimation. **What we find instead is that the positive impact of FSP funding is significant only at the roughly 40% level of significance.** At best, the results suggest there may have been cases where FSP funding had a positive impact, but the degree of uncertainty is high so it is not possible to state with confidence that FSP funding has any impact at this stage on the outcomes of interest (R&D spending per employee; R&D employment as a proportion of total employment).
- Being in receipt of other government funding had no statistically significant impact on the change in R&D intensity among winners. However, **the results indicate that the change in R&D intensity between 2009 and 2012 was higher among winners in receipt of other TSB funding**. The statistically significant result indicates the change in R&D spending per employee was around £7,600 higher among winners in receipt of other TSB funding.
- **Firm size in 2009, whether measured by employment or turnover, had no significant impact on the change in R&D intensity among winners between 2009 and 2012**. And although not statistically significant, the coefficients indicate the impact of firm size varied widely in size and direction.
- There are some mixed results with regards to **patent ownership**. The number of patents currently held does not have a statistically significant impact on R&D spending per employee at the 10% level. However, in the case of R&D employment as a proportion of total employment there is some influence; there is a small negative effect that is statistically significant (at the 5% level). **In other words, the greater the number of patents currently held, the lower the share of total employment made up of R&D employees**. This would be consistent with firms switching away from R&D towards more sales, marketing or production activities once they have secured protection on their key inventions or innovations. **The greater the number of patents held, the more likely may be that a firm has secured protection on its key inventions or innovations and thus able to focus on marketing and commercialising the invention/innovation.**
- Where the R&D intensity is measured by R&D spending per employee:
  - **The impact for those who reported zero turnover in 2009 was statistically significant (at the 5% level). Current R&D spending per employee among firms in this group tended to be around £16,000 higher than for those with a turnover of £150,001-500,000 in 2009.** It needs, however, to be considered that current R&D spending per employee may be negatively influenced by firm size in 2009. The results show statistically significant and negative impacts for those firms that earned, £500k-£2m or £2m+ in 2009 (compared to those earning £150,001-£500,000). R&D employment as a share of total employment for those firms that earned £500k-£2m or £2m+ in 2009 tended to be around 15 percentage points and 32 percentage points lower respectively, compared to those that earned £150,001-£500,000. **This may suggest that larger in terms of turnover firms (and perhaps older) tend to have a smaller proportion of R&D employees than do smaller firms.**

- There appears to be a significant effect where the winner's main activity is Education: the change in R&D spending per employee between 2009 and 2012 was around £20-24,000 higher among winners whose main activity was education (compared to those whose main activity is not education).
- There appears to be a statistically significant effect among winners in the Nuclear and Energy programmes: the change in R&D spending per employee between 2009 and 2012 was around £11,000-12,000 lower among winners in the Nuclear or Energy programmes compared to winners in the Nanotechnology programme (the base case).

FSP: Pathway to Business Improved Performance and Growth

4.15 A selection of cross tabulations between the most popular ways winners intended to spend funding and the impacts/benefits of most interest/relevance to business performance were selected in order to establish whether different types of expenditure influenced the impact/benefits felt in key areas of business performance. These included the following:

Type of Expenditure	Impact
• Proving a concept/investigating the feasibility of an idea • Producing new scientific/technical knowledge • Testing the application of a new product • Investigating the feasibility of applying an existing product/process to a new area • Collaborating with other businesses	• Enter new markets • Increased employment

Extent to which FSP helped winners entering new markets or increasing market share

- Just over a third of winners reported having already benefited as a result of FSP support through entering new markets or increasing market share. Across the five categories of spending intentions, this proportion was slightly higher (36%) for those spending the funding on *proving a concept/investigating the feasibility of an idea*, *producing new scientific/technical knowledge* or *investigating the feasibility of applying an existing product/process to a new area*. **An even higher proportion (40-44%) of those that spent their FSP funding on *testing the application of a new product or collaborated with other businesses* reported as having already benefited as a result of FSP support.**

Extent to which FSP helped winners' employment

- Among winners, 30% indicated that their project had already led to an increase in employment. This was consistent with the corresponding proportions of those winners who planned to spend the funding on *proving a concept/investigating the feasibility of an idea* or *investigating the feasibility of applying an existing product/process to a new area*. **But across the other spending categories e.g.** *producing new scientific/technical knowledge, testing the application of a new product or collaborating with other businesses*, **a noticeably higher share of winners, 40%, had already benefited in terms of employment generation.**

Econometric Analysis

4.16 As set out in the logic chain, in the relatively short time since the FSP funding was granted, statistically significant impacts on business performance indicators such as turnover or profitability would be unlikely. However, some modelling was undertaken in an attempt to investigate this, with the key question being, *has FSP funding contributed to higher growth*?

4.17 Because data for turnover was categorised into bands, we were not able to calculate good measures of the growth of turnover. Therefore, ordered probit models with 2012 turnover as the

dependent variable, were used for the estimations. Within this context, any statistically significant impact of, for example, TSB funding needs to be interpreted with caution. Any significant result may just be picking up the association between high turnover firms and the likelihood of being selected for funding, and not a causal relationship: it cannot be interpreted that receiving TSB funding results in a higher (or lower) level of turnover in 2012.

4.18 The key findings were as follows:

- Being in receipt of FSP funding did not have a statistically significant impact on or association with the level of turnover in 2012.
- In some cases, the main activity of the firm has a statistically significant association with turnover. The results indicate that being engaged principally in Production or Services is associated with a higher level of turnover in 2012, compared to firms whose principal activity was not Production or Services.
- Being in receipt of other government funding was not statistically significant: there is no association between 2012 turnover and being in receipt of other government funding.
- Participating in the Nuclear programme has a statistically significant association with turnover. Firms conducting studies under the Nuclear programme were likely to have a higher level of turnover in 2012 compared to firms participating under the Nanotechnology programme (the base case). However, firms engaged in Nuclear activities were likely to be relatively large.
- The firms with the greatest likelihood of having a high turnover were those in the Nuclear sector and were engaged principally in Production or Services. They were receiving other funds from TSB and had a relatively large workforce in 2009. But none of these explanatory variables can be said to have directly led to (caused) a higher level of turnover.

FSP: Additionality of Assistance

4.19 Survey participants were asked to evaluate the overall contribution of FSP assistance to technological capabilities and R&D, and their business performance.

4.20 Across all programmes, the value on business performance, and technological capabilities and R&D is presented in Figure 4.4.

Figure 4.4: Business performance and, technological capabilities and R&D

% of winners reporting that, without FSP assistance:	Technological capabilities and R&D	Business performance
They would definitely not have achieved similar results	57%	53%
They would probably not have achieved similar results	12%	14%
They would not have achieved all the results that they did	4%	5%
They would have achieved similar results, but not as quickly	27%	27%
TSB/FSB assistance made no contribution	<1%	<1%

4.21 As shown in the figure, with respect to impact on both technological capabilities and R&D and business performance, the winners' survey results indicated that **FSP assistance did make a difference:**

- 67%-69% of winners interviewed indicated they would not have achieved similar results (without FSP assistance). More than half of the winners interviewed said they would **definitely not** have achieved similar results, while around 12%-14% of interviewees said they would **probably not** have achieved similar results. These figures indicate relatively high additionality (and relatively low deadweight) as a result of the FSP support[13].
- In addition, roughly 4% indicated that, without FSP assistance, they would not have achieved **all the results** that they did.
- Around 27% of interviewees stated that the FSP assistance **made no difference** to the results they achieved, but it did **speed up the delivery** of the results.
- Only less than 1% indicated FSP assistance made no contribution (would have achieved similar results without assistance).

FSP Additionality by Sector/Competition

4.22 Analysis of the responses by the main competition themes/sectors, with regard to both business performance and technological capabilities and R&D impacts a number of variations emerge.

Digital

4.23 Of those interviewed:

- **55-57% stated they would definitely not have achieved similar results, in line with the average, but a slightly higher proportion (16%) stated they would *probably* not have achieved similar results;** while 4% would not have achieved all the results that they did without FSP assistance.
- 22-25% stated that FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results, slightly below average, while 2% indicated that FSP assistance made no contribution, roughly twice the sample average.

Space

4.24 **Around 40% of those interviewed stated that they would definitely not have achieved similar results, well below the average,** but a slightly higher proportion (15-17%) would probably not have achieved similar results.

4.25 Around 4%-6% stated that, without FSP assistance, they would not have achieved all the results that they did, while for **37% FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results, well above average (27%)**. None of the programme interviewees indicated that FSP assistance made no contribution.

Materials and Nano

4.26 With regard to both technological capabilities and R&D and business performance, **a third (33%) stated that FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results, noticeably above average.** Just over 10% indicated that without the TSB/FSP assistance they would not have achieved all the results related to business performance. Across both business performance and technological capabilities and R&D, none of the programme interviewees indicated that FSP assistance made no contribution.

Energy

4.27 Around **77-83% indicated that they would definitely or probably not have achieved similar results without assistance, compared to a survey average of 67-69%.** About 6% indicated that

[13] Note: these figures are not comparable with the CR&D additionality figure – 86%, which indicates additionality of projects i.e. the proportion of businesses that would not have definitely or probably proceeded with their project in the absence of funding.

without TSB/FSP assistance they would not have achieved all the results that they did, while 12%-18% stated that FSP assistance speeded up the delivery of the results (which is well below average). None of the programme interviewees indicated that FSP assistance made no contribution.

Health - Fighting Infection through detection

4.28 **71% indicated that they would definitely or probably not have achieved similar results without assistance –** and this is in line with survey average of 67-69%. None of the respondents indicated that FSP assistance was crucial to them achieving *all* the results that they did, while for 29% the FSP assistance assisted them in speeding up the delivery of the results, slightly above average. None of the programme interviewees indicated that FSP assistance made no contribution.

Nuclear R&D

4.29 Of those interviewed, 50-57% stated they would definitely not have achieved similar results, in line with or just below the average, but a much higher proportion (21% and 36%) stated that they would probably not have achieved similar results. So overall, **78-86% indicated that they would definitely or probably not have achieved similar results without assistance**.

4.30 Other notable responses included the following:

- Feasibility Studies for Responsible Development of Nanoscale Technologies: 86% of respondents would definitely not have achieved similar results with regard to technological capabilities and R&D, which is well above the average.
- Feasibility Studies for Biotechnology: 80% of respondents would definitely not have achieved similar results, again well above the average.

FSP Additionality by Region

4.31 Figure 4.5 presents estimates of additionality by FSP winners by broad UK region.

Figure 4.5: Contribution of FSP by Region

Region	% Of respondents indicating that they would		
	Definitely not have achieved similar results	Probably not have achieved similar results	Definitely or probably not have achieved similar results
North East	50%	13%	63%
Scotland	38%	9%	47%
West Midlands	53%	0%	53%
Yorkshire & Humberside	50%	10%	60%
East Midlands	59%	11%	70%
London	63%	7%	70%
South East	63%	18%	81%
South West	57%	17%	74%
East of England	62%	15%	77%
Average across all regions	**57%**	**12%**	**69%**

4.32 The following observations are made:

- The proportion of respondents indicating that they would definitely or probably not have achieved similar results without FSP assistance was below average, particularly for Scotland (47%) and the West Midlands (53%).
- At the same time, these same regions have the highest shares of respondents indicating that **FSP assistance made no difference to the results they achieved but did speed up the delivery of the results**, and in each all above the average across all regions: over 40% in the case of Scotland and West Midlands (compared with 30% in the case of Yorkshire & Humberside, over 37% in the case of North East).
- Furthermore, in Yorkshire & Humberside, Scotland and West Midlands 6-10% of respondents indicated that they would not have achieved *all* the results that they did without the FSP assistance. The average across all regions is 3.5%.
- In London and North West around 6-7% of respondents indicated that they would *probably* not have achieved similar results without FSP assistance, below average, while for the other regions (East Midlands, East of England, South East, South West, Wales) the corresponding figure was 11-20%.

FSP Additionality by Firm Size

4.33 **Across all winners, the firm size averaged 37 employees in 2009, increasing to 59 employees in 2012.** The survey responses on the impact on business performance showed that:

- Across the 53% of winners who definitely would not have achieved similar results without FSP assistance, the average firm size was 19 employees in 2009 and 30 employees in 2012.
- For the 13% of winners who probably would not have achieved similar results without FSP assistance, the average firm size was 103 employees in 2009 and this was unchanged in 2012.
- A very small number of winners (less than 1%) indicated they would have achieved the same results without TSB assistance. In 2009 they averaged 25 employees, by 2012 this had doubled to 50 employees.
- For those who would have achieved similar results, but not as quickly (just over a quarter of winners), average firm size increased from 44 employees in 2009 to 102 employees in 2012.
- For those that would have achieved some but not all the results, a smaller (roughly 12%) increase was observed, from 26 employees to 29 employees.

4.34 The survey responses on the impact on technological capabilities and R&D show similar results:

- Firms that stated that they would definitely have not achieved the same R&D results were those with the smallest average size in 2009 (19 employees). This average has increased significantly (proportionally) since 2009, up to 30 employees in 2012.
- Firms that stated they would have achieved the same results but at a slower pace were also those that experienced average size increase by the greatest amount, from 46 employees in 2009 to 105 in 2012.
- The winners that stated that they would have achieved *some* of the results or thought that they would *probably* not have achieved the same results experienced minimal movement in firm size across the period.

4.35 On the basis of the responses of '**definitely would not have achieved similar results', the results suggest that TSB assistance was more important to smaller firms** (an example of which is provided below) **– the average size of firms among these respondents** was 19 employees, which was well below the average for all winners**.**

NOVEL STERILISATION PROCESS

The project was undertaken by SERE – Tech Innovation Ltd, a micro R&D company specialising in renewable, environmental and sustainability solutions including waste management.

There are two main sterilisation techniques used for milk and cream production, these being High Temperature Short Time (HTST) and Ultra High Temperature (UHT). A by-product from the milk separation process cannot be technically or cost effectively sterilised by these techniques making it highly bacterially unstable and leading to waste disposal costs of £100k - £1m per dairy per year. This project was to develop a novel sterilisation technology to turn this protein-rich waste product into a valuable by-product.

The FSP Assistance represented around 20% of the total estimated project cost and enabled the company to develop a product that would improve an existing process in the dairy market within the next 1-2 years.

Commercial feasibility and technology readiness have now been established with benefits expected to last more than 5 years. A wide range of business benefits have already materialised and on average are expected to last for 4-5 years. Company profitability has also grown from zero to approximately £50K. The direct project returns to the company from this project suggest **an initial return on investment for TSB funds of 2-4 times.**

The new product would help dairy businesses avoid or reduce effluent discharge costs of £100k-£1m per dairy (there are approximately 11,000 dairy production holdings in the UK). It could also support production of 200,000 tonnes of protein rich by-product per year in the UK. One major dairy producer in the UK produces 50-60 tonnes of desludge per day that must be disposed of. The project could save disposal costs as well as providing a final market for the desludge. As well as UK impacts, the project could have international application. It is worth noting that the kit can be retrofitted onto existing plant so the costs of installation are not prohibitive.

SERE-Tech attaches a very high level of attribution to TSB funding, as it was the **only significant** source of funding open to this type of company. *'We believe that this application represents an excellent way to bring our technology to market quicker and also lever in specialist R&D support.'*

FSP Additionality By Rating of Application Process

4.36 Comparing those who gave the application process the lowest score (1=confusing) and those who gave it the highest (5=straightforward), the following results emerge:

- In the case of those giving the application process the lowest score, 75% of respondents stated that they would **definitely** not have achieved similar results without assistance, whereas for those giving the application process the highest score, the corresponding figure was 66%, with 10% saying they would **probably** not have achieved similar results without assistance. However, in both cases around 75% of those interviewed indicated that they would definitely or probably not have achieved similar results without assistance.
- In both cases, none of those interviewed indicated that FSP assistance made no contribution.

- For those giving the application process the lowest score, the remaining 25% of respondents indicated that FSP assistance was important to them in achieving **all the results** that they did.
- In contrast, only 2% of interviewees who gave the application process the highest score indicated that FSP assistance was crucial to them achieving **all the results** that they did. The remaining 22% said that TSB/FSP assistance **speeded up the delivery** of the results.

FSP Contribution by Collaboration Activity

4.37 Review of the responses relating to contribution of TSB/FSP assistance to technological capabilities and R&D indicates that **there is a marked difference in the distribution of responses between those who carried out the project alone and those who had partners working on the project:**

- **Among those that worked on the project alone, 41% of those interviewed said they would definitely not have achieved similar results without the assistance, compared to 72% in the case of those who worked with partners.**
- Just over 13% of those that worked on the project alone stated that they would probably not have achieved similar results, only slightly higher than the 10% of those who worked with partners said they would probably not have achieved similar results.
- As a result, nearly 83% of those who worked with partners stated that without FSP assistance they would definitely or probably not have achieved similar results, compared to just 54% of those who worked alone.
- At the same time, around 38% of those who worked alone indicated that without FSP assistance they would have got similar results, but just not as quickly (compared to just 16% of those who worked with partners).
- In both cases, less than 1% of respondents indicated that FSP assistance made no contribution.

4.38 Overall, **for those who worked alone, assistance appears to have had less impact on what results were achieved,** but a greater impact on the speeding up the delivery of these results.

FSP Contribution by Level of FSP Grant (%)

4.39 There is no clear correspondence between how critical TSB/FSP funding was to delivering the results and the average offer rate of grant. The average funding rate for all winners was around 72%. With regard to the impact on business performance and technological capabilities and R&D, broadly similar rates were seen for those who:

- Definitely or probably not have achieved similar results; and,
- Would have achieved similar results, but not as quickly.

4.40 However, with regard to the impact on technological capabilities and R&D, slightly higher funding rates (74-75%) were seen for those who would have achieved similar results and for those who would have achieved some but not all the results.

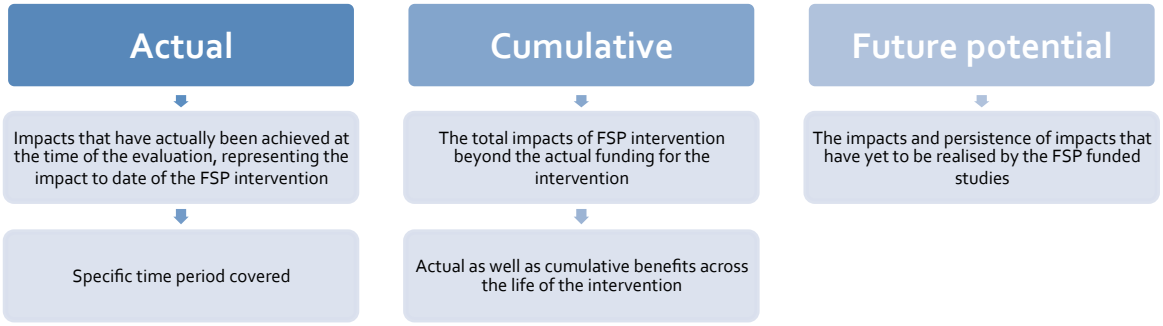
4.41 With regard to the impact on business performance, a slightly higher rate (75%) was seen for those who would have achieved similar results, while a slightly lower funding rate (70%) was reported for those who would have achieved some but not all the results.

5. FSP Estimated Return on Investment

5.1 This section presents estimates of costs and benefits emerging from the FSP investment. Estimates of the return on investment are based on the following formula.

Cost Benefit Ratio (CBR) = Net additional impact/public sector or total expenditure

5.2 'Costs' are simply represented by the estimated total amount of FSP grants/TSB expenditure to date. Benefits accrued as a result of the FSP support have been calculated on the basis of the estimated economic benefits i.e. jobs and corresponding GVA created that can be attributed to FSP assistance. Benefits generated from the FSP intervention would fall in the following three categories as shown below.



5.3 The econometric analysis has shown that both indicators used as proxies of intermediate output/changing organisational behaviour and performance resulting from FSP (i.e. R&D spending per employee and R&D employment as % of total employment), are positively influenced by FSP funding[14]. However, it is recognised that, at this stage, the positive impact of FSP funding is significant only at the roughly 40% level of significance. On the other hand, the survey results and the case studies, all indicate that the actual employment impact of the Programme to date (and hence the basis of its cumulative effect) has predominantly emerged from additional engagement of staff[15] and related costs in R&D and technological capabilities i.e. R&D staff. Therefore, calculations for the actual and cumulative benefits draw upon the R&D jobs and additionality estimates provided by the survey respondents (the survey of winners).

5.4 As shown in Figure 5.1, on the basis of **actual benefits generated to date**, it is estimated that:

- The gross additional benefit i.e. Gross Value Added, for every pound spent by TSB (GVA/FSP expenditure) is 1.75 – meaning that £1 spent by TSB will increase GVA by £1.75.
- Assuming that the benefits of FSP would last up to 5 years, the net cumulative benefit for every pound spent by TSB/FSP is 2.72 - £1 spent by TSB would increase GVA by £2.72.
- When the private sector investment is also taken into account the equivalent figures are 1.26 and 1.96.
- Based on the survey responses, 35% of FSP winners have levered additional funding as a result of their project (with the equivalent figure among non-winners being 0%). The survey, however, did not collect data on the amount of funding levered and therefore, estimates of quantifiable benefits generated by the FSP assistance in the short and medium term may be underestimated; and these can be considerable as the example of Oxford Photovoltaics indicates (end of this Section).

[14] The regression results suggest that R&D spending per employee is around £7,000-9,000 higher among winners, while R&D employment as a proportion of total employment is around 11-14% higher among winners.
[15] Over 70% spent some proportion of the funding on additional staff cost.

Figure 5.1: Estimates of Actual and Cumulative Impacts

(a) R&D Jobs Change: Gross and Net Estimates	
Gross no of jobs[16]	411
Deadweight jobs	57
Net Additional	354
Deadweight	*24%*
No evidence of displacement at this stage	*0%*
No multiplier has been applied	
(b) GVA Calculations: Gross and Net Cumulative	
GVA per job:	£33,317[17]
Net Additional GVA (all net additional jobs)	£11,794,218
Net Additional GVA per annum (assuming that it has taken 3 yrs for job creation)	£3,931,406
Net Cumulative GVA – total (over 5 years where 2011/12 first year; discount rate 3.5%)	£18,371,772
(c) FSP Investment/Spent	
FSP Total Costs of R&D Jobs Created	£6,742,455
(£16,405 per R&D job created)	
All company costs for these jobs	£9,364,521
Net Return on Investment / CBR	
Net Additional GVA / £ FSP spent	**1.75**
Net Cumulative GVA/ £ FSP spent	**2.72**
Net Additional GVA / £ all project costs (public & private)	**1.26**
Net Cumulative GVA/ £ all project costs (public & private)	**1.96**

5.5 It can be safely assumed that due to the nature of the projects, the employment changes resulting from the FSP investment would predominantly be in R&D jobs, at least in the short/intermediate term. Nevertheless, additional calculations have taken place drawing upon the survey results to enable comparability with other related programmes. For example, the survey results indicate that nearly half the winning organisations indicate that the project will have a positive impact on future employment in their business. Therefore, estimates of future potential benefits have been calculated based on additional overall job creation and the corresponding GVA. These calculations are summarised in Figure 5.2.

5.6 In calculating future potential benefits, additional review of existing research literature on estimating R&D returns of public investment has been undertaken and a number of issues need to be considered in interpreting the results of this analysis:

- Additionality indicators such as displacement, multipliers etc. need to be used with caution. Although, there is a considerable volume of research on the impact of public R&D spending and in particular crowding out and displacement effects, overall, the literature is inconclusive. For example, one of the key issues that continues to be debated is that public investment on R&D focuses on product innovation and outputs that tend to become public goods or products sold back to the government. It is argued that in such circumstances there seems to be little basis for expecting that the R&D performed with public monies would have a substantial direct impact on the supported firm's own business performance indicators or sector.
- Calculations of future potential benefits exclude specific project benefits that would arise either in the form of increased turnover and sales or economic savings from the commercialisation and exploitation of successful products. As shown in the case study at the end of this Section, commercialisation/application of a new technology (if it were to go ahead),

[16] All based on jobs created as reported by 266 businesses providing this information.
[17] Sourced from the 2011 Annual Business Survey (SIC code 72 - scientific research and development)

it would provide considerable financial benefits to the end user i.e. businesses and/or the economy.

- Within this context, additional future potential benefits are presented under two assumptions: (1) jobs created are of average value to the economy; and (2) jobs are of high value added. The estimates of the values of these jobs are taken from the 2011 Annual Business Survey.

Figure 5.2: Estimates of Future Potential Impacts

	(1) Average Job Value	(2) High Value Added Jobs
(a) All Jobs Change: Gross and Net Estimates		
Gross no of additional jobs (change pre and post FSP)	**1036**	
Deadweight jobs	*249*	
Additional	787	
Displacement	*472*	
Linkages	*755*	
Net Additional	**755**	
Deadweight	*24%*	
Estimated displacement[18]	*40%*	
Linkages/Multipliers[19]	*1.6*	
(b) GVA Calculations: Gross and Net Cumulative		
GVA per job:		
Whole Economy Average	**£37,108**	
High tech industries – approximately		*£100,000*
Net Additional GVA (all net additional jobs)	**£28,016,540**	£75,500,000
Net Additional GVA per annum (assuming 3 yrs for jobs to be created)	**£9,338,847**	£25,166,667
Net Cumulative GVA – total (5 years; discount 3.5%)	**£43,641,172**	£117,605,828
(c) FSP Investment/Spent	**£13,056,530**	
Total Spent/Expenditure includes company cost	**£18,080,564**	
Net Return on Investment/CBR		
Net Additional GVA / £ FSP spent	**2.15**	**5.78**
Net Cumulative GVA/ £ FSP spent	**3.34**	**9.00**
Net Additional GVA / £ all spent	**1.55**	**4.18**
Net Cumulative GVA/ £ all spent	**2.41**	**6.50**

5.7 The calculations in Figure 5.2 indicate that on the basis of estimates of **future potential benefits**:

- The gross additional benefit i.e. Gross Value Added for every pound spent by TSB (GVA/FSP expenditure) would be 2.15 i.e. £1 spent by TSB would increase GVA by £2.15, if the jobs created are of average value to the economy, or, by £5.78, if they are high value added jobs.
- The net cumulative benefit/GVA for every pound spent by TSB/FSP would be between 3.34 and 9.00 i.e. £1 spent by TSB would increase GVA anything between £3.34 - £9 depending on

[18]. The displacement figure used here is based on the results from the non-winners survey – the % of respondents continuing with the project (actual and likely) is taken to represent the displacement that would otherwise occur by public funding.

[19] This is based on the estimates of the indirect multiplier of employment generated by the Intermediate Research and Technology Sector, which comprises a range of companies and organisations whose activities bridge gaps in the process of converting research outcomes into innovation and new technologies for use in business, industry and government. It is based on a comprehensive study of the impact of the Intermediate Research and Technology Sector on the UK economy undertaken by Oxford Economics on behalf of the Association of Independent Research and Technology Organisations (AIRTO).

the type of the job created through this investment (with the lowest return corresponding to an average value job created and the highest to a high value added sector job).

- When the private sector investment is also taken into account the cost benefit ratio for additional GVA would be 1.55 – 4.18 (for average value jobs and high value adding jobs respectively). The cost benefit ratio for cumulative GVA would be between 2.41 – 6.50. The equivalent figure for the Collaborative R&D programme was estimated to be 5.75.

HUMAN EMBRYONIC STEM CELL (HES) PROJECT

The project was undertaken by Plasticell Ltd. Plasticell is a limited company specialising in high throughput stem cell technologies and providing services to companies wishing to use stem cells for scientific research and therapy. This project aimed to devise a platform technology for the generation of fluorescent reporter human embryonic stem cell (hES) lines, with the aim of deriving functional (demonstrator) lines that can be integrated with Plasticell's CombiCult® platform technology. FSP provided approximately 60% of the costs of the project to Plasticell. 70% of the costs were for staff, 25% for supplier costs and 5% for travel.

The project was seen to be risky, uncertain and unaffordable without TSB funding. '*Plasticell would not be able to afford ZFNs from Sigma on a commercial basis, Sigma would not be able to justify diverting resources from client projects in order to perform a feasibility study, and QMUL would not have resources to participate in applied research projects.*

Plasticell is a limited company specialising in high throughput stem cell technologies and providing services to companies wishing to use stem cells for scientific research and therapy. This project aimed to devise a platform technology for the generation of fluorescent reporter human embryonic stem cell (hES) lines, with the aim of deriving functional (demonstrator) lines that can be integrated with Plasticell's CombiCult® platform technology. FSP provided approximately 60% of the costs of the project to Plasticell. 70% of the costs were for staff, 25% for supplier costs and 5% for travel. The project was seen to be risky, uncertain and unaffordable without TSB funding. '*Plasticell would not be able to afford ZFNs from Sigma on a commercial basis, Sigma would not be able to justify diverting resources from client projects in order to perform a feasibility study, and QMUL would not have resources to participate in applied research projects.*'

Over the next 2-5 years it is expected that the company **will develop new markets, increase export sales and increase turnover and profits. The project will create both scientific and sales jobs. It will support academia and industry through enabling technologies (hES reporters and facilitated HTS). It will deliver health benefits through better stem cell treatments as well as supporting drug development through in vitro toxicity tests.**

The project will support CombiCult® screen sales through an improved technology offering. Each screen is associated with significant added value in jobs and downstream economic activity. It will also support development of CombiCult® kits for the discovery of differentiation protocols towards any specific lineage. There are no similar current competing HTS technologies specifically for stem cell differentiation. There are also very few commercially available hES reporter cell lines that signal differentiation to a given lineage.

If bundling of hES cell reporter lines with CombiCult® leads to sales of just a few screens in the first year the project costs will be exceeded. **Sales of around a 100 screens over 3 years will provide over 30-fold return on investment and sales of 1,000 screens over 5 years will give over a 300-fold return.**

SOLAR STATE DYE SENSITIZED SOLAR CELLS

Oxford Photovoltaics is a limited company specialising in design and manufacture of a new type of solar photovoltaic (PV) cells that can be printed onto glass. It was spun out from Oxford University in 2010/11, which has exclusively licensed the portfolio of Intellectual Property developed by Dr. Henry Snaith and his academic team at Oxford Photovoltaics. The company is based in Oxford with eight employees (50% part-time).

The company was successful in securing TSB funding for a feasibility study with regards to a new solar photovoltaic glazing technology, working together with Advanced Screen Technology UK. The new product would represent a direct source of electrical power generation and address many of the core problems associated with creating sustainable power. According to Oxford PV, buildings are responsible for 40% - 70% of energy consumption in the UK and are obvious targets for technology that will reduce electricity consumption. The ability to use the cells as cladding should allow their use to increase significantly. It is expected that financial benefits of at least £500k will result directly to Oxford PV. Furthermore, another 15 jobs are expected over the next 3 years or so with turnover of at least £2m.

According to Oxford PV the FSP assistance *'would enable to accelerate our plan dramatically and strengthen our position with potential customers who wish to engage with us, and potential investors'*.

At the time of the writing of the report, Cleantech investment specialists MTI Partners announced the completion of a £2 million investment round in Oxford Photovoltaics – **representing significant leverage and an estimated return on FSP investment of around 20.**

This latest investment round would allow OPV construct its own product development and test facilities at the Begbroke Science Park near Oxford.

6. Summary and Conclusions

6.1 The Feasibility Studies Programme aims to support businesses in accelerating their journey from concept to commercialisation by enabling them to test the feasibility of ideas and technologies.

6.2 The rationale for public sector funding and support is based on the recognition that the route from innovation to economic growth is not straightforward and therefore allowing businesses and the market to operate without public sector intervention may not necessarily lead to policy/socially desirable outcomes within the preferred time period i.e. market failures would occur that in this instance would have a significant impact on the UK's ambition and ability to be a key knowledge hub in the global economy, with a reputation not only for outstanding research but also for turning that knowledge into new products/services and improved public services/quality of life for UK residents.

6.3 Market failures would arise from a combination of factors including varying perceptions of the positive externalities of innovation and the willingness to finance it, risk aversion and lack of relevant resources among the various agents involved on the route that takes a new idea from concept to market. Risk aversion could be particularly high for small and medium sized companies: the further products are from the market, the higher the level of uncertainty of the return on their investment (considering that this investment may represent a relatively high proportion of their income/turnover).

6.4 Most importantly, a key market failure in a global economy would arise from the lack of a level playing field, where for a number of reasons key competitor and emerging economies enjoy competitive advantages supported by strong R&D conditions and infrastructure.

6.5 Within this context, the policy rationale underpinning such a programme is to further improve and accelerate the likelihood of success and impact occurring from investment on potentially innovative/collaborative R&D and technology projects by enabling testing and showcasing of their feasibility prior to investing further substantial resources. As a grant, the Programme also minimises any risks perceived by businesses as associated with uncertain investments.

6.6 FSP is a relatively new form of a public grant awarded for specific a purpose - it was announced in 2008 and it started funding projects in 2009/10, with an estimated total of 425 projects funded and completed to date (including 100 projects that were funded as part of an early pilot exercise). The evaluation of the 2010-11 Programme provides insightful information on the profile of these organisations, their views on the Programme and its added value and their future plans. It also throws some light into specific issues that could inform the future design and management of similar programmes.

6.7 The key evaluation findings are summarised below under the six questions that were addressed by the evaluation.

Summary of Key Findings

Q1: To what extent projects funded under FSP have met their objectives and have assisted businesses in bringing to market new products, services or in using new processes that can potentially contribute to improved business performance?

- FSP has helped around 90% of winners to actually investigate the technical feasibility of an idea and 78% to acquire new scientific/technological knowledge.
- Furthermore, FSP has enabled 58% of businesses to investigate the commercial feasibility of their ideas.
- For approximately three quarters of businesses (73%), FSP has helped to improve the

technological readiness of their business.

- Over half of respondents (58%) have already developed new products/service(s) and an additional 34% will do so in the next 1-5 years.
- 46% have improved existing products service(s) or processes and an additional 14% will do so in the next 1-5 years. It is noteworthy that the development of *new* products seems to be more skewed towards benefits that will be felt in 1-5 years whereas many of the *improvements* of existing products appear to have been felt immediately.
- Most respondents who went ahead with a project have experienced improved *access* to R&D capabilities.
- The FSP support also helped over two thirds of winners (67%) to immediately enhance their business networks. On the other hand, for over half the winners (54%), the support has not led to enhanced networks in HEIs nor is expected to do so in the future. In relation to the latter, it needs to be noted that only under a quarter of winners (23%) were expecting to benefit from collaborating with HEIs as a result of FSP in the first place.

Q2: To what extent the projects have encouraged other beneficial changes in participating businesses e.g. further R&D projects carried out with or without the fund, activities pursued or going to pursue, raising investment and, increased employment, profitability or productivity?

- On average, FSP support supported one in three businesses to improve one or more of their key business performance indicators such as turnover, profit, employment or market share. FSP funded projects seem to have been relatively successful in securing new markets/larger market shares for companies (now or in the future) than other QCD or financial indicators.
- On the whole, business performance improvements for most businesses were expected to be delivered in the near future – with two notable exceptions: the value of the business (53%) and leverage of the business profile (69%), which have already materialised for a relatively large proportion of businesses.
- The largest group of winners (20%) estimated their annual turnover (or sales) as equating to zero in 2009 (the next largest group at 14% was between £50k and £150k). The majority estimated their current turnover at £50k and £150k (16.7%).
- Over two thirds of winners (79%) had seen or expected to see an increase in employment as a result of their FSP funded project.
- Comparing winners against non-winners that went ahead with their project, a much higher proportion of non-winners (73% compared to 34% of winners) reported already having benefited from the project through entering new markets or increasing market share. However, an additional 55% of winners expect to benefit in this area over the next 1-5 years or beyond.
- The vast majority of winners (88%) had realised or expected to realise increased profits as a result of the FSP support.
- Just under a third of winners had also benefited from easier access to finance, whilst none of the non-winners had achieved this to date. Unwillingness of the end user/beneficiary to acknowledge the potential benefits of the project for their business or their inability to appreciate the extent of benefits have been cited as the main obstacles in accessing private sector finance.
- Businesses consider productivity to be the least affected business performance indicator by FSP support.

- The impact of projects on quality improvements (to products, processes or services) was not too dissimilar for winners and non-winners that went ahead with the project. The key difference was that non-winners expected benefits to materialise in the next 6-12 months whereas winners expected quality improvements to materialise at each point over the next five years.
- The survey results have also revealed that FSP winners seemed much more likely to engage in more R&D work following their project compared to non-winners. 62% of winners reported that their project had led to additional R&D work.

Q3: Quantification, if possible, of economic impacts such as Gross Value Added (GVA) and employment, but also social and environmental impacts.

- Non-winners of FSP grants saw an average growth in R&D employment of around 20%. However, winners saw a far greater growth with an average rate of 51%.
- Job creation was strongly identified as a wider benefit that had already been, or would be, generated by the projects.
- On the other hand, the survey evidence suggests that the impact of winners' projects on generating wider social benefits was generally weak.
- Around 40% of all winners stated that benefits from the winners would *only* apply to the UK, while around 80% of all winners said that these benefits would *also* apply to global economies.
- On the basis of measurable actual benefits generated to date i.e. R&D jobs, it is estimated that £1 spent by TSB has increased GVA by £1.75. Assuming that project benefits will last for the next five years, it is estimated that £1 spent by TSB would increase GVA by £2.72.
- Estimates of future potential benefits are based on multiple assumptions including that the expectations of businesses to create jobs will materialise. If the jobs created were of average value to the economy, for every £1 spent, GVA would increase by £2.15. On the other hand, if these were jobs of high value added, GVA would increase by £5.78 per £1 of public money spent by TSB.

Q4: The additional value of this investment

- With respect to its contribution and impact on technological capabilities, R&D and business performance, the winners' survey results indicate that the FSP assistance did make a difference.
- Around 72% of grant winners interviewed indicated that they would not have achieved similar results without the FSP assistance. Only less than 1% indicated that FSP made no contribution. Just over a quarter (27%) stated that FSP made no difference to the final results, but it did speed up the delivery of the results.
- Despite the Programme's emphasis on direct impact on technological and R&D capabilities rather than business performance, the Programme's perceived additionality is as high for business related benefits as for R&D and Technology.
- For over half the winners (54%) and just over two thirds of non-winners (67%), TSB was considered to be the only additional finance available for testing the feasibility of an idea or product. These results match the feedback received from businesses for the Collaborative R&D (CR&D) programme that indicated that nearly two thirds (65%) would have to rely on their own finance to fund their project in the absence of CR&D.
- 17.5% of winners and 9% of non-winners perceived FSP funding involving fewer risks for financing the feasibility of an idea.

- 14% of both winners and non-winners stated that they consider TSB as a key source of R&D funding.
- 8% of both winners and non-winners stated that this funding offered more attractive terms and conditions of finance.
- For just under a quarter of businesses (24%), FSP benefits would be short-lived i.e. would last for up to 3 years. For the largest group of responses (45%), however, benefits were expected to last indefinitely.
- In comparison, non-winners were more likely to expect benefits from their project lasting for either a relatively short time period (up to 3 years) or not to be indefinite.

Q5: Where possible, to establish cost benefit ratios and cost per job for the support provided.

- The CBR of the public investment to date and assuming that benefits generated would last up to five years is: 1:2.72
- The average cost for each new R&D job created between 2009 and 2012 was £16,405.
- The lowest cost per R&D job region is in Scotland, at around £8,400, followed by the North West at just under £10,000; Wales and the North East follow at £11,300-11,500 (on the basis of grant offered). The most expensive region is London, at around £32,000 per additional R&D job.
- The lowest cost per R&D job sector is in Space technologies, at around £6,800, followed by Nutrition for Life at just under £8,000 and then Nanotechnology at around £9,300. The most expensive sectors are Energy and Health and Medical, at just over £32,000 per additional R&D job each.

Q6: Impact of various factors on impact generated e.g. sector or technology area, company size, type of collaboration and structure.

- Review of the profiles of winning and non-winning organisations indicates that **a *typical* 2010/11 FSP winner would be** an organisation:
  - Whose main business activity is in R&D and/or Production (it is quite unlikely to be just in the Service sector);
  - Its area of interest/work is more likely to be in Nanotechnology & Materials, Digital or Space;
  - Is a relatively small business (but not a micro);
  - Is more likely to be less than 10 years old;
  - Is an independent company rather than a subsidiary;
  - Is a regular visitor to the TSB website; and,
  - Is more likely than a non-winner to have asked clarifications from TSB before completing the application form.
- Furthermore, it would be rather unlikely for a typical winner to have received any external assistance for completing the application form; and if they did receive assistance, they most probably did not pay anything for it.
- The econometric analysis has not revealed any single statistically significant factor affecting either R&D intensity or turnover following the FSP investment. This may be explained by the fact that in the relatively short time since the FSP funding was granted, statistically significant impacts on business performance indicators such as turnover or profitability would be unlikely.
- The econometric analysis, however, has shown that the sector that a firm belongs to broadly

appears to impact on R&D expenditure per employee more than R&D proportion of total employment. This may be due to some sectors being relatively less labour intensive in R&D than others or, they may be outsourcing their R&D activities while at the same time the nature of the products/services still require substantial investments of other resources through R&D. For example, Biotechnology firms appear to have noticeably lower proportions of R&D workers compared to Nanotechnology firms. Furthermore, Biotechnology, Digital, Energy and Nuclear firms all spent relatively less on R&D per employee compared to Nanotechnology firms (with Energy and Nuclear spending £24,000-£28,000 less).

- Results provide some evidence that R&D intensity falls once firms secure protection of key inventions/innovations – as measured by number of patents held. For example, the number of patents held had a relatively small impact on both R&D indicators. Where it was significant, it had a negative relationship with both measures of R&D intensity.
- Being in receipt of other funding was associated with a higher probability of winning FSP funding (probably indicating an experience effect), but it had no significant effect on the R&D intensity outcomes. Firms engaged in Services had a lower likelihood of winning FSP funding and were also likely to have lower R&D intensity.
- The survey results also highlighted a few more variations in terms of impact depending on various factors. For example:
  - There was a marked difference in the contribution of FSP to technological capabilities and R&D between those businesses that worked alone and those that worked with partners. For those that worked in collaboration, the full additionality of FSP was markedly higher than those working alone, 72% compared with 41%. On the other hand, those that worked alone were more likely to have seen speeding up of the delivery of results that they would otherwise have achieved later.
  - The average size of firms that would *definitely* not have achieved similar results was just 19 employees and well below the average for all winners, suggesting that FSP has been more important to smaller firms.
  - Notable sector variations include the Energy and Space sectors. Around 77%-83% of projects in Energy indicated that they would not have achieved similar results without assistance, compared to a survey average of 67-69%. About 37% of projects in Space said that the FSP assistance helped them speeding up the delivery of the results, well above the average (27%).

Conclusions

6.8 The analysis undertaken to date has shown that:

- **FSP is a highly effective Programme**
  - ✓ On the whole, it has met the expectations of businesses and stimulated innovation activity – not by just enabling investigation of the feasibility of new ideas but also developing new products and testing their application.
  - ✓ It has contributed to business performance improvements and job creation earlier than expected to.
  - ✓ It has yielded notable immediate improvements in: increasing the value of a business, leveraging of business profile and improving the quality of products/processes or services.
  - ✓ It has delivered sustainable benefits – business & R&D related - for the majority of businesses.

- ✓ Its aim has been to enable testing the feasibility of a mainly technological idea/process; therefore, it should not be surprising that it has attracted R&D focused organisations. Nevertheless, it has also offered a platform for organisations to test the commercial feasibility of their project – **with nine in ten FSP winners having improved their market position or expected to do so in the future.**
- ✓ The Programme is also acting **as a stepping-stone for further R&D activities,** including collaborative work.

- **It has also made a significant difference in a number of areas**
  - ✓ FSP has helped to deliver results that would not have happened without its assistance and speeded up the delivery of results that would otherwise materialise later. The latter is highly important as timing of achieving competitive advantage matters in a global competitive market with uneven resources and information.
  - ✓ The Programme has also demonstrated that, in line with its rationale, it can positively affect both, those that work in collaboration and those who decide to act alone at this early stage of concept testing. Collaborations have proved to achieve results that would not have been otherwise achieved. Single projects have also delivered results earlier than they would have otherwise done.
  - ✓ For smaller firms, it has proved to be a very important form of assistance for delivering results and minimising financial risk taking.
  - ✓ To all – winners and non-winners, FSP is seen as the main trusted source of finance support for testing new things.
- **The Programme has been highly valued** by businesses (winners and non-winners) and the future potential benefits to be generated by it would add considerable value to the economy, were they to materialise.
- **Management and delivery of the Programme has also worked well to date**. Both, the application and selection processes have been assessed as straightforward by the vast majority of businesses (winners and non-winners).

Methodological Issues for Future Consideration

6.9 The evaluation has demonstrated that a combination of methodological techniques is required to explore the multi-dimensional character of both R&D support/concept to commercialisation interventions and the targeted population. If resources and timing allow, descriptive analyses of administrative and management information should be combined with primary research and quantitative analyses to increase confidence in research findings but also open up new avenues of exploration – every new step taken in better understanding the impact of public R&D spending on the economy and the individual business behaviour could further improve future policy design for economic growth.

6.10 Comparisons of 'beneficiary' (i.e. winners) and 'non-beneficiary' (non-winners/others) groups represent a robust methodological approach. At the same time, mapping the project pathways followed by both groups can also provide important performance management information for the sponsoring organisations. The decision of the public sponsor, for example, not to fund a project that nevertheless goes ahead with private monies and succeeds could be seen as a successful outcome i.e. in this instance there is no market failure that would justify expenditure of public monies. A feasibility study demonstrating that an idea could not be feasible or commercially viable could be also seen as a legitimate and successful outcome of the whole process. It is recognised that collection of data and information to capture the exact impact of these decisions on the economy should be kept as simple as possible. However, a simple

framework similar to the one in Figure 6.1 could be used as a performance management tool that demonstrates the soundness of the decision-making process and its potential economic and financial impacts.

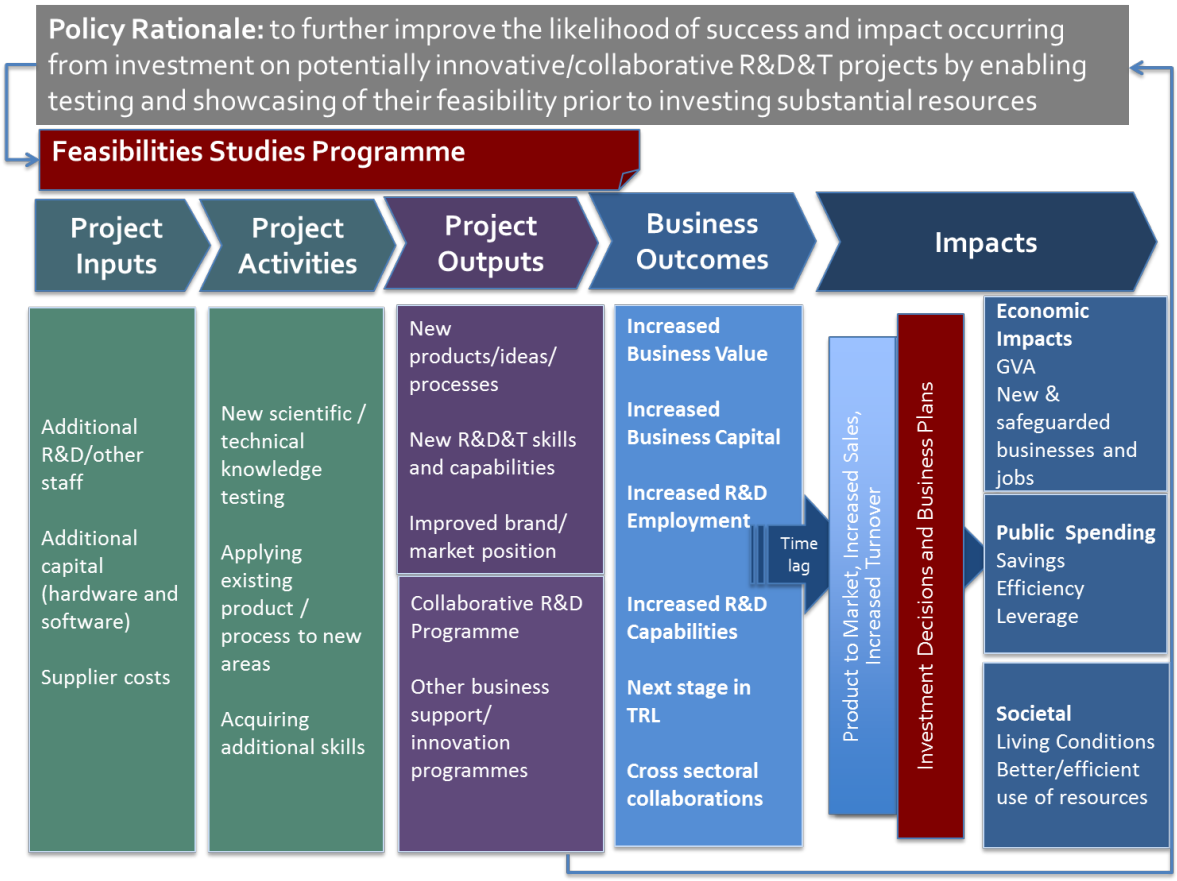
Figure 6.1: Capturing the Impact of the Feasibilities Studies Process

Application	Screening	Status	Feasibility Outcome	Outcome	Benefits	TSB/Public Sector Decision Quality
FSP Applications	FSP Approved	Continued with Project	Positive Results	Successful R&D	Long Term Investment and Return	Good
			Negative Results	Project Discontinued	Monies Not Wasted Further / Ideas Refined	Good
	FSP Not Approved	Continued with Project	Positive Results	Successful R&D	Private Funds Secured for Long Term Return	Good
			Negative Results	Project Discontinued	Monies Not Wasted Further / Ideas Refined	Good
		Continued with Smaller Project	Positive Results	Successful R&D	Private Funds Secured for Long Term Return	Good
			Negative Results	Project Discontinued	Monies Not Wasted Further / Ideas Refined	Good
		Project Discontinued	Not Tested	No Action	No Action	Unkown

Future Policy Considerations

6.11 This evaluation has also provided additional information to refine the logic chain underpinning this programme (and probably similar programmes including the CR&D programme). The refined logic chain is depicted in Figure 6.2 and it attempts to take into account other factors that could affect the impact of promising ideas on economic growth and the channelling of the emerging wealth to wider social and economic priorities. For example, it should be considered that creation of new jobs and businesses that would benefit the UK economy and society as a result of a new product would very much depend upon the business model and the decisions of the businesses in charge of these products.

Figure 6.2: Capturing the Impact of R&D Support



6.12 Consideration should, therefore, be given in the future to the following issues:

- The grant is currently used by businesses as a relatively modest injection to fill in various gaps in R&D capabilities of a business including staff costs (predominantly), testing, supplier costs, etc. However, it seems that these modest allocations of monies manage to lever the profile of a business and its value. In order to target future assistance accurately, there is a need to further explore, unpack and better understand the **success factors** underpinning this process including **how success is defined** by businesses involved in R&D activities, whether **policy and business aspirations are attuned** and the **role of government intervention in the 'technology push – market pull' spectrum.**
- There is also a need to 'track' the next steps of successful projects emerging from these feasibilities studies (or at least a small number of them) in a **systematic way** to ensure that **R&D investment leakage is minimised** and appropriate levels of support are provided depending on the distance of the product from the market and/or its potential contribution to economic growth (time and impact-wise).
- Further work will also need to be undertaken to better understand the **dynamics of business-HEIs partnerships and collaborations at this early stage of the concept to commercialisation route**/level of Technology Readiness Level (TRL), particularly as businesses are seen as the delivery agents of innovation (commercialisation) and HEIs as centres of substantial research infrastructure, skills and global resourcing networks.

ANNEXES

ANNEX A: Survey Scripts

SURVEY OF WINNERS

Good morning/afternoon/evening, my name is ..... and I am calling from .....
We have been commissioned by the Technology Strategy Board to conduct a review of the impacts of the 2010-11 Feasibility Study projects. As part of the research we are talking to businesses that were successful in getting a grant. Your contact details have been provided by..... (name of the Competition Owner) The questionnaire will take around 20 minutes and covers issues around the project and its delivery, the application process, benefits and impacts that have been generated or will be generated in the future, your recommendations about future funding and some general information about your business. All information provided will be treated as confidential and results will be presented in an aggregate and anonymised form.

A. GENERAL INFO

Is it convenient to speak to you now or would you prefer to make an appointment for another time?

Yes	1	**CONTINUE**
No	2	**MAKE APPOINTMENT**
Refused to participate	3	**Reason, if willing to provide THANK & CLOSE**

Firstly, can I just check that you are not a public sector organisation?
INTERVIEWER NOTE: Businesses, HIGHER EDUCATION INSTITUTIONS, SOCIAL ENTERPRISES, NOT-FOR-PROFIT ORGANISATIONS AND CO-OPERAT IVES CAN BE INTERVIEWED. Others should be screened out.

1. Has your business/organisation received a grant from the Feasibilities Studies Programme between 2010 and 2011 ? **(Interviewer note: The programme we are evaluating is the 2010-2011 programme. There have been others since then. Therefore we need to specify to the respondent that we are talking about the 2010-2011 programme)**

Yes	1	**continue**
No	2	**THANK & CLOSE**

2. And are you still receiving funds from TSB under the Feasibilities Studies Programme?

Yes	1
No	2

3. And are you receiving other funds from TSB

Yes (please specify)	1
No	2

4. And are you receiving funds from other Government resources

Yes (please specify source)	1
No	2

B. ORGANISATIONAL PROFILE

5. What is the main activity of your business? **RECORD VERBATIM. PROBE FOR INDUSTRY TYPE – WHAT TYPE OF Production? Medical/Manufacturing?**

WRITE IN AND CODE BELOW:	
Production (specify industry)	1

R&D	2
Services	3
Education	4
Other (SPECIFY)	5

6. How long ago was your business established?
   READ OUT AS NECESSARY. IF NEEDED, CLARIFY THAT THIS MEANS WHEN THE BUSINESS STARTED TRADING

1-2 years ago	1
3-4 years ago	2
5 years ago	3
6-10 years ago	4
11-20 years ago	5
More than 20 years ago	6
Refused	7

7. A) How many people are currently employed by your business at the site where you work? B) What proportion is full time?

Number (write in)		Go to Q8
What proportion is full time?	%	

8. And how many people were employed in 2009?

Number (write in)		Go to Q9
What proportion is full time?	%	

9. And is the business currently...?

An independent single site organisation	1
The headquarters of a multi-site organisation	2
One of several company sites	3
Other (**SPECIFY**)	4

10. Is your company currently a subsidiary of another?

Yes	1
No	2

11. What was your status prior to receiving the TSB grant?

Independent	1
Subsidiary	2

12. If you had to estimate your annual turnover (or sales) in 2009, into which of the following bands would you put yourself?

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8

£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

13. If you had to estimate your current annual turnover/sales, into which of the following bands would you put yourself? **READ OUT**

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

14. If you had to estimate your current profit, into which of the following bands would you put yourself? **READ OUT**

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

15. If you had to estimate your profit in 2009, into which of the following bands would you put yourself? **READ OUT**

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

16. How many employees do you engage in R&D activities?

	Write in
In 2009	
Currently	

17. Could you please specify your annual budget on R&D activities?

	Write in

In 2009	
Currently	

18. How many patents are you holding (**GIVE A NUMBER**)?

	Write in
In 2009	
Currently	

C. THE PROJECT

19. What was the Feasibility Studies Programme funding for... Was it for...? **CAN MULTI-CODE**

Proving a concept/investigating the feasibility of an idea	1
Producing new scientific/technical knowledge	2
Testing the application of a new product	3
Testing a new process	4
Investigating the feasibility of applying an existing product/process to a new area	5
Investigating taking a product to market/commercialising an idea	6
Collaborating with other businesses	7
Collaborating with universities	8
Accessing leading edge research	9
Accessing research equipment and infrastructure	10
Acquiring additional skills	11
Acquiring higher skills	12
Other (**SPECIFY**)	13

20. And how was the Feasibility Studies Programme funding spent?

Grant Spent	**Approximate % grant**
Additional Staff Costs	
Supplier Costs	
Prototypes and Testing	
Market Testing	
Capital (hardware and software)	
Other (specify)	
Total	**100%**

21. And why did you approach TSB to finance this project? …TSB …**(CAN MULTICODE)**

Was the only additional finance available for testing feasibility of an idea/product	1
Offered more attractive terms and conditions of finance	2
Involved less risk in financing	3
Is a key source of R&D funding	4
Is a key source of commercialization funding	5
Other **(SPECIFY)**	6

22. Did you seek alternative funding for your project prior to approaching TSB?

Yes **(SPECIFY)**	1
No **(WHY NOT)**	2

23. Was any match funding provided out of your company's internal resources?

Yes	1	Go to Q25

No	2	Go to Q24

24. If no to the above, what was the source?

Bank loan	1
Other government funding **(SPECIFY)**	2
Other	3
Did not need additional funding	4

25. Would you have undertaken the project without the TSB grant?

Yes - in the same time frame	1
Yes - in a longer time frame	2
Yes – in a shorter frame	3
Unlikely	4
Definitely not	5

D. APPLICATION PROCESS

26. How did you first become aware of the TSB competition? **CAN MULTI-CODE**

TSB email	1
TSB website	2
Trade Magazine/Paper/ Trade Fair	3
Word of Mouth/Colleague/Friend/New employee	4
Local Business Association/Seminar/Presentation	5
Supplier/Customer	6
Other (**SPECIFY**)	7

27. How often do you visit the TSB website?

Once a month	1	Ask Q28
Every couple of months	2	
Every six months	3	
Annually	4	
Never	5	Go to Q29
Less than once a year	6	Ask Q28

28. How well would you rate the '_connect' website (https://connect.innovateuk.org/) in terms of usefulness for your application. Please use a scale where **5 means very useful and 1 means not at all useful**? **KEY IN SCORE**

	1=not at all useful →				5=very useful
Understanding the competition eligibility requirements	1	2	3	4	5
Downloading relevant documentation	1	2	3	4	5
Providing clear instructions for completion of the application	1	2	3	4	5
Uploading relevant documentation	1	2	3	4	5
Other (specify)	1	2	3	4	5

29. Did you seek further clarification/advice whilst trying to complete the application?

Yes	1	Ask Q29a
No	2	Go to Q31

a) If yes, please specify the nature of your query(ies)

30. How would you rate the advice received? Please use a scale where **5 means very useful and 1 means not at all useful**?

1=not at all useful	1
2	2
3	3
4	4
5=very useful	5

31. Did you have to get external advice/support to fill in your application?

Yes	1	Ask Q32
No	2	Go to Q34

32. If yes, did you have to pay for this support/advice?

Yes	1	Ask Q33
No	2	Go to Q34

33. (If yes) If you had to estimate what you paid for the extended consultancy into which of the following bands would you put it?

Zero/nothing	1
Up to £500	2
£501 - 1,000	3
£1,001 - 2,000	4
£2,001 - 5,000	5
More than £5,000	6
Refused	7

34. How would you rate the overall applications process on a scale 1 to 5, **5 means straightforward and 1 mean confusing**

1=confusing	1
2	2
3	3
4	4
5=straightforward	5

35. Do you have any suggestions for improvement?

E. DELIVERY

36. Did you have any partners working with you on the project?

Yes	1	Ask Q37
No	2	Go to Q38

37. If yes, a) were they…b)and had you worked together before?

	a) If yes, were they..(if yes specify how many)		b) Had you worked together before	
	Yes	No	Yes	No
A small business (how	1	2	1	2

many)				
A large business (how many)	1.....	2	1	2
Education institution (how many)	1	2	1	2
Other (specify and how many)	1	2	1	2

38. Did you face any challenges **during** the implementation of the project?

Yes	1	Ask Q39
No	2	Go to Q40

39. If yes, what were these?

Funding	1
Resources – Skills	2
Resources – Equipment	3
Technological (Specify)	4
Collaboration (Specify)	5
Other (Specify)	6

F. BENEFITS AND IMPACT

I am going to read out several ways in which you might have benefitted from the support.

40. These first refer to R&D collaborations and expertise and technological improvements. Please tell me for each of the following, whether **it is actually** a benefit that your business has experienced/**will** experience in the future or not (TICK BOXES)

Benefits	**Actual/has materialised**	**Will materialise in the future**				**No**
		Next 6-12 months	**Next 1-2 years**	**Next 2-5**	**After 5 years**	
Products/Services						
Develop new product/service(s)/processes	1	2	3	4	5	6
Improve existing product/service(s)/processes	1	2	3	4	5	6
Technological						
Produce new scientific/technical knowledge	1	2	3	4	5	6
Explore the feasibility/application of technologies	1	2	3	4	5	6
Investigate the technical feasibility of an idea(s)	1	2	3	4	5	6
Investigate the commercial feasibility of an idea	1	2	3	4	5	6
Improve technological readiness of the business	1	2	3	4	5	6
R&D Capabilities						
Access commercialisation skills	1	2	3	4	5	6
Access technical / R&D skills	1	2	3	4	5	6
Access leading edge research	1	2	3	4	5	6
Access equipment and research	1	2	3	4	5	6

infrastructure						
Strengthen collaborative activity with other businesses	1	2	3	4	5	6
Strengthen collaborative activity with HEIs	1	2	3	4	5	6
Provide placements/sponsorship for research students	1	2	3	4	5	6
Other (specify)	1	2	3	4	5	6

41. And how long would you say these benefits would last on average?

Less than a year	1
1-3 years	2
4-5 years	3
More than 5 years	4
Indefinitely	5

42. What are the next steps following the completion of your project? **(PLEASE DESCRIBE)……(PROMPT prototyping, production, take to market)**

43. More specifically, has the participation in this programme led to any new follow on R&D projects?

Yes	1	Ask Q44
No	2	Go to Q45

44. If yes, have you applied for/secured grant funding for them? **(CAN MULTICODE)**

Another Feasibilities Studies Programme grant	1
Collaborative R&D	2
Alternative public funding	3
Private funding	4
Other (specify)	5

45. Overall, in terms of technological capabilities and R&D as described above, which of the following best describes your view of the contribution TSB/FSP assistance?

We would have achieved similar results anyway	1
We would have achieved similar results, but not as quickly	2
We would have achieved some but not all of the results	3
We **probably** would **not** have achieved similar results	4
We **definitely** would **not** have achieved similar results	5

46. Turning now to your business performance, please tell me for each of the following, whether **it is actually** a benefit that your business has experienced/**will likely experience** in the future or not:

Benefits	Actual/has materialised	Will materialise in the future				No
		Next 6-12 months	Next 1-2 years	Next 2-5	After 5 years	
Business Performance						
Enter new markets or increased market share	1	2	3	4	5	6
Increase export sales (or start exporting)	1	2	3	4	5	6
Increase income from	1	2	3	4	5	6

intellectual property						
Increase turnover	1	2	3	4	5	6
Increase profits	1	2	3	4	5	6
Increase employment	1	2	3	4	5	6
Improve productivity	1	2	3	4	5	6
Increase values of business	1	2	3	4	5	6
Easier to access finance	1	2	3	4	5	6
Lever additional funding	1	2	3	4	5	6
Lever business profile	1	2	3	4	5	6
QCD						
Reduce costs of production	1	2	3	4	5	6
Reduce costs of business running	1	2	3	4	5	6
More efficient use of resources	1	2	3	4	5	6
Reduce waste	1	2	3	4	5	6
Improve quality of products/processes/services	1	2	3	4	5	6
Improve delivery times	1	2	3	4	5	6
Skills and Capabilities						
Improve commercialisation skills	1	2	3	4	5	6
Improve technical /R&D skills	1	2	3	4	5	6
Improve technical knowledge / understanding	1	2	3	4	5	6
Enhance equipment & research infrastructure	1	2	3	4	5	6
Enhance networks in business	1	2	3	4	5	6
Enhance networks in HE	1	2	3	4	5	6
Other	1	2	3	4	5	6

47. And how long would you say these benefits would last on average?

Less than a year	1
1-3 years	2
4-5 years	3
More than 5 years	4
Indefinitely	5

48. More specifically, has the project led to any other qualitative benefits or changes to your business?

49. To date, would you say that the benefits from the project have already exceeded the costs?

Yes	1
No	2
Too early to say	3

50. Do you expect the overall benefits (including future benefits) from the project to exceed the costs?

Yes	1	Ask Q51
No	2	Go to Q52

51. If yes, into which of these bands would you put these financial returns for your business **(ROUGH ESTIMATE)?**

Up to £10,000	1
£10,001 - £25,000	2
£25,001 - £50,000	3
£50,001 - £100,000	4
£100,000 - £500,000	5
More than £500,000	6
Refused	8

52. Overall, which of the following best describes your view of the contribution TSB/FSP assistance has made to the performance of your business, or is expected to make to your firm in the future?

We would have achieved similar results anyway	1
We would have achieved similar results, but not as quickly	2
We would have achieved some but not all of the results	3
We **probably** would **not** have achieved similar results	4
We **definitely** would **not** have achieved similar results	5

53. In terms of **wider benefits**, please tell me for each of the following, whether **it is actually** a benefit that the project has generated/**will likely generate** in the future…

	Yes	No	DK
Job creation	1	2	3
More efficient use of energy	1	2	3
Health improvements	1	2	3
Social care improvements	1	2	3
Educational improvements	1	2	3
Transport improvements	1	2	3
Housing improvements	1	2	3
General living / quality of life conditions	1	2	3
Other (Specify)	1	2	3

54. And would you say that these wider benefits would apply to: **(CAN MULTICODE)**

The UK	1
Global economies/society	2

55. During your involvement with this competition, had your company experienced any other changes that could explain a substantial proportion of the impacts you mentioned earlier? (will need to PROBE for example, changes to key staff, changes in market conditions)

Yes (specify)	1
No	2

G. FUTURE IMPROVEMENTS

56. Please tell us what you would like to see less and more in the future:

Less of (please write in):
More of (please write in):

57. Would you be willing to be contacted again to participate in follow up research?

Yes	1

No	2

SURVEY OF Non – Winners

Good morning/afternoon/evening, my name is ..... and I am calling from .....We have been commissioned by the Technology Strategy Board to conduct a review of the of the 2010-11 Feasibility Study projects. As part of the research we are talking to businesses that applied but did not get a grant. Your contact details have been provided by TSB and ..... (name of the Competition Owner) The questionnaire will take around 15 minutes and covers issues around the application process, whether your project went ahead without the TSB grant and your recommendations about future funding and support. All information provided will be treated as confidential and results will be presented in an aggregate and anonymised form.

A. GENERAL INFO

1. Is it convenient to speak to you now or would you prefer to make an appointment for another time?

Yes	1	**CONTINUE**
No	2	**MAKE APPOINTMENT**
Refused to participate	3	**Reason, if willing to provide THANK & CLOSE**

Firstly, can I just check that you are not a public sector organisation?
INTERVIEWER NOTE: Businesses, HIGHER EDUCATION INSTITUTIONS, SOCIAL ENTERPRISES, NOT-FOR-PROFIT ORGANISATIONS AND CO-OPERAT IVES CAN BE INTERVIEWED. Others should be screened out.

2. Did your business/organisation applied for a grant from the Feasibilities Studies Programme between 2010 and 2011 ? **(Interviewer note: The programme we are evaluating is the 2010-2011 programme. There have been others since then. Therefore we need to specify to the respondent that we are talking about the 2010-2011 programme)**

Yes	1	**continue**
No	2	**THANK & CLOSE**

3. Did you receive funding from TSB under the Feasibilities Studies Programme?

Yes	1
No	2

4. And are you receiving other funds from TSB

Yes (please specify)	1
No	2

5. And are you receiving funds from other Government resources

Yes (please specify source)	1
No	2

B. ORGANISATIONAL PROFILE

6. What is the main activity of your business? **RECORD VERBATIM. PROBE FOR INDUSTRY TYPE – WHAT TYPE OF Production? Medical/Manufacturing?**

WRITE IN AND CODE BELOW:

Production (specify industry)	1
R&D	2
Services	3
Education	4
Other (SPECIFY)	5

7. How long ago was your business established?
READ OUT AS NECESSARY. IF NEEDED, CLARIFY THAT THIS MEANS WHEN THE BUSINESS STARTED TRADING

1-2 years ago	1
3-4 years ago	2
5 years ago	3
6-10 years ago	4
11-20 years ago	5
More than 20 years ago	6
Refused	7

8. A) How many people are currently employed by your business at the site where you work? B) What proportion is full time?

Number (write in)		Go to Q8
What proportion is full time?	%	

9. And how many people were employed in 2009?

Number (write in)		Go to Q9
What proportion is full time?	%	

10. And is the business currently...?

An independent single site organisation	1
The headquarters of a multi-site organisation	2
One of several company sites	3
Other (**SPECIFY**)	4

11. Is your company currently a subsidiary of another?

Yes	1
No	2

12. What was your status prior to applying for the TSB grant?

Independent	1
Subsidiary	2

13. If you had to estimate your annual turnover (or sales) in 2009, into which of the following bands would you put yourself?

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10

Refused	11

14. If you had to estimate your current annual turnover/sales, into which of the following bands would you put yourself? **READ OUT**

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

15. If you had to estimate your current profit, into which of the following bands would you put yourself? **READ OUT**

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

16. If you had to estimate your profit in 2009, into which of the following bands would you put yourself? **READ OUT**

Zero/nothing	1
Up to £50,000	2
£50,001 - £150,000	3
£150,001 - £300,000	4
£300,001 - £500,000	5
£500,001 - £1,000,000	6
£1,000,001 - £2,000,000	7
£2,000,001 - £5,000,000	8
£5,000,001 - £10,000,000	9
More than £10million	10
Refused	11

17. How many employees do you engage in R&D activities?

	Write in
In 2009	
Currently	

18. Could you please specify your annual budget on R&D activities?

	Write in
In 2009	
Currently	

19. How many patents are you holding (**GIVE A NUMBER**)?

	Write in
In 2009	
Currently	

C. THE PROJECT

20. What was the funding that you applied for… Was it for…? **CAN MULTI-CODE**

Proving a concept/investigating the feasibility of an idea	1
Producing new scientific/technical knowledge	2
Testing the application of a new product	3
Testing a new process	4
Investigating the feasibility of applying an existing product/process to a new area	5
Investigating taking a product to market/commercialising an idea	6
Collaborating with other businesses	7
Collaborating with universities	8
Accessing leading edge research	9
Accessing research equipment and infrastructure	10
Acquiring additional skills	11
Acquiring higher skills	12
Other (**SPECIFY**)	13

21. Why did you apply for TSB for funding? …**(CAN MULTICODE)**

Was the only additional finance available for testing feasibility of an idea/product	1
Offered more attractive terms and conditions of finance	2
Involved less risk in financing	3
Is a key source of R&D funding	4
Is a key source of commercialization funding	5
Other **(SPECIFY)**	6

22. Did you seek alternative funding for your project prior to approaching TSB?

Yes **(SPECIFY)**	1
No **(WHY NOT)**	2

23. And what did you do when you did not get the funding

Options	
Went ahead with the project as applied for	Q23
Went ahead with the project but at a smaller scale	Q23
Will go ahead with it in the future	Q23
Have abandoned the project (for good)	Ask why

24. If went ahead, or will go ahead with it in the future, what has been/will be the source of funding?

Source		**%**
Own funds	0	
Bank loan	1	
Other government funding **(SPECIFY)**	2	
Other	3	

Total		100%

D. APPLICATION PROCESS

25. How did you first become aware of the TSB competition? **CAN MULTI-CODE**

TSB email	1
TSB website	2
Trade Magazine/Paper/ Trade Fair	3
Word of Mouth/Colleague/Friend/New employee	4
Local Business Association/Seminar/Presentation	5
Supplier/Customer	6
Other (**SPECIFY**)	7

26. How often do you visit the TSB website?

Once a month	1	Ask Q26
Every couple of months	2	
Every six months	3	
Annually	4	
Never	5	Go to Q27
Less than once a year	6	Ask Q26

27. How well would you rate the '_connect' website (https://connect.innovateuk.org/) in terms of usefulness for your application. Please use a scale where **5 means very useful and 1 means not at all useful**? **KEY IN SCORE**

	1=not at all useful → 5=very useful				
Understanding the competition eligibility requirements	1	2	3	4	5
Downloading relevant documentation	1	2	3	4	5
Providing clear instructions for completion of the application	1	2	3	4	5
Uploading relevant documentation	1	2	3	4	5
Other (specify)	1	2	3	4	5

28. Did you seek further clarification/advice whilst trying to complete the application?

Yes	1	Ask Q28
No	2	Go to Q34
a)If yes, please specify the nature of your query(ies)		

29. How would you rate the advice received? Please use a scale where **5 means very useful and 1 means not at all useful**?

1=not at all useful	1
2	2
3	3
4	4
5=very useful	5

30. Did you have to get external advice/support to fill in your application?

Yes	1	Ask Q30

No	2	Go to Q32

31. If yes, did you have to pay for this support/advice?

Yes	1	Ask Q31
No	2	Go to Q32

32. (If yes) If you had to estimate what you paid for the extended consultancy into which of the following bands would you put it?

Zero/nothing	1
Up to £500	2
£501 - 1,000	3
£1,001 - 2,000	4
£2,001 - 5,000	5
More than £5,000	6
Refused	7

33. How would you rate the overall applications process on a scale 1 to 5, **5 means straightforward and 1 mean confusing**

1=confusing	1
2	2
3	3
4	4
5=straightforward	5

34. Do you have any suggestions for improvement?

E. DELIVERY

Ask those that went ahead with the project – q.20 (without the FSP monies)

35. Did you have any partners working with you on the project?

Yes	1	Ask Q35
No	2	Go to Q38, **if they have done the project without the Government monies** Go to 51a **if they have not done the project**

36. If yes, a) were they…
    b)and had you worked together before?

	a) If yes, were they..(if yes specify how many)		b)Had you worked together before	
	Yes	No	Yes	No
A small business (how many)	1	2	1	2
A large business (how many)	1.....	2	1	2
Education institution (how many)	1	2	1	2
Other (specify and how many)	1	2	1	2

37. Did you face any challenges **during** the implementation of the project?

Yes	1	Ask Q37
No	2	Go to Q38

38. If yes, what were these?

Funding	1
Resources – Skills	2
Resources – Equipment	3
Technological (Specify)	4
Collaboration (Specify)	5
Other (Specify)	6

F. BENEFITS AND IMPACT

For the ones who went ahead with the project without FSP monies, I am going to read out several ways in which you **might** have benefitted from the project.

39. These first refer to R&D collaborations and expertise and technological improvements. Please tell me for each of the following, whether **it is actually** a benefit that your business has experienced/**will** experience in the future or not (TICK BOXES)

Benefits	**Actual/has materialised**	**Will materialise in the future**				**No**
		Next 6-12 months	**Next 1-2 years**	**Next 2-5**	**After 5 years**	
Products/Services						
Develop new product/service(s)/processes	1	2	3	4	5	6
Improve existing product/service(s)/processes	1	2	3	4	5	6
Technological						
Produce new scientific/technical knowledge	1	2	3	4	5	6
Explore the feasibility/application of technologies	1	2	3	4	5	6
Investigate the technical feasibility of an idea(s)	1	2	3	4	5	6
Investigate the commercial feasibility of an idea	1	2	3	4	5	6
Improve technological readiness of the business	1	2	3	4	5	6
R&D Capabilities						
Access commercialisation skills	1	2	3	4	5	6
Access technical / R&D skills	1	2	3	4	5	6
Access leading edge research	1	2	3	4	5	6
Access equipment and research infrastructure	1	2	3	4	5	6
Strengthen collaborative activity with other businesses	1	2	3	4	5	6
Strengthen collaborative activity with HEIs	1	2	3	4	5	6
Provide placements/sponsorship for research students	1	2	3	4	5	6
Other (specify)	1	2	3	4	5	6

40. And how long would you say these benefits would last on average?

Less than a year	1
1-3 years	2

4-5 years	3
More than 5 years	4
Indefinitely	5

41. What are the next steps following the completion of your project? **(PLEASE DESCRIBE).....(PROMPT prototyping, production, take to market)**

42. More specifically, has this project led to any new follow on R&D projects?

Yes	1	Ask Q42
No	2	Go to Q45

43. If yes, have you applied for/secured grant funding for them? **(CAN MULTICODE)**

Another Feasibilities Studies Programme grant	1
Collaborative R&D	2
Alternative public funding	3
Private funding	4
Other (specify)	5

44. Turning now to your business performance, please tell me for each of the following, whether **it is actually** a benefit that your business has experienced/**will likely experience** in the future or not:

Benefits	Actual/has materialised	Will materialise in the future				No
		Next 6-12 months	Next 1-2 years	Next 2-5	After 5 years	
Business Performance						
Enter new markets or increased market share	1	2	3	4	5	6
Increase export sales (or start exporting)	1	2	3	4	5	6
Increase income from intellectual property	1	2	3	4	5	6
Increase turnover	1	2	3	4	5	6
Increase profits	1	2	3	4	5	6
Increase employment	1	2	3	4	5	6
Improve productivity	1	2	3	4	5	6
Increase values of business	1	2	3	4	5	6
Easier to access finance	1	2	3	4	5	6
Lever additional funding	1	2	3	4	5	6
Lever business profile	1	2	3	4	5	6
QCD						
Reduce costs of production	1	2	3	4	5	6
Reduce costs of business running	1	2	3	4	5	6
More efficient use of resources	1	2	3	4	5	6
Reduce waste	1	2	3	4	5	6
Improve quality of products/processes/services	1	2	3	4	5	6
Improve delivery times	1	2	3	4	5	6
Skills and Capabilities						
Improve commercialisation skills	1	2	3	4	5	6

Improve technical /R&D skills	1	2	3	4	5	6
Improve technical knowledge / understanding	1	2	3	4	5	6
Enhance equipment & research infrastructure	1	2	3	4	5	6
Enhance networks in business	1	2	3	4	5	6
Enhance networks in HE	1	2	3	4	5	6
Other	1	2	3	4	5	6

45. And how long would you say these benefits would last on average?

Less than a year	1
1-3 years	2
4-5 years	3
More than 5 years	4
Indefinitely	5

46. More specifically, has the project led to any other qualitative benefits or changes to your business?

47. To date, would you say that the benefits from the project have already exceeded the costs?

Yes	1
No	2
Too early to say	3

48. Do you expect the overall benefits (including future benefits) from the project to exceed the costs?

Yes	1	Ask Q49
No	2	Go to Q52

49. If yes, into which of these bands would you put these financial returns for your business **(ROUGH ESTIMATE)?**

Up to £10,000	1
£10,001 - £25,000	2
£25,001 - £50,000	3
£50,001 - £100,000	4
£100,000 - £500,000	5
More than £500,000	6
Refused	8

50. In terms of **wider benefits,** please tell me for each of the following, whether **it is actually** a benefit that the project has generated/**will likely generate** in the future, or not:

	Yes	No	DK
Job creation	1	2	3
More efficient use of energy	1	2	3
Health improvements	1	2	3
Social care improvements	1	2	3
Educational improvements	1	2	3
Transport improvements	1	2	3
Housing improvements	1	2	3
General living / quality of life conditions	1	2	3

Other (Specify)	1	2	3

51. And would you say that these wider benefits would apply to: **(CAN MULTICODE)**

The UK	1
Global economies/society	2

52. During your involvement with this project had your company experienced any other changes that could explain a substantial proportion of the impacts you mentioned earlier? (will need to PROBE for example, changes to key staff, changes in market conditions)

Yes (specify)	1
No	2

For the ones who did not go ahead with the project:

53a. How would you rate the impact of non-going ahead with the project on a scale 1 to 5 **means high impact and 1 means no impact at all**? **KEY IN SCORE**

Development of new products/processes	1	2	3	4	5	6
R&D Capabilities	1	2	3	4	5	6
Collaborative activities	1	2	3	4	5	6
Reduced turnover	1	2	3	4	5	6
Reduced employment	1	2	3	4	5	6
Other (specify)	1	2	3	4	5	6

Q53b If you had gone ahead with the project into which of these bands would you put these net financial returns for your business **(ROUGH ESTIMATE)?**

Up to £10,000	1
£10,001 - £25,000	2
£25,001 - £50,000	3
£50,001 - £100,000	4
£100,000 - £500,000	5
More than £500,000	6
Refused	8

G. FUTURE IMPROVEMENTS

54. All, please tell us what you would like to see less and more in the future:

Less of (please write in):
More of (please write in):

55. Would you be willing to be contacted again to participate in follow up research?

Yes	1
No	2

ANNEX B – Econometric Analysis

Introduction

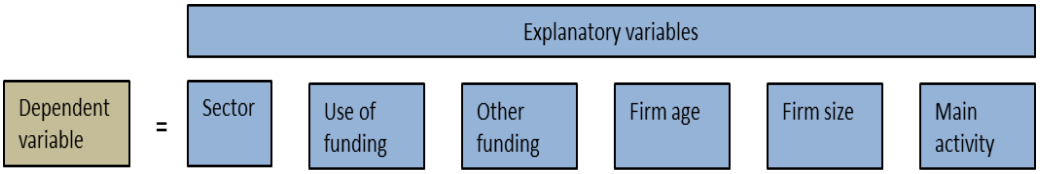
This Annex outlines in very general terms the econometric approach that has been applied by **Cambridge Econometrics** to test and measure the impact of TSB funding. Key questions addressed through this analysis include:

- What were the impacts of the Board's funding on outcomes of interest? Controlling for business characteristics such as sector or firm size, are there significant differences between winners and non-winners of the Feasibility Study funding?
- What factors influence the extent and nature of the impacts? Are differences in impacts dependent upon factors such as sector or firm size?
- What factors influence the outcome of the funding application? In addition, the econometric models used provide further insights into which factors contribute to the probability of a firm's application being successful (being a winner)?

The data sources for this project are TSB's administrative database of applicants (winners and non-winners) to the 2010/11 Feasibility programme and a dataset of survey responses from a sub-set of winners and non-winners who were interviewed for this project.

General approach

The general approach to the econometric analysis involves seeking to explain the variation in the dependent variable (*y*) between different firms (*i*) in terms of variation in a vector of explanatory variables (*x*). Conceptually, this can be presented as:



The dependent variable is a function of, or determined by, some combination of explanatory variables. In the diagram above, the explanatory variables listed are examples for presentation purposes only. More specifically, the analysis involves testing econometric models of the following form:

$$[1] \qquad y_i = \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \ldots. + \beta_n x_{im} + u_i \,,\; i = 1 \ldots .\mathrm{n}$$

where, across $i = 1 \ldots .\mathrm{n}$ firms:

y_i = the dependent variable;

$x_{i1}, x_{i2}, x_{i3}, x_{im}$ = the *m* explanatory variables identified as potentially important in explaining changes in y_i (e.g. firm size, main activity);

$\beta_1, \beta_2, \beta_3, \beta_n$ = the parameters on the corresponding explanatory variables, which measure the effect of a change in x_{im} on y_i ;

u_i = the residual term and captures that part of the variation that cannot be attributed to the explanatory variables.

The estimated β values are what are of most interest to the analysis. The statistical significance and value of each β will provide information about 1) whether or not the associated explanatory variable influences the dependent variable (y_i); and, if so, 2) the size and direction (positive or negative) of that influence.

The extensive representation of the model in [1] can be also written as follows, where $\mathbf{x_i}$ is a vector of the *m* explanatory variables and $\boldsymbol{\beta}$ is the vector of corresponding *m* parameters associated with each explanatory variable.

$$[2] \quad y_i = \boldsymbol{\beta}\mathbf{x_i} + u_i\,,\; i = 1\ldots.\mathrm{n}$$

Specifying the models to be tested

The impact of receiving funding from TSB

To test and measure the impact of receiving funding from TSB (on indicators of interest), the general form of the model needs to be extended as follows[20]:

$$[3] \quad y_i = \boldsymbol{\beta}\mathbf{x_i} + \gamma TSB_i + \alpha\lambda_i + u_i\,,\; i = 1\ldots.\mathrm{n}$$

In this case:

- The dependent variable (y_i) would be the indicator of interest (e.g. a measure of employment or R&D spending);
- The explanatory variables (x_m) would include various firm characteristics (e.g. size, sector, main activity etc.) identified from the survey;
- A dummy variable TSB would be included to indicate whether the firm in question received financial support from TSB. If the coefficient γ is significant this would indicate that there is a significant difference between funded and non-funded firms in the indicator of interest.
- λ is an adjustment factor used to correct for any potential sample bias and ensure estimates of **β** and γ are unbiased.

Specifications Tested

Several specifications of the model [3] were constructed and tested to investigate the impacts of TSB funding by including different variables for:

- The outcome of interest (i.e. the dependent variable, y_i);
- Firm characteristics (i.e. the explanatory variables, x_m).

Variable selection

Main regression equation

Dependent Variable: In the econometric models estimated **"R&D intensity"** has been used as the key outcome of interest. In the time elapsed since funding was granted, an impact of funding on R&D activity should be expected. Two alternative measures of R&D intensity were tested to assess impact at this stage because the impact of funding on either turnover or profit is unlikely to have been realised in the relatively short period of time since funding was granted.

The first dependent variable to be used is R&D spending per employee. This is calculated by dividing the current R&D budget stated in question 17 of the winners and non-winners questionnaires by the current total number of employees stated in question 7a of the winners and non-winners questionnaires (£ per employee). A measure per employee was used to consider R&D spending while taking into account the size of the firm. It was not possible to calculate measures of R&D spending as a proportion of revenue or profit because the data for revenue and profit were expressed in broad bands rather than specific figures.

The second dependent variable used is the proportion of total employees that are involved in R&D. This was calculated by dividing the current total number of employees engaged in R&D stated in question 16b in the winners and non-winners questionnaires by the current total number of employees stated in question 7a of the winners and non-winners questionnaires. All values should be a decimal between 0 and 1.

[20] Note, that the presentation here is a simplified version. In actual fact, a two-step estimation process is applied in order to adjust for selection bias. This involves first estimating the probability of receiving TSB funding (i.e. being a winner). This gives us the estimate for λ. This estimate is then included as an explanatory variable in the main model so to correct for any bias in the estimates of **β** and γ (i.e. the Heckman Treatment Effects Model has been used).

Explanatory Variables

- **Competition/Sector**. Indicators for sector are included in the regression equation by using the 'quota area' stated by both winners and non-winners. The sectors are Biotechnology, Digital, Energy, Health and medical, Nanotechnology and materials, Nuclear, Nutrition for life, and Space. Each of these sectors has a dummy variable in the regression equation. It equals 1 if the firm does belong to the relevant sector and equals zero otherwise. These variables are included to look at the difference in the impact of TSB funding for different sectors especially as some sectors account for a much higher proportion of respondents than others (e.g. Nanotechnology). In this case a firm cannot state multiple answers so one of the sector dummies must be omitted, as they are perfectly collinear. The dummy omitted is that for Nanotechnology as this sector accounts for the largest proportion of respondents. So, when the results are interpreted what is compared is the effect of sector versus the "reference" sector of Nanotechnology.
- **What was the funding for:** There are several further dummy variables based on what the firms indicated the FSP funding was for. The most relevant categories appeared to be for producing new scientific/technological knowledge (question 19b), for investigating the feasibility of applying an existing product/process to a new area (question 19e), for acquiring additional skills (question 19k). For this question the respondents were able to select multiple answers. These dummy variables equal 1 if the firm indicated the relevant intention for the funding as one of their answers.
- **Was the firm in receipt of other funding:** It is worth controlling for the impact of other funding that a firm may have received such that we do not attribute any costs/benefits from this funding to the FSP funding. Questions 3 and 4 ask if the firm is receiving other TSB funds or other government funds respectively. There is a dummy variable for each of these questions which equal 1 if the firm is receiving the relevant funding.
- **Firm size by employment or turnover:** 2009 total employment figures were included. This raw figure is taken from the answer given to question 7a in the questionnaires and is not converted into another unit. Turnover is an alternative measure of size. This could not be factored into the dependent variable because it was banded but it can be used as an explanatory variable where a group of dummy variables are created for each response. The responses to question 13 have been aggregated to the following broader categories: zero turnover up to £50,000, £50,001-£150,000, £150,001-£500,000, £500,001-£2,000,000, over £2,000,000, refused to answer, and does not know turnover. The higher levels of turnover were aggregated because there were relatively few firms in these categories. The coefficient of each dummy variable is to be interpreted in terms of the £150,001-£500,000 group. This band was omitted to avoid collinearity and it was the most popular response. As measures of firm size, indicators for each of employment and turnover have been tested separately in the specifications.
- **Number of patents held:** The number of patents is correlated with R&D spending/employees so it is worth including this in the explanatory variables to control for any impact on the dependent variable. This variable takes the raw number of patents stated as the answer to question 18b.
- **Main Activity of the firm:** The types of activities that a firm involves itself with will have a bearing on the necessity of R&D. Question 5 asks respondents to state the main activity of the business and they are allowed to select more than one area. The possible areas are production, R&D, services, education, and other. There are dummy variables for each of the areas, which are equal to 1 if the firm indicated the relevant area as a main activity. The dummy of most interest is likely to be for R&D activity but it is also of interest to compare the other areas against one another.

Selection Bias Equation

The analysis includes only firms that applied for funding and it seeks to compare the outcomes for winners and non-winners. But it is possible that firms that applied for funding are different to those that

did not. To test and account for this potential selection bias, the econometric models include a selection equation to estimate the probability that the application was successful (i.e. the firm was funded).

- **Dependent Variable**. In the selection equation, the dependent variable is whether or not the firm was successful in applying for TSB FSP funding. This is represented by a dummy variable, which equals 1 for winners and equals zero for non-winners. A parameter obtained from this equation can be used to adjust the main regression for the selection bias and include the TSB FSP funding dummy as an explanatory variable.
- **Explanatory variables**. The list of explanatory variables for the selection equation will include all of the explanatory variables from the main regression.
- In addition, it must also include at least one additional (exclusion restriction) variable that must: be correlated with whether or not the firm is a winner - *but not correlated with the R&D intensity outcomes assessed by the main regression*. Suitable additional variables were drawn from section D of the questionnaire, which allows respondents to review the application process. This fits the criteria, as for some of the questions in this section the winners would be more likely to review the process more favourably. At the same time their experience of the application process is unlikely to directly impact R&D intensity.
- Question 34 in the winners' questionnaire (32 in the non-winners questionnaire) asks the respondent to rate the application process as a whole with a score between 1 and 5. A dummy variable is included for each score, which equals 1 if the firm gave the relevant score. Respondents cannot indicate more than one answer to this question and there was a small number of respondents who did not answer the question at all. The dummy variable for firms giving a score of 5 has been omitted to avoid collinearity; hence the other dummy coefficients should be interpreted relative to this group.
- Question 29 in the winners' questionnaire (27 in the non-winners questionnaire) asks the respondent whether they had to seek clarification during the application process. A dummy variable is included which equals 1 if the firm did seek further clarification. There is also a dummy for whether the firm did not seek clarification. This is because despite there only being two possible answers, a small number of firms did not answer the question at all.
- Question 27 in the winners' questionnaire (25 in the non-winners' questionnaire) asks the respondent how often they have used the TSB website. This is a banded question where respondents can indicate site usage as: once a month, every couple of months, every six months, annually, never, or less than once a year. A dummy variable is included for each of these bands, which equals 1 if the firm indicated the relevant band. One of these is omitted from the regression due to collinearity as there are no missing answers and firms can only choose one band. The dummy omitted (the "reference" case) is that for firms that used the website once per month as this was the most popular response.

Specifications presented

In the models tested, the outcome of interest **is a measure of R&D intensity. The two indicators tested are: R&D expenditure per employee and R&D employment as a proportion of total employment.** Each of the outcomes of interest has been tested on two different regression specifications (so four specifications in total).

The key difference in each of the three specifications is the measure of firm size. One specification uses 2009 employment as the measure while another uses 2009 turnover bands as the measure. One of these two measures of firm size may be more appropriate than the other and it is likely that one measure would be sufficient to represent firm size. The other groups of explanatory variables will be the same for each of the specifications. All of the groups, with the exception of that for patents, contain a variety of dummy variables relevant to the category.

The specifications are summarised as follows:

	Specification	1	2	3	4
Explanatory variables	Dependent variable	R&D Spend per employee	R&D Spend per employee	R&D as % of total employment	R&D as % of total employment
	Competition				
	Biotech	✓	✓	✓	✓
	Digital	✓	✓	✓	✓
	Energy	✓	✓	✓	✓
	Health	✓	✓	✓	✓
	Nuclear	✓	✓	✓	✓
	Nutrition for Life	✓	✓	✓	✓
	Space	✓	✓	✓	✓
	What was funding for?				
	New scientific or technical knowledge	✓	✓	✓	✓
	Applying an existing product or process to a new area	✓	✓	✓	✓
	Acquiring additional skills	✓	✓	✓	✓
	Receiving other funding?				
	Other TSB funding	✓	✓	✓	✓
	Other govt. funding	✓	✓	✓	✓
	Employment in 2009				
	Number employed	✓		✓	
	Patents held currently				
	Number of patents	✓	✓	✓	✓
	Turnover in 2009				
	£0		✓		✓
	Up to £50,000		✓		✓
	£50,000 to £150,000		✓		✓
	£500,000 to £2m		✓		✓
	£2m+		✓		✓
	Refused to say		✓		✓
	Don't know		✓		✓
	Main activity of firm				
	Production	✓	✓	✓	✓
	R&D	✓	✓	✓	✓
	Services	✓	✓	✓	✓
	Education	✓	✓	✓	✓
	Other	✓	✓	✓	✓
	Winner of FSP funding				
	Winner	✓	✓	✓	✓

Results

Models with dependent variable: R&D expenditure per employee

Specification	1			2		
		Confidence interval			Confidence interval	
	Coefficient	Lower	Upper	Coefficient	Lower	Upper
Competition						
Biotech	-25,066.6	-43,559.1	-6,574.1	-21,804.0	-39,843.9	-3,764.1
Digi	-17,104.5	-35,058.3	849.4	-16,986.2	-34,909.8	937.4
Energy	-23,405.7	-43,271.3	-3,540.1	-28,126.8	-48,585.1	-7,668.5
Health	3,086.9	-15,596.3	21,770.1	5,030.0	-13,264.1	23,324.2
Nuclear	-27,031.3	-44,239.4	-9,823.1	-25,219.3	-43,156.7	-7,282.0
Nutri	-25,029.8	-46,890.4	-3,169.3	-18,640.4	-41,908.8	4,628.0
Space	-9,096.3	-30,784.1	12,591.5	-5,838.1	-27,248.4	15,572.2
What was funding for?						
	-5,199.4	-15,156.7	4,757.8	-5,007.4	-15,432.8	5,418.0
New scientific/technical knowledge	-3,912.3	-14,606.1	6,781.5	-2,387.3	-12,775.6	8,000.9
Applying an existing product/process to a new area						
Acquiring additional skills	-2,086.5	-15,362.0	11,188.9	-3,378.9	-16,196.8	9,438.9
Receiving other funding?						
Other TSB funding	11,093.4	-3,846.9	26,033.6	10,295.1	-4,176.3	24,766.5
Other govt. funding	3,757.6	-10,362.3	17,877.4	2,162.4	-10,986.3	15,311.0
Employment in 2009						
Number employed	-30.4	-88.9	28.2			
# patents held currently						
Number of patents	24.3	-47.4	96.0	-13.4	-57.9	31.2
Turnover in 2009						
£0				16,545.4	1,168.2	31,922.6
Up to £50,000				-731.5	-16,729.6	15,266.6
£50,000 to £150,000				-1,108.5	-10,651.8	8,434.9
£500,000 to £2m				3,801.9	-8,469.7	16,073.5
£2m+				3,435.5	-19,145.7	26,016.6
Refused to say				-3,532.8	-17,164.4	10,098.7
Don't know				-4,406.7	-16,892.0	8,078.5
Main activity of firm						
Production	-6,356.1	-20,443.1	7,730.9	-5,147.9	-19,868.5	9,572.6
R&D	9,828.3	-1,088.5	20,745.1	8,998.1	-2,399.4	20,395.7
Services	-13,878.4	-27,346.0	-410.8	-13,155.3	-27,171.8	861.2
Education	-15,266.0	-29,455.6	-1,076.4	-17,891.4	-40,514.1	4,731.2
Other	8,430.4	-13,127.5	29,988.3	10,903.4	-10,252.7	32,059.5
Winner of FSP funding						
Winner	6,781.9	-11,518.7	25,082.5	8,754.9	-12,328.3	29,838.1
Intercept	37,449.5	9,673.0	65,226.0	30,926.5	92.6	61,760.5

Key:

Result significant at the	1% level	5% level	10% level

Models with dependent variable: R&D employees as a proportion of total employment

Specification	3			4		
		Confidence interval			Confidence interval	
	Coefficient	Lower	Upper	Coefficient	Lower	Upper
Competition						
Biotech	-0.267	-0.526	-0.009	-0.323	-0.567	-0.078
Digi	-0.028	-0.129	0.073	-0.041	-0.140	0.058
Energy	-0.012	-0.199	0.176	0.010	-0.192	0.211
Health	-0.113	-0.231	0.004	-0.091	-0.208	0.026
Nuclear	-0.170	-0.317	-0.023	-0.081	-0.221	0.059
Nutri	-0.027	-0.253	0.200	0.018	-0.207	0.243
Space	-0.096	-0.222	0.031	-0.089	-0.213	0.034
What was funding for?						
New scientific/technical knowledge	0.015	-0.063	0.092	0.001	-0.075	0.076
Applying an existing product/process to a new area	0.018	-0.061	0.098	0.019	-0.058	0.096
Acquiring additional skills	-0.079	-0.175	0.016	-0.052	-0.148	0.044
Receiving other funding?						
Other TSB funding	-0.023	-0.103	0.058	-0.017	-0.095	0.061
Other govt. funding	-0.003	-0.085	0.078	-0.001	-0.085	0.084
Employment in 2009						
Number employed	-0.0004	-0.001	0.000			
# patents held currently						
Number of patents	-0.0004	-0.001	0.000	-0.0004	-0.001	0.000
Turnover in 2009						
£0				0.021	-0.083	0.124
Up to £50,000				0.040	-0.094	0.174
£50,000 to £150,000				0.088	-0.026	0.202
£500,000 to £2m				-0.148	-0.268	-0.027
£2m+				-0.339	-0.482	-0.196
Refused to say				-0.006	-0.163	0.151
Don't know				-0.161	-0.306	-0.015
Main activity of firm						
Production	-0.103	-0.188	-0.018	-0.080	-0.167	0.006
R&D	0.201	0.113	0.289	0.185	0.097	0.272
Services	-0.101	-0.201	-0.001	-0.088	-0.192	0.016
Education	0.345	0.209	0.481	0.320	0.155	0.485
Other	0.235	0.050	0.420	0.253	0.080	0.427
Winner of FSP funding						
Winner	0.107	-0.128	0.341	0.138	-0.166	0.443
Intercept	0.631	0.449	0.813	0.622	0.365	0.879

Key:

Result significant at the	1% level	5% level	10% level

Impact of FSP Funding

The key result from the econometric estimations is that for both dependent variables (R&D spending per employee; R&D employment as % of total employment), there is no evidence that the impact of FSP funding on either outcome was statistically significant.

In both cases, the FSP funding has a positive influence on the outcome of interest: the regression results suggest that R&D spending per employee is around £7,000-9,000 higher among winners, while R&D employment as a proportion of total employment is around 11-14% higher among winners.

However, these results **do not hold at the levels of significance commonly used** (1%, 5% or, if we wish to relax the threshold a little, 10%) in econometric estimation. **What is found instead is that the positive impact of FSP funding is significant only at the roughly 40% level of significance.**

At best, the results suggest there may have been cases where FSP funding had a positive impact, but the degree of uncertainty is high so it is not possible to state with confidence that in statistical terms, FSP funding has any impact at this stage on the outcomes of interest (R&D spending per employee; R&D employment as a proportion of total employment).

What factors influence the extent of the impacts

While the results suggest that winning FSP funding had no statistically significant or strong effect on the outcomes of interest, other variables on firms' behaviour or characteristics may have.

Competition: The specifications tested exclude the dummy variable for Nanotechnology (for design purposes). This means the results for those competitions that are included represent the effect of that competition compared to Nanotechnology.

In the case of both dependent variables, **some competition areas have statistically significant impacts although the results are sensitive to how firm size is measured.**

In the case of R&D employment as a share of total employment, where firm size is measured by employment only, there are statistically significant effects for the Biotechnology, Nuclear and Health and Medical competitions. The result for the latter is significant only at the 10% level (compared to 5% for Biotechnology and Nuclear). Only the impact of Biotechnology also remains statistically significant where firm size is measured by turnover. None of the other competitions have statistically significant results.

The results obtained when the dependent variable is R&D spending per employee are similarly varied. Where firm size is measured by employment, there are statistically significant effects for the Biotechnology, Digital, Energy, Nutrition and Nuclear competitions at varying levels of significance but all within the 10% level. These competition areas continue to have statistically significant impacts where turnover is used to measure firm size, except for Nutrition, where the impact is no longer statistically significant. The impact of participating under the Space or Health programmes is not statistically significant at all: R&D spending per employee in firms under these competitions tends to be the same as for those operating under the Nanotechnology competition. In the case of those competition areas where the effect is significant, the impact is negative (compared to those who participated under the Nanotechnology programme): the current level of R&D spending per employee in those firms participating under any of these programmes (Biotechnology, Digital, Energy, Nutrition and Nuclear) tended to be £16,000-29,000 lower than in firms participating under the Nanotechnology programme.

Type of expenditure: For both dependent variables (R&D spending per employee; R&D employment as % of total employment), **there is no evidence that the outcome of interest was influenced by whether the recipient intended to spend the funding on:**

- Producing new scientific/technical knowledge;

- Investigating the feasibility of applying an existing product/ process to a new area; or,
- Acquiring additional skills.

Where the dependent variable was R&D spending per employee, all the coefficients were negative which suggests that firms that intended to spend funding on these activities currently spent less on R&D per employee than firms that funded other activities.

Where the dependent variable was R&D employment as a proportion of total employment there is some variation, with some positive coefficients where funding was for Producing new scientific/technical knowledge or Investigating the feasibility of applying an existing product/ process to a new area.

Nevertheless, in all cases the coefficients are not statistically significant at the 10% level, so we cannot say with sufficient confidence that how the money was meant to be spent affected R&D intensity (the outcomes of interest).

Receiving Other Funding. Some firms were also in receipt of funding from other TSB programmes or from other government sources. However, the results indicate that neither had significant influence on R&D intensity. None of the coefficients were statistically significant at the 10% level.

In the case of R&D spending per employee, the coefficients were positive, suggesting higher levels of R&D spending per employee among some of those in receipt of other funding. This is especially true for those in receipt of other TSB funding, which has a much higher coefficient and although not statistically significant at 10%, it is at the roughly 17% level of significance.

The results are a little different in the case of R&D employment as % of total employment. The coefficients are mostly negative or close to zero. This suggests that even for those firms where other funding had an impact, it did not help to lift the ratio of R&D employees to total employees.

Patents held. There are some mixed results with regard to patent ownership. The number of patents currently held does not have a statistically significant impact on R&D spending per employee at the 10% level.

However, in the case of R&D employment as a proportion of total employment there is some influence; there is a small negative effect that is statistically significant (at the 5% level). In other words, the greater the number of patents currently held, the lower the share of total employment made up of R&D employees.

This would be consistent with firms switching away from R&D towards more sales, marketing or production activities once they have secured protection on their key inventions or innovations. **The greater the number of patents held, the more likely may be that a firm has secured protection on its key inventions or innovations and thus able to focus on marketing and commercialising the invention/innovation. This could translate into more non-R&D staff and thus a reduction in the share of R&D staff in the firm's total workforce.**

Employment. The results show that when firm size in 2009 is measured by employment (number of people employed in 2009), the impact on current R&D spending per employee is not statistically significant. However, the impact on R&D employment as % of total employment is statistically significant and negative: the more a firm employed in 2009 the larger the fall in its current ratio of R&D employment to total employment. However, the effect is very small: a firm that employed 100 people in 2009 would have seen the proportion of its workforce currently employed in R&D fall by 2-3%.

Turnover. When the specification uses turnover to measure firm size in 2009 (measured by banded categories) the results show some statistically significant impacts, although there is some variation.

Note, that the specifications tested exclude a variable for £150,001-500,000 band (for design purposes). This means the results for those turnover bands that are included represent the effect of that level of turnover compared to those with a turnover of £150,001-500,000.

Where the outcome of interest is R&D spending per employee, only the band for those who reported zero turnover in 2009 was statistically significant (at the 5% level). Current R&D spending per employee among firms in this group tended to be around £16,000 higher than for those with a turnover of £150,001-500,000 in 2009. The coefficients for all other turnover bands were not statistically significant.

This provides some weight to the argument that current R&D spending per employee may be negatively influenced by firm size in 2009 and this is reinforced when looking at the results for modelling R&D employment as a share of total employment. The results show statistically significant and negative impacts for those firms that earned, £500k-£2m or £2m+ in 2009 (compared to those earning £150,001-£500,000). R&D employment as a share of total employment for those firms that earned £500k-£2m or £2m+ in 2009 tended to be around 15 percentage points and 32 percentage points lower respectively, compared to those that earned £150,001-£500,000. **This may suggest that larger (perhaps older) firms tend to have a smaller proportion of R&D employees than do smaller firms.**

Company activity. Survey respondents were asked to indicate the main activity of their firm:

- Production
- R&D
- Services
- Education
- Other

The results indicate that the main area of activity had some bearing on the outcomes of interest, with some reported activities being statistically significant.

For both measures of R&D intensity the results indicate a statistically significant (10% level) negative impact for firms engaged primarily in services. R&D spending per employee among those citing services as their main activity tended to be £13,000 lower compared to those who did not cite services as their main activity. On the other outcome of interest, R&D employment as a share of total employment tended to be 9-10% lower for the same group of respondents.

In the case of R&D employment as a share of total employment, a similar statistically significant result holds for those citing production as their main activity. In the case of R&D spending per employee, being engaged principally in production does not have a statistically significant impact.

In the case of those firms citing R&D as their main activity statistically significant results are found for both outcomes of interest, although there is one specification where the statistical significance is weak. Even so, as we would expect, the results indicate that firms employed principally in R&D activities tended to have a higher level of R&D spending per employee or a higher share of R&D staff in the total workforce compared to those whose principal activity was not R&D.

The impact of being engaged principally in education was mixed, and again sensitive to the specification chosen.

Respondents who cited education as their principal activity tended to have lower levels of R&D spending per employee (a negative coefficient on the Education variable), where firm size is defined by employment; the spending tended to be around £15,000 lower than those not principally engaged in education. Where firm size is measured by turnover, the result held with slightly weaker statistical significance.

However, those who cited education as their principal activity typically had a higher share of R&D staff in their total workforce (a positive coefficient on Education): on average around 32-35 percentage points more than those whose principal activity was in another field.

Selection equation - What factors influence the outcome of the funding application?

Studying the selection equation allows examination of factors contributing to the probability of a firm's application being successful (being a winner).

Rating of the Application Process - The selection equation included dummy coefficients for each of the scores that the participants could give to rate the overall application process. For design purposes a variable for the top mark of five is left out. This means the results are the impact of that score compared to a score of five.

In relation to both final outcomes of interest (R&D employment as a share of total employment; R&D spending per employee) virtually all of these coefficients were statistically significant. Relative to those firms that gave a top mark of five, all firms giving other scores had negative coefficients meaning that they were less likely to be winners. Unsurprisingly these negative coefficients grow in magnitude with lower scores, which implies that the less favourably an applicant rated the process, the less likely it was to have won funding.

Firms that sought clarification - **Firms that sought clarification during the application process were more likely to be winners compared to those who did not seek clarification, as the coefficient on this variable was positive and statistically significant.**

Regularity of website usage - The relationship between regularity of the use of the TSB website and the probability of being winners is more mixed. The dummy coefficients are in relation to the group of firms that use the website once per month. With all the other rates of website usage being less regular that once per month it is not surprising that all of the coefficients are negative (those firms less engaged are less likely to be winners) but few are statistically significant. With much less confidence it could be argued that as a rule of thumb, more frequent usage of the website is associated with a higher probability of winning.

The other explanatory variables in the selection equation are the same as those in the main regression.

Competition - Generally, firms that did not participate under the Nanotechnology programme were less likely to be winners than those who were in this sector. Statistically significant results are found for the Health, Nuclear, Nutrition, Space and Energy competitions. All of these generated negative coefficients. This means that firms that participated under these competitions were less likely to have won FSP funding than firms participating under the Nanotechnology programme. This is especially true for the Nutrition and Nuclear competitions, which had the largest negative coefficients.

What was the funding for - Where a firm's intention was to use FSP funding to produce new scientific/technical knowledge or investigating the application of a product/process to a new area, both had no statistically significant impact on the probability of a firm being a winner. **There was one significant result suggesting firms that intended to use the funding to acquire additional skills were more likely to be winners than those without this intention, but it was only significant at the 10% level of significance in one specification. At best, there is a weak suggestion that firms that intended to spend the funding on acquiring additional skills were more likely to be winners.**

Other funding - Statistically significant results are observed on the variable that captures funding from other government sources; the effect is positive and relatively large. **Those in receipt of other government funding were more likely to win FSP funding, compared to those who were not receiving other funding.**

The variable that captures other TSB funding is statistically significant in one specification with a positive coefficient. But for the most part, the variable is not statistically significant. This suggests that being **in receipt of other TSB funding may have had a positive effect on winning FSP funding in some cases, but the effect is weak statistically and a causal effect cannot be asserted with any certainty.**

Firm Size - Firm size, when measured by employment does not have a statistically significant impact of the probability of a firm being a winner. **Firms had an equal probability of winning FSP funding regardless of how many people they employed in 2009.**

Where measured by turnover, the results need to be compared to the reference case: those earning £150,001-£500,000. In this case, none of the other turnover bands were statistically significant. In other words, firms earning less than £150,000 or more than £500,000 were no more or less likely to win FSP funding than those earning £150,001-£500,000.

Main activity - Of the main firm activities only the variable capturing those firms engaged in services was statistically significant, with a negative coefficient. **In other words, those firms engaged primarily in service activities were less likely to win FSP funding than those that did not report services as their main activity.** None of the other main activity categories had a statistically significant effect in the probability of winning FSP funding.

OVERALL CONCLUSIONS

The econometric analysis has investigated the following evaluation questions:

- What were the impacts of the Board's funding on outcomes of interest? **Given the long-term nature of the projects that are funded, it is likely to be too soon for the impacts (if any) on measures of firm performance to be realised i.e. employment/turnover/profitability.** The approach focuses on estimating the impact of TSB FSP funding on the R&D intensity (as measured by: R&D expenditure per employee; and proportion of all employees in R&D) in winning firms.
- What factors influence the extent and nature of the impacts? A number of firm characteristics are included in the econometric models to assess what factors influence the extent and nature of the impacts.
- What factors influence the outcome of the funding application? In addition, the econometric models used provide further insights into which factors contribute to the probability of a firm's application being successful (being a winner)?

The key findings are summarised below.

- The results suggest that those firms that received TSB FSP funding were more likely to have a higher level of R&D intensity, but this relationship was not statistically significant. This indicates that there are other variables, possibly unobservable in the econometric analysis that are more significant determining factors for R&D activity than is FSP funding.
- If a firm was engaging in service activities then this had a statistically significant negative impact on the level of R&D intensity. This was the case across all of the econometric specifications tested. This is likely because the nature of services means that firms providing them are less intensive in R&D compared to firms producing tangible goods. Firms engaging in production activities have lower R&D expenditure per employee and lower R&D proportion of total employment but only the latter was statistically significant. Engagement in R&D activities has a positive relationship with R&D proportion of total employment and this is statistically significant at the 1% level, but the relationship is not significant in most specifications for R&D expenditure per employee.

- The different measures of firm size have differing associations with the two R&D outcomes of interest:
    - The number of people employed in 2009 does not have a significant impact on R&D expenditure per person employed but it does have a highly significant negative, if small, impact on R&D proportion of total employment.
    - The results suggest that larger (perhaps older) firms tend to have a smaller proportion of R&D employees than do smaller firms. This outcome seems reasonable given that a smaller firm may have a greater need to push innovation to get its product/service noticed and thus they may be more intensive in their R&D activity given the number of people that they employ, especially as a larger firm is likely to require a greater number of non-R&D staff for functions such as.
- The sector that a firm belongs to broadly appears to impact R&D expenditure per employee more than R&D proportion of total employment. This is likely due to some sectors being much less labour intensive in R&D than others but the nature of the products/services still require substantial investments of other resources through R&D. Biotechnology firms appear to have noticeably lower proportions of R&D workers compared to Nanotechnology firms. On the other hand, Biotechnology, Digital, Energy and Nuclear firms all spent less on R&D per employee compared to Nanotechnology firms (with Energy and Nuclear spending £24,000-£28,000 less) and this was significant across all specifications.
- The number of patents held had a relatively small impact on both R&D indicators and was only significant in a few of the specifications. Where it was significant it had a negative relationship with both measures of R&D intensity.
- Biotech and Nuclear were Competitions most likely to have a lower level of R&D spending per employee (compared to Nanotechnology).
- How money was intended to be spent had no bearing on the probability of winning FSP funding or on the R&D intensity outcomes.
- Being in receipt of other funding was associated with a higher probability of winning FSP funding, but it had no significant effect on the R&D intensity outcomes.
- The statistical results also provide some evidence that R&D intensity falls once firms secure protection of key inventions/innovations (as measured by number of patents held).
- Firms engaged in services had a lower likelihood of winning FSP funding and were also likely to have lower R&D intensity.

Turnover in 2012 as dependent variable

As set out in the logic chain, in the relatively short time since the FSP funding was granted we would not expect to observe an impact on business performance indicators such as turnover or profitability. However, some modelling was undertaken in an attempt to investigate this - but the available data limited what could be attempted and interpreted. The key question of interest was: *has FSP funding contributed to higher growth?* However, because the data for turnover was categorised into bands, it was not possible to calculate good measures of the growth of turnover.

Therefore, probit models were estimated with 2012 turnover as the dependent variable. It should be noted, however, that any statistically significant impact of, for example, TSB funding needs to be interpreted with caution. Any significant result may just be picking up the association between high turnover firms and the likelihood of being selected for funding, and not a causal relationship: it cannot be interpreted that receiving TSB funding results in a higher (or lower) level of turnover in 2012.

Controlling for selection, the key findings are as follows:

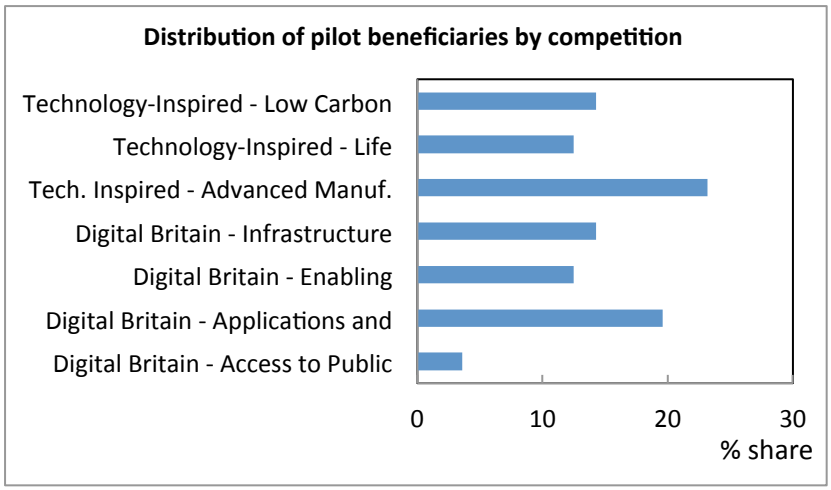
- Being in receipt of TSB FSP funding did not have a statistically significant impact on or association with the level of turnover in 2012.
- In some cases, the main activity of the firm has a statistically significant association with turnover. The results indicate that being engaged principally in Production or Services is associated with a higher level of turnover in 2012, compared to firms whose principal activity was not Production or Services.
- Being in receipt of other government funding was not statistically significant: there is no association between 2012 turnover and being in receipt of other government funding.
- Participating in the Nuclear programme had a statistically significant association with turnover. **Firms conducting studies under the Nuclear programme were likely to have a higher level of turnover in 2012 compared to firms participating under the Nanotechnology programme (the base case). It is likely that firms conducting studies under the Nuclear programme also had a higher level of turnover in 2009 compared to firms participating under the Nanotechnology programme. All this confirms is that firms engaged in Nuclear activities are likely to be relatively large**.
- The analysis also showed that the firms with the greatest likelihood of having a high turnover, participated under the Nuclear programme, were engaged principally in Production or Services, may have been receiving other funds from TSB, and had a relatively large workforce in 2009.
- Overall **none of these explanatory variables can be said to have directly led to (caused) a higher level of turnover at this stage.**

ANNEX C – Profile of FSP Pilot Beneficiaries

The dataset for the beneficiaries from the 2008-09 Pilot programme covers 56 respondents to the survey questionnaire. There was no additional information for non-responding beneficiaries.

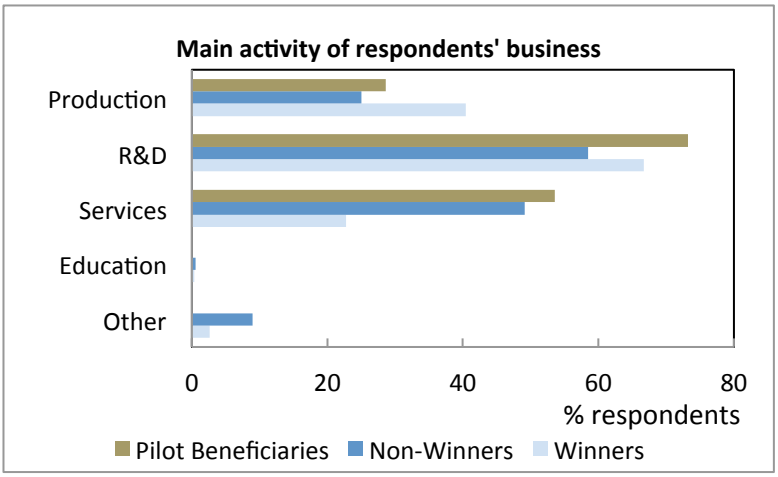
Profile of Competitions and Applicants

In the 2008-09 Pilot programme, there were seven competitions. Three fell under the Technology-Inspired stream; four fell under the Digital Britain stream. Each of these streams accounted for exactly half of the beneficiaries.



- The Digital Britain - Access to Public Services programme accounted for the smallest share of beneficiaries, just under 4%.
- The Technology-Inspired - Life Sciences, Technology-Inspired - Low Carbon, Digital Britain – Infrastructure, and Digital Britain - Enabling Technologies programmes each accounted for 12-14% of beneficiaries.
- The largest shares of beneficiaries were attributable to the Technology Inspired - Advanced Manufacturing and Digital Britain - Applications and Services programmes.

Survey participants were asked to indicate the main activity of their business. The results are presented in the chart below. Note, that respondents were able to provide more than one answer, so the sum of responses for each survey group will not add up to 100%.



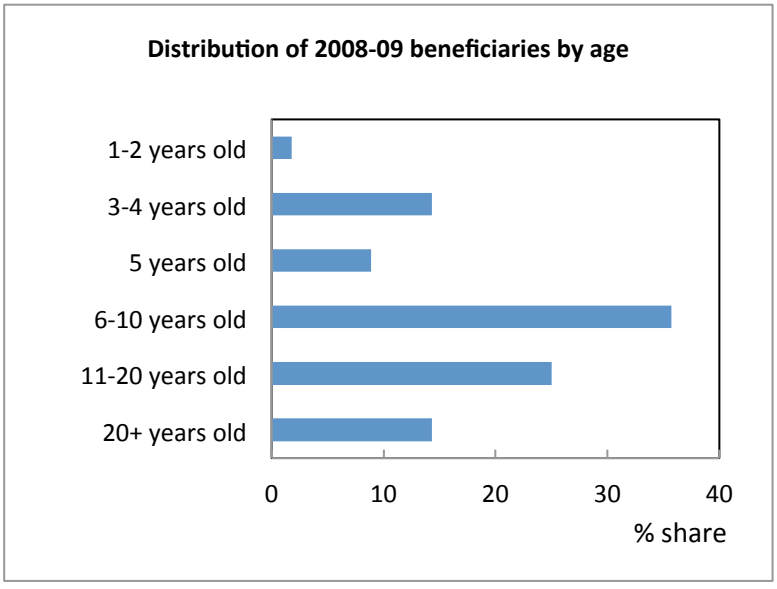
In each group of respondents, the proportion of respondents who indicated Education as their main activity was very small or zero. The proportion of non-winners who said some Other activity was their main activity was noticeably higher than for winners and pilot beneficiaries. But overall, for each group a relatively low proportion of respondents indicated some Other activity as their main activity.

A high proportion of each group indicated R&D as their main activity and in each group no other activity was more popular. With around 59%, non-winners had the lowest proportion involved primarily in R&D. Two-thirds of winners and nearly three-quarters of Pilot beneficiaries indicated R&D was the main activity of their business.

The most striking differences are seen in the proportions of each survey group involved primarily in Production or Services. A noticeably higher proportion of winners (40%) indicated Production as their main activity compared to non-winners (25%), whilst a markedly lower proportion of winners (23%) reported Services as their main business activity compared to non-winners (49%). The proportions for Pilot beneficiaries are much closer to those for non-winners than winners.

With regard to firm size (by employment), across all firms that applied for a grant the average number of employees in 2009 was 53 employees. Average firm size among the 2010-11 winners was 37 employees.

- Just 2% of beneficiaries from the Pilot programme were less than three years old, compared to 15-16% of new winners.
- A quarter of beneficiaries from the Pilot programme were five years old or younger, compared to nearly 40% of the new winners.
- Around 35% of Pilot beneficiaries were 6-10 years old, a much higher proportion than the 21-25% of the new winners.
- Similar to the 2010-11 programme, around 60% of Pilot beneficiaries were ten years old or younger. However, among Pilot beneficiaries a higher proportion (compared to the 2010-11 programme) were aged 11-20 years old and a lower proportion was more than 20 years old.



Awareness of TSB Competition

The most common method through which winners discovered the TSB competition was word of mouth (40%) with the next most common mediums being TSB email (27%) and the TSB website (22%). In comparison, a larger proportion of pilot firms found out through email (36%) – with word of mouth for 38% and the TSB website for 23%.

What FSP Money Was Spent On

How applicants under the 2008-09 Pilot programme intended to spend any funding received is detailed and compared in the chart below (note, respondents were able to indicate more than one purpose for the funding).

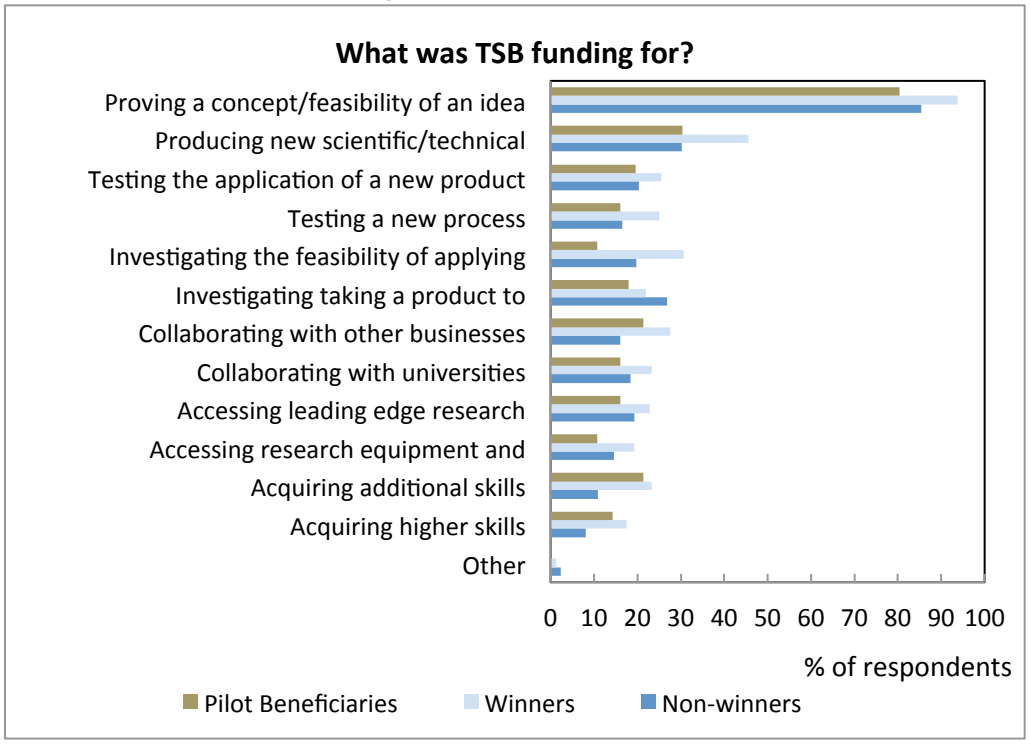
Broadly speaking, the frequency of responses **is similar to that seen across winners** and non-winners from the 2010-11 programme: '**Proving a concept/feasibility of an idea' was by far the most commonly cited purpose for the funding, followed much further behind by 'Producing new scientific/technical knowledge'.**

Generally speaking, roughly 10-30% of Pilot beneficiaries intended to spend any funding received on other options, similar to the findings from the 2010-11 programme.

The proportions of pilot beneficiaries intending to spend any funding on 'Testing a new process', 'Testing the application of a new product' and 'Producing new scientific/technical knowledge' were similar to those for non-winners from the 2010-11 programme.

The proportions of pilot beneficiaries intending to spend any funding on acquiring skills were higher than those for non-winners from the 2010-11 programme and closer to those for winners.

Compared to winners and non-winners from the 2010-11 programme, **lower proportions of pilot beneficiaries intended to use the funding to access leading edge research or access research equipment and infrastructure; or to investigate the feasibility of applying an existing product/process to a new area or taking a product to market.**



Of the funding they received, 2010-11 winners and 2008-09 Pilot beneficiaries were asked what proportion they spent:

- on additional staff costs;
- on supplier costs;
- on prototyping and testing;
- on market testing;
- on capital;
- in some other way.

The table below indicates where funding received was spent.

2010-11 Winners	**2008-09 Beneficiaries**
Additional staff costs	
Just over 15% of winners spent none of the funding on additional staff costs. This means just **over 70% spent some proportion of the funding on additional staff costs.**	Just over 25% of Pilot beneficiaries spent none of the funding on additional staff costs. This means around **two-thirds spent some proportion of the funding on additional staff costs.**
Supplier costs	
Around 40% of winners spent none of the funding on supplier costs. Given 12-13% refused to answer or did not know, this means just under 50% of respondents said they spent some proportion of the funding on supplier costs.	Nearly 60% of beneficiaries spent none of the funding on supplier costs. This means just under 40% of respondents said they spent some proportion of the funding on supplier costs.
Prototype and testing	
Nearly 50% of winners spent none of the funding on prototypes and testing. Given 12-13% refused to answer or did not know, this means around just 40% of winners spent some proportion of the funding on prototypes and testing.	Just over half of beneficiaries spent none of the funding on prototypes and testing. This means just over 40% of beneficiaries spent some proportion of the funding on prototypes and testing.
Market testing	
Over 75% of winners spent none of the funding on market testing. This means just 10% of winners spent some proportion of the funding on prototypes and testing.	Nearly 90% of beneficiaries spent none of the funding on market testing, and around just 7% of beneficiaries spent some proportion of the funding on market testing.
Capital	
Over 70% of winners spent none of the funding on capital (hardware or software). This means around just 15% of winners spent some proportion of the funding on capital.	Just over 60% of beneficiaries spent none of the funding on capital, while a third of beneficiaries spent some proportion of the funding on capital (the remainder did not know).

Contribution of TSB/FSP Assistance

With respect to impact on both technological capabilities and R&D and business performance, the 2008-09 Pilot beneficiaries survey results indicate that TSB/FSP assistance did make a difference:

- Around 60% of beneficiaries interviewed indicated they **would not have achieved** similar results (without TSB/FSP assistance).
- In addition, roughly 11-12% indicated that, without TSB/FSP assistance, they would not have achieved **all the results** that they did.
- Around a quarter of interviewees said that TSB/FSP assistance **made no difference** to the results they achieved, but it did **speed up the delivery** of the results.
- No beneficiaries indicated that TSB/FSP assistance made no contribution (would have achieved similar results (without assistance)).

Across all programmes, the impact on business performance, and technological capabilities and R&D is presented in the table below.

% reporting that, without TSB/FSP assistance:	Technological capabilities and R&D	Business performance
they would definitely not have achieved similar results	39%	37.5%
they would probably not have achieved similar results	21%	23%
they would not have achieved all the results that they did	12.5%	11%
they would have achieved similar results, but not as quickly	23%	25%

When looking at the responses by the programmes, with regard to both business performance and technological capabilities and R&D impacts:

Technology Inspired – Advanced Manufacturing

31% said they would definitely not have achieved similar results, below the average. A higher proportion (30% and 38%) said they would probably not have achieved similar results. Just under a quarter said that TSB/FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results.

Digital Britain – Applications and services

27% said they would definitely not have achieved similar results, while a slightly higher proportion (27%) said they would probably not have achieved similar results. While 9% said that TSB/FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results, well below the average.

Digital Britain – Infrastructure and Digital Britain – Access to Public Services

For each programme, of those interviewed, 50% said they would definitely not have achieved similar results, while the other 50% said that TSB/FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results.

Technology Inspired – Low Carbon

A quarter said they would definitely not have achieved similar results. Across the programme, 12.5% of participants said that without TSB/FSP assistance, they would not have achieved all the results that they did, while a quarter said that TSB/FSP assistance made no difference to the results they achieved other than to speed up the delivery of the results.

Digital Britain – Enabling Technologies

Just over 40% said they would definitely not have achieved similar business performance results, while just fewer than 60% said they would definitely not have achieved similar R&D results, well above the average. A quarter said that TSB/FSP assistance made no difference to the business performance results they achieved other than to speed up the delivery of the results.

Technology Inspired – Life Sciences

Just fewer than 60% said they would definitely not have achieved similar results, well above the average, while just 14% said they would probably not have achieved similar results, below average.

Overall Impact by Collaboration

For 2008-09 Pilot beneficiaries, there are some similarities and differences in the distribution of responses between those who carried out the project alone and those who had partners working on the project.

- Around 40% of those interviewed said they would definitely not have achieved similar results without the assistance, whether they worked alone or collaborated. **This result is in contrast with the 2010/11 winners, where the equivalent figure is 72%.**
- Among both those worked alone and those who collaborated, roughly 22-23% said they would probably not have achieved similar results.
- As a result, around 63% of those who worked with partners or worked alone said that without TSB/FSP assistance they would definitely or probably not have achieved similar results.
- At the same time, around 31% of those who worked alone indicated that without TSB/FSP assistance they would have got similar results, but just not as quickly; compared to just 10% of those who worked with partners.

Impact on Business Performance

Extent to entering new markets

Overall, comparing winners against non-winners who went ahead with their project, we find a much higher proportion of non-winners (73% compared to 34%) reported already having benefited from the project through entering new markets or increasing market share. Around 27% of 2008-09 Pilot beneficiaries reported having already benefited. However, the impact of the project appears to be more sustainable for winners and to a lesser extent beneficiaries: non-winners do not expect to benefit after two years, but around a quarter of winners and 15% of Pilot beneficiaries expect to benefit over the next 2-5 years or beyond. **A much higher proportion of beneficiaries did not or do not expect to enter new markets or increase market share as a result of TSB/FSP assistance.**

Project lead to profits

A noticeably higher proportion of beneficiaries had not or did not expect to benefit from increased profits. Among winners, only about 60% had already benefited or expected to benefit within the next two years; nearly 30% expected to project lead to increased profits in the next 2-5 years or beyond. Among pilot beneficiaries, around 50% had already benefited or expected to benefit within the next two years, with just over 20% expecting to benefits to materialise after two years. On the other hand, **just 11% of winners indicated that they had not or do not expect increased profits as a result of TSB/FSP assistance. But around a quarter of beneficiaries had not or do not expect increased profits as a result of TSB/FSP assistance.**

Impact of projects on productivity

The impact of projects on productivity was broadly similar for winners and pilot beneficiaries. Among winners, a high proportion had not benefited from improved productivity and did not expect to do so in future; this was also true for beneficiaries from the 2008-09 programme.

Impact of projects on employment

The **2010/11 winners had a notably higher increase in employment than the pilot beneficiaries.** Among winners, 30% indicated that their project had already led to an increase in employment. Among pilot beneficiaries, just over a fifth indicated that their project had already led to an increase in employment. 15-20% of winners and beneficiaries expected to see increases after two years.

Extent to easier access to finance

The experience of pilot beneficiaries was similar to that of new winners. Just under a third of winners reported having already benefited as a result of TSB/FSP support through easier access to finance,

whilst around a fifth of beneficiaries reported having already benefited. 46% of 2010/11 winners indicated that the assistance had not or would not make accessing finance easier. **For beneficiaries, this share was even higher, at 61%.**

Projects lead to quality improvements

At the headline level, the impact of projects on quality improvements (to products, processes or services) is not too dissimilar for winners and non-winners: around 60% of winners reported a benefit at some point in time, while roughly 70% of non-winners reported a benefit at some point in time. In both cases around 45% reported quality improvements having already materialised. Just 40% of beneficiaries reported a benefit at some point in time, with only a third indicating they had already benefited.

Impacts on cost reduction

Survey responses suggest that TSB/FSP support did not, or was not expected to, have much impact on reducing business costs either for winners or beneficiaries.

Just over 80% of winners and 84% of beneficiaries reported that TSB/FSP support had not helped to lower *production* costs and was not expected to. Similarly, 87% of winners and 89% of beneficiaries reported that TSB/FSP support had not and would not help to lower *business* costs.

Impact on R&D skills

It seems as though most respondents who went ahead with a project have experienced improved access to R&D skills. The pilot group follow a very similar pattern to that of the winners as 61% reported immediate benefits to R&D skills while 30% expected there to be no such benefit. However, it is interesting to note that a slightly higher proportion (compared to the winners) expected improvements in R&D skills between 6 months and 2 years' time.

ANNEX D – Summary of Key Sector Facts and Figures

The feasibility studies cover areas of work in seven key sectors: Health and Medical (including Nutrition for Life), Biotechnology, Digital, Energy, Nanotechnologies, Nuclear and Space. Sector analysis has been undertaken for a limited number of areas of research covering the profile of applications and winning projects, collaborations, key achievements and impact.

Key Findings

- Nanotechnology and Materials projects represent the largest group of successful applicants with 92 winners (28% of all winning projects). The projects in this area were of relatively small average value (at around £24,000 per project on average); overall, representing 17% of the total grant (£2.2 million).
- On the other hand, around a third of the overall grant (£4 million) was received by 38 projects (12% of all winning projects) involved in Health and Medical studies.
- Projects in Nanotechnology and Materials and Health and Medical were more likely to use the grant to investigate commercial ideas. On the other hand, Space and Digital projects were more likely to have explored technical ideas with the support of FSP.
- Organisations involved in Nanotechnology accounted for 40% of the winners that have seen immediate benefits in terms of being able to develop new products as a result of FSP. Space and Digital were the next largest group of firms to immediately experience benefits but they appeared to have greater proportions of winners believing that benefits would materialise in the longer term.
- Of the 141 winners that did engage in follow on R&D projects, one third of them were involved in collaborative R&D projects. Energy, Health, Nanotechnology, Nuclear and Nutrition all seemed to have higher proportions of firms engaging in follow on collaborative R&D. The largest sector, Nanotechnology, accounted for around a third (33%) of those winners who would not engage in follow on R&D work, although this sector also accounted for a similar proportion (36%) of those who would engage. There was a more noticeable divide for the Space sector as it accounted for 29% of those who would not engage in further R&D activity compared to only 16% of those that would.
- The most common source of funding was through Collaborative R&D (a third of those engaging in more R&D work). Nanotechnology comfortably accounts for the majority of winners that would go for this type of funding (45%) with the next closest sector being Health (15%). Health accounted for the majority of those winners using private funding for further R&D (36%).
- In terms of changes in persons employed in R&D between 2009 and the survey, non-winners saw an average growth in R&D employment of around 20%. Winners saw a far greater growth with an average rate of 51%. Across all sectors, the growth rates experienced by winners were far greater than those experienced by non-winners.
- The lowest cost per R&D job sector is in Space, at around £6,800, followed by Nutrition for Life at just under £8,000 and then Nanotechnology at around £9,300. The most expensive sectors are Energy and Health and Medical, at just over £32,000 per additional R&D job each.
- The econometric analysis has shown that the sector that a firm belongs to broadly appears to impact R&D expenditure per employee more than R&D proportion of total employment. This may be due to some sectors being relatively less labour intensive in R&D than others or they be outsourcing their R&D activities, while at the same time, the nature of the products/services still require substantial investments of other resources through R&D. For example, Biotechnology firms appear to have noticeably lower proportions of R&D workers compared to Nanotechnology firms. Furthermore, Biotechnology, Digital, Energy and Nuclear firms all spent relatively less on R&D per employee compared to Nanotechnology firms (with Energy and Nuclear spending £24,000-£28,000 less).

A summary of key findings by sector as emerging from the review of the administrative data and the surveys is presented below. More detailed information is presented in the relevant chapters in the main report.

- **Biotechnology Feasibility Studies 2010/11:**
  - Attracted a relatively small number of applications, 16, making it the smallest group of applications. The studies represent 2.5% of all projects funded in 2010/11 and 6% of all funding (i.e. one of the smallest group of winners).
  - On average, the studies are the largest in terms of project cost and grant. For example, the average cost per project (as estimated by the applicant) was around £55,000; the equivalent figure for this sector was £193,000. The average grant was £40,000; the average winning project in this sector was around £103,000 (second only to Health and Medical Feasibility Studies).
  - As a consequence, Biotechnology had the lowest grant value vs. project value ratio, with an average grant percentage of just below 54% (average was 72%).
  - Just over half of all winners collaborated with another partner, while just under half undertook the project alone. In this sector, around 40% of projects are collaborative, with the greater share of firms in these competitions proceeding with the project alone.
- **Energy Feasibility Studies 2010/11:**
  - Attracted a relatively small number of applicants – only 19.
  - Only 3% of the 2010/11 FSP grant (just under half a million) went to this sector covering 8 projects i.e. the smallest group of winning projects.
  - The average value of grant in this sector was above the overall average of £40,000 – at approximately £56,000.
  - On average, the FSP grant covered 85% of the estimated project costs. In fact, a detailed review of the projects and grant approved showed that in Energy it is more likely than in other sectors for the projects to have been funded up to 100%.
  - Tow thirds of the projects were collaborative projects (above the average).
- **Digital Feasibility Studies 2010/11:**
  - The largest group of applications came from the Digital sector, with 342 applications. Nearly 1 in 3 (23%) were successful.
  - 15% of the overall grant (just under £2 million) went to 79 projects (representing 24% of all winning projects).
  - On average, the estimated cost of the project was around £32K; on average the value of the offer grant was at £25,000 well below the overall average of £40K.
  - In terms of collaborations, **winning projects in this area are more likely to have gone alone rather than with collaborators (**Digital accounted for around 15% of winners who had partners but 30% of winners who went ahead alone)**.** When they have partnered, their partners are more likely to be from the industry rather than academia.
  - Similarly to Space Feasibility Studies, Digital studies were more likely to use the grant to explore technical ideas and knowledge than commercial ideas.
  - Despite the lack of extensive collaborations, Digital projects were very likely to have seen access to R&D skills immediately.
- **Health and Medical Feasibility Studies 2010/11:**
  - Attracted a sizeable number of applications – 105 representing over a third of all applications (36%). Just over one in three was successful.

- On average, the studies received the highest amount of grant - £109,000.
- Around a third of the overall grant (£4 million) was received by the 38 projects in this sector (12% of all winning projects).
- Around 40% the winning projects were in collaboration with others. Partners were more likely to be from the academia in this type of studies.
- Similarly to nanotechnology, studies in this area were more likely to use the funding to explore commercial ideas for their products than technical ideas/knowledge.
- Health accounted for the majority of those winners that stated that they would use private funding for further R&D (36%).

- **Nutrition for Life Feasibility Studies 2010/11:**
  - Attracted a relatively small number of applicants – 30.
  - Only 6 winning projects of relatively small value each (on average, £25K each) representing a total value of less than £200,000.
- **Nanotechnology and Materials Feasibility Studies 2010/11:**
  - Attracted the third largest group of applicants (after Digital and Space) – 155 (59% of all applications)
  - It is also the largest group of successful applicants with 92 winners (28% of all winning projects), with the sector also demonstrating the highest success ratio (winners vs. applicants) at just below 60%.
  - Relatively small average value at £24,000 each project on average; overall, representing 17% of the total grant (£2.2 million).
  - Relatively small number of collaborators among the winning projects and quite unlikely for those to come from the academia.
  - Projects in this area (as was also the case with Health and Medical) were more likely to investigate commercial ideas (than technical ideas) with the support of FSP.
  - Nanotechnology, accounted for around a third (33%) of those winners who would not engage in follow on R&D work, although this sector also accounted for a similar proportion (36%) of those who would engage.
- **Nuclear Feasibility Studies 2010/11**:
  - Attracted a relatively large number of applications (92) but only 18.5% of them were successful (17), thus having the lowest success ratio.
  - The estimated projects costs amongst the highest at £122,000, with the average offer grant at £91,000 (the third highest and over twice as high as the overall average of £40K).
  - The studies accounted for 13% of the overall grant (£1.6 million).
  - **All winning projects in this area have been collaboration projects –** involving collaborations with at least one other business/industry partners.
- **Space Feasibility Studies 2010/11:**
  - Attracted the second largest group of applicants – 215, with over a third of them being successful.
  - 77 winning projects represent nearly a quarter of all winning projects (24%) and 14% of all the 2010/11 FSP grant (approximately $1.8 million).
  - On average, relatively small projects at around £23K (well below the £40K average).

- Two thirds of winning projects have been collaborative projects, with a relatively high number of academic collaborators i.e. more than other sectors (with the exception of Health and Medical).
- Space related projects were more likely to investigate technical ideas rather than explore commercialisation. Not surprisingly, therefore, that the majority of companies in this area stated that they had not seen any commercial benefits as yet at the time of the survey.
- Winners in this area were less likely to state that they would engage in further R&D work. Companies involved in Space studies accounted for 29% of those who would not engage in further R&D activity compared to only 16% of those that did.

Applicants - successful and unsuccessful applications by sector

Sector	Winners (No)	Winners %	Non-Winners (no)	Total (No)	Success Rate %
Health and Medical	38	12%	67	105	36%
Nuclear	17	5%	75	92	18.5%
Energy	8	2.5%	11	19	42%
Biotechnology	8	2.5%	8	16	50 %
Digital	79	24%	263	342	23 %
Nanotechnology and Materials	92	28%	63	155	59 %
Space	77	24%	138	215	36%
Nutrition for Life	6	2%	24	30	20%
Total no of projects	**325**	**100%**	**649**	**974**	**33%**

All Winning Projects – Total Project Costs and Overall Grant by sector

Sector	Total Project Costs (£) –	FSP Grant (£) – projects	FSP as % of Total Project Value	% Of Overall Grant received by Sector
Health and Medical	5,677,605	4,033,458	71%	31%
Nuclear	2,196,890	1,643,701	75%	13%
Energy	526,419	449,416	85%	3%
Biotechnology	1,543,957	825,234	53.5%	6 %
Digital	2,554,896	1,952,473	76%	15%
Nanotechnology and Materials	2,940,196	2,205,656	75%	17%
Space	2,442,032	1,797,665	74%	14%
Nutrition for Life	198,569	148,927	75%	1%
Total	**£18,080,564**	**£13,056,530**	**72.2%**	**100.0**

Average Project Cost and Grant per Project

Sector	Average Project Cost (£)	Average Project Grant (£)	Average Grant (%)
Health and Medical	153,449	109,002	71%
Nuclear	122,049	91,316	75%
Energy	65,802	56,177	85%
Biotechnology	192,995	103,154	53.5%
Digital	32,340	24,715	76%
Nanotechnology and Materials	31,959	23,974	75%
Space	31,715	23,346	74%
Nutrition for Life	33,095	24,821	75%
Average all	**55,632**	**40,174**	**72%**

ANNEX E: UK Regional Distribution of Business and Employment

Sector		East Midlands	East of England	London	North East	North West	Northern Ireland	Scotland	South East	South West	Wales	West Midlands	Yorkshire & the Humber	Other	Total
Nuclear 2012 *(from NIA Jobs Map)*	Jobs (2012)	3321	2108	4442	3693	24742	1	5322	6609	9358	1270	721	578	813	62978
	Companies (2012)	19	12	72	30	163	1	63	102	70	28	47	26	126	759
Space	Jobs (2011)	40723	54984	78976	27293	74397	NA	41511	91679	64035	27315	49079	38394	NA	588386
	Companies (2008)	4436	6877	7396	1632	5773	NA	3470	9903	5264	2294	4987	4423	NA	56455
Digital	Jobs (2011)	33099	49935	163099	19482	49104	NA	30612	162598	38933	9523	40159	26798	NA	623342
	Companies (2008)	6402	13528	27143	1929	9840	NA	5602	27227	9849	2689	8324	5914	NA	118447
Nutrition for Life	Jobs (2011)	10281	4160	8229	1689	6857	NA	3660	7114	3593	2635	4712	4369	NA	57299
	Companies (2008)	508	488	1189	280	941	NA	523	872	681	394	638	777	NA	7291
Nanotechnology & Ma	Jobs (2011)	15723	30469	25638	8686	24434	NA	17848	34913	14829	6645	14802	17749	NA	211736
	Companies (2008)	902	1225	1028	379	1083	NA	829	1607	1054	535	1002	936	NA	10580
Energy	Jobs (2011)	12738	6972	10090	7948	15699	NA	45003	19468	9222	8882	13017	14455	NA	163494
	Companies (2008)	116	163	230	94	192	NA	472	237	147	109	117	167	NA	2044
Biotechnology	Jobs (2011)	11422	7466	5663	4340	9846	NA	7373	17954	6810	5304	6988	9500	NA	92666
	Companies (2008)	250	358	390	134	461	NA	234	550	314	187	285	312	NA	3475

		Proportions (excepting NI and Other)			Largest Proportion in Row										
Nuclear 2012 *(from NIA Jobs Map)*	Jobs (2012)	5.27%	3.35%	7.05%	5.86%	39.29%		8.45%	10.49%	14.86%	2.02%	1.14%	0.92%		1
	Companies (2012)	2.50%	1.58%	9.49%	3.95%	21.48%		8.30%	13.44%	9.22%	3.69%	6.19%	3.43%		1
Space	Jobs (2011)	6.92%	9.34%	13.42%	4.64%	12.64%		7.06%	15.58%	10.88%	4.64%	8.34%	6.53%		1
	Companies (2008)	7.86%	12.18%	13.10%	2.89%	10.23%		6.15%	17.54%	9.32%	4.06%	8.83%	7.83%		1
Digital	Jobs (2011)	5.31%	8.01%	26.17%	3.13%	7.88%		4.91%	26.08%	6.25%	1.53%	6.44%	4.30%		1
	Companies (2008)	5.40%	11.42%	22.92%	1.63%	8.31%		4.73%	22.99%	8.32%	2.27%	7.03%	4.99%		1
Nutrition for Life	Jobs (2011)	17.94%	7.26%	14.36%	2.95%	11.97%		6.39%	12.42%	6.27%	4.60%	8.22%	7.62%		1
	Companies (2008)	6.97%	6.69%	16.31%	3.84%	12.91%		7.17%	11.96%	9.34%	5.40%	8.75%	10.66%		1
Nanotechnology & Ma	Jobs (2011)	7.43%	14.39%	12.11%	4.10%	11.54%		8.43%	16.49%	7.00%	3.14%	6.99%	8.38%		1
	Companies (2008)	8.53%	11.58%	9.72%	3.58%	10.24%		7.84%	15.19%	9.96%	5.06%	9.47%	8.85%		1
Energy	Jobs (2011)	7.79%	4.26%	6.17%	4.86%	9.60%		27.53%	11.91%	5.64%	5.43%	7.96%	8.84%		1
	Companies (2008)	5.68%	7.97%	11.25%	4.60%	9.39%		23.09%	11.59%	7.19%	5.33%	5.72%	8.17%		1
Biotechnology	Jobs (2011)	12.33%	8.06%	6.11%	4.68%	10.63%		7.96%	19.37%	7.35%	5.72%	7.54%	10.25%		1
	Companies (2008)	7.19%	10.30%	11.22%	3.86%	13.27%		6.73%	15.83%	9.04%	5.38%	8.20%	8.98%		1