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European Industrial Doctorates - towards increased employability and innovation

Final report
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Final report

This report has been produced by ICF in cooperation with Technopolis

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Table of Contents

1.	Introduction	1
1.1.	Method of approach	1
1.1.1.	Online Survey	1
1.1.2.	Interview programme	3
1.1.3.	Case studies	3
1.1.4.	Comparator programmes	3
2	Rationale for the EID scheme	4
2.1	Strengthening public-private collaboration in research and innovation	4
2.2	A growing number of researchers work in the business sector	5
2.3	Training and skill requirements of researchers are changing	6
2.4	EID scheme	6
3	Relevance of the EID scheme	8
4	Review of EID activities	11
4.1	Motivations to apply	11
4.1.1.	Main motivations of organisations to apply for EID funding	11
4.1.2.	Main motivation of fellows to apply	11
4.2	Demand and participation	13
4.2.1.	Overall statistics	13
4.2.2.	Demand and participation by calls	14
4.2.3.	Demand and participation by countries	15
4.2.4.	Demand and participation by organisations types	17
4.2.5.	Demand and participation by scientific panels	23
4.2.6.	Fellows	27
4.2.7.	Success rates	30
4.3	Nature of partnerships	36
4.3.1.	Novelty of partnerships	36
4.3.2.	Time spent in non-academic host organisation	38
4.3.3.	Collaborative links	38
5	Appropriateness of EID funding and implementation	40
5.1	Objectives and structure	40
5.2	Funding	41
5.3	Administrative and financial rules	42
5.4	Conflicts between EID rules and requirements and national regulations or organisational practices	44
5.5	Appropriateness of quality assurance approaches in EID	47
5.6	Issues and challenges identified	49
5.6.1.	Expert evaluation	49
5.6.2.	Implementation	50
5.6.3.	Implementing and managing EID projects	50
6	Added value	53
6.1	Researcher level	53

6.2	Organisational level	55
7	Preliminary review of results and impacts	58
7.1	Researcher level results and impacts	58
7.1.2	Career paths.....	58
7.1.3	Employment	58
7.1.4	Skills.....	60
7.2	Organisational level results and impacts	63
7.2.1	Partnerships	63
7.2.2	Commercial impacts	65
7.3	Initial outputs from EID projects in terms of publications, patents, innovations	66
7.3.1	Patents and IPR.....	66
7.3.2	Publications.....	66
7.3.3	Curriculum changes.....	67
8	Conclusions and recommendations.....	68
8.1	Rationale for the EID scheme and relevance.....	68
8.2	Pathways to participation.....	69
8.3	Attractiveness and demand for funding.....	70
8.4	Effectiveness of scheme implementation	71
8.5	Added value	72
8.6	Preliminary outputs and results	73
Annex 1	Interviews conducted.....	76
Annex 2	Case studies	79
Annex 3	Comparator programmes.....	112
Annex 4	Programme demand and participation – further analysis	143

1. Introduction

This is the final report for a study assessing the European Industrial Doctorates (EID) scheme. The report presents findings and conclusions from an assessment of the EID scheme activities up until March 2016.

The remainder of this report is structured as follows:

- Section 2 reviews the rationale for the EID scheme, based on conducted interviews and survey responses;
- Section 3 discusses the relevance of the EID scheme;
- Section 4 presents an analysis of demand for EID funding and activities, based on an analysis of CORDA data and survey responses – the section compares activities funded to comparator programmes where data were available;
- Section 5 discusses the appropriateness of EID implementation;
- Section 6 presents an initial assessment of the scheme's added value; and
- Section 7 discusses preliminary results and impact reported by survey respondents.

1.1. Method of approach

The method of approach consisted of four main elements:

- An online survey of fellows and organisations funded, plus organisations unsuccessful in winning EID funding;
- An interview programme with stakeholders at EU, national and international level and expert evaluators involved in the EID proposal evaluation;
- Case study research investigated in detail the pathways to participation in EID, nature of partnerships supported and preliminary project results;
- A review of four national industrial doctorate programmes to investigate the added value and effectiveness of the EID scheme vis-à-vis these comparators.

Annex 1 presents an overview of stakeholder interviews. Annex 2 presents the case studies. Annex 3 presents a summary of the four national comparator programmes investigated.

1.1.1. Online Survey

The study involved an online survey of EID fellows, participant organisations and unsuccessful applicant organisations conducted in July 2016. The number of individuals/organisations contacted and the responses received are summarised in Table 1.7. Table 1.8 below provides the number of projects and the number of unsuccessful proposals covered by survey responses.

Table 1.1 Online survey – stakeholders contacted and responses received

	Number of contacts	Number of responses received	Response rate
EID fellows	311	224	72%
EID participants – Academic organisations	123	39	32%
EID participants – Non-academic organisations	112	48	43%
Unsuccessful applicants	378	47	12%
Total	924	358	39%

Table 1.2 Online survey – projects and proposals covered

	Number of projects/proposals covered by stakeholders contacted	Number of projects/proposals covered by responses received	Response rate
EID fellows	101	73	72%
EID participants organisations (Academic and non-academic)	101	64	64%
Unsuccessful applicants	146	39	27%

Responses to the EID fellow survey covered 73 distinct projects representing 72 per cent of the EID projects. The total EU contribution for these 73 projects was €81million, accounting for 71 per cent of the total EC contribution allocated to EID projects. The EU contribution varies from €0.5million to 3.9million per project. All the projects were ongoing at the time of the research, with 22 per cent ending in 2016 while 36 per cent will end in 2017 and 32 per cent in 2018. The remaining 11 per cent will end in 2019 or 2020.

224 EID fellows responded to the survey, with only 37 (17 per cent) having completed their fellowships at the time.

64 distinct projects were covered by responses to the surveys of academic and non-academic organisations, out of 101 projects facilitated through the scheme – or 64 per cent of all projects. Out of these 64 projects, 4 projects could not be linked back to the EID data. The total EU contribution for the 60 projects where this was possible was €81 million, accounting for 71 per cent of the total EC contribution allocated to EID projects.

Of the 60 distinct projects surveyed which could be linked back to EID data, none had reached completion. Ten projects were due to end in the short-term - in 2016 (17 per cent of those surveyed). The rest of the projects covered in the surveys of beneficiary organisations end in 2017 or later.

For the three surveys, it is unlikely that most project participants could make realistic assessments of final project outputs, impacts and future prospects at the time of study research. It was assumed that such assessments are more meaningful for projects nearing completion.

The sections on results and impact in this report should therefore be interpreted considering the status of projects at the time of the survey.

1.1.2 Interview programme

26 semi-structured interviews were conducted with stakeholders from EU institutions, national policy makers, national interest groups and expert evaluators of the EID scheme. An overview of these can be found in Annex 1.

1.1.3 Case studies

The study team identified 10 case study projects, nine of which have been completed and are attached in Annex 2. Case studies were conducted through semi-structured interviews with project coordinators and EID fellows supported by the respective projects. The case studies in Annex 2 provide further insight into the nature of partnerships supported, pathways to participation in EID projects, details of supervision and training arrangements and project results and lessons learnt.

1.1.4 Comparator programmes

To further investigate the relevance and EU added value of the EID scheme, the study team mapped out a list of 22 comparator programmes that fund industrial PhD positions. From this long list, four programmes were investigated in detail and are presented in Annex 3.

2 Rationale for the EID scheme

Higher Education and Innovation Policy are both priorities in European policy. Both include strongly focused policy priorities and areas where coherence and complementarity between the two are developed and exploited. Both policy areas at European level are central to the Europe 2020 Strategy, adopted in 2010, setting the EU's goals of smart, sustainable and inclusive growth.

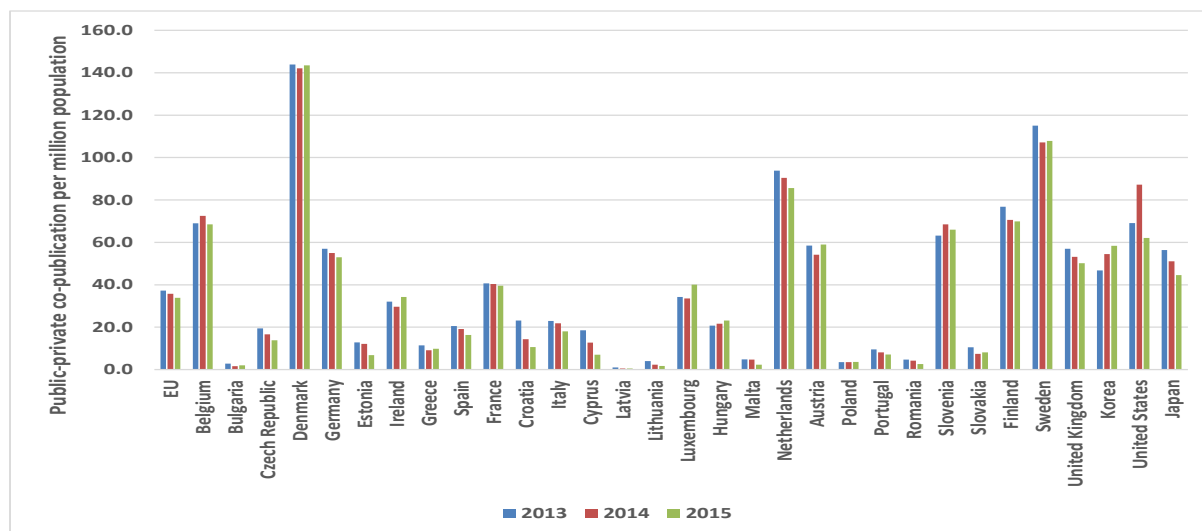
The strategy presents a clear message: to remain competitive, Europe must invest in people, their ability to innovate and adapt to change. The flagship initiatives of the strategy, in particular the Innovation Union, underpin this by aiming to achieve 3 per cent of the GDP as investment in research in the European Union by 2020.

Highly skilled, talented individuals are core to a well-functioning innovation system and knowledge-based economy. Higher education provides many of the mechanisms for developing and educating such people, but cannot do so alone. The skills developed must match the needs of business and wider society, which require much greater agility and flexibility than before. The European Commission's Agenda for New Skills and Jobs¹ also highlights the importance of establishing ventures and networks between business and higher educational establishments to address new skill requirements and labour market needs.²

2.1 Strengthening public-private collaboration in research and innovation

Collaboration between the public and the private sector is seen as key to the transfer and circulation of knowledge, often linked to innovation. The process of public-private cooperation in research and development can be proxied by looking at co-publication patterns. In terms of public-private co-publications per population of one million, the US, South Korea and Japan are world leading, while the European Union lags behind. Within the EU, there are strong differences in the level of public-private cooperation measured in publications. Denmark, Sweden and the Netherlands lead (see Figure 2.1 below).

Figure 2.1 Public-private co-publication per population of one million (2013-2015)



Source: European Innovation Scoreboard

¹ Strasbourg, 23.11.2010, COM(2010) 682 final

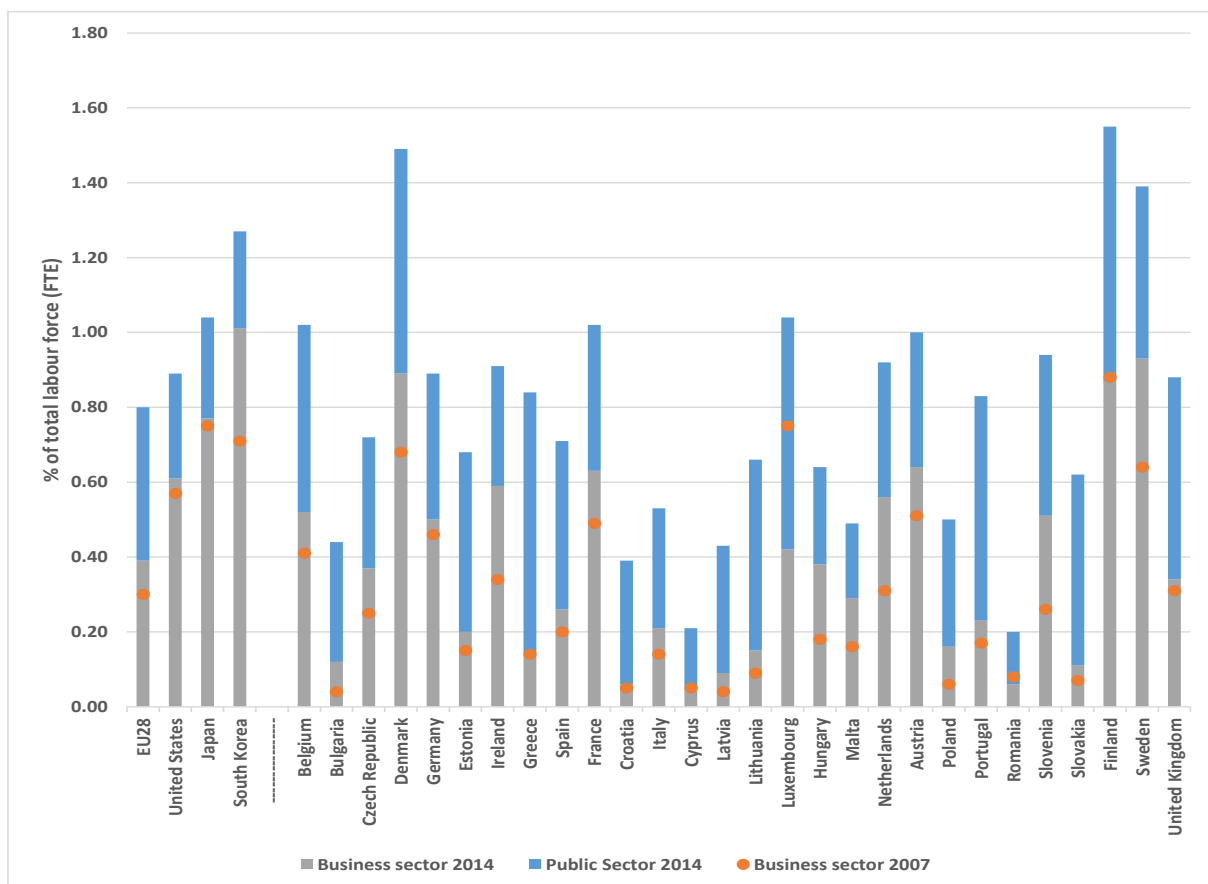
² European Commission (2010) An Agenda for new skills and jobs: A European contribution towards full employment. Com(2010)682 Final.

A recent European Commission report³ enforced the importance of this point, highlighting the positive correlation between the level of science-business collaboration and the quality of research and frequency of innovation. The report also highlighted the link between human resources mobility in science and technology and knowledge transfer and spill-over.

2.2 A growing number of researchers work in the business sector

Over the past decades, the number of doctoral candidates has gradually increased, resulting in a growing proportion of PhD candidates leaving academia for jobs in the private sector. As highlighted by the Report from the 2014 ERAC mutual learning workshop on Human Resources and Mobility,⁴ most of the doctoral candidates are ill-prepared for the realities of the non-academic labour market. Figure 2.2 below portrays striking differences in employment patterns of researchers between the EU28 average, leading European Countries, the US and Japan – measured by the number of researchers in the business sector per thousand labour force. Figure 2.2 also shows an increase in the number of researchers employed in the EU business sector between 2007 and 2014. This necessitates that researchers are equipped with skillsets relevant for employment in the business sector.

Figure 2.2 **Researchers (Full Time Equivalent) in business sector and public sector, 2007 and 2014, EU countries and competitor regions, as per cent of total labour force**



Source: Eurostat, US 2008, 2012, Japan 2007, 2013, Korea 2007, 2013.

³ European Commission (2016), Science, Research and Innovation Performance of the EU, 2016.

⁴ Karen Vandeveld: Intersectoral Mobility, Report from the 2014 ERAC mutual learning workshop on Human Resources and Mobility, Brussels, March 26, 2014

2.3 Training and skill requirements of researchers are changing

Given the clear benefits of public-private collaboration in research, and the growing numbers of researchers working in the business sector, it's important to tailor training offers for researchers towards skills relevant to the non-academic sector.

It is crucial to prepare Bachelor and Master students for entry into the labour market and equip them with transferable skills. Recently, there has also been added emphasis on equipping doctoral candidates for the labour market.

Interviewees said that at doctoral level, training needs and skill requirements depend heavily on the individual scientific disciplines, business sectors and the specific career options in the non-academic sector. The researcher development framework proposed by Vitae is seen as a helpful guide to identify skill needs for individual groups of graduate students and PhD candidates.⁵

At European level, there is a trend towards streamlining doctoral training in the EU. The Salzburg Principles, the Salzburg II Recommendations and the Principles for Innovative Doctoral Training (IDTP) are examples of attempts to make doctoral training more coherent and comparable throughout Europe. The introduction of these guidelines and recommendations could be seen as a reaction to a perceived need for clearer structures and better order in the way doctoral training is arranged. There is also an element of securing the rights of doctoral candidates.

With a stronger focus in education on the employability of students and PhD researchers, higher education institutions cannot compromise on certain core elements of doctoral training. Concerns presented above will need to be balanced with, for example, the scientific quality and training needed to become a good researcher, where the scientific methodology and development of writing skills are fundamental. Employers still want those skills, but generally also want to complement graduates' competencies with other skills relevant to business, industry or the public sector.

2.4 EID scheme

The Marie Skłodowska-Curie Actions aim to support researcher mobility and training. During the inception stage of the EID scheme, interviewees confirmed that it focuses on addressing three main issues that provide the rationale for a European programme on industrial doctorates:

- Lack of intersectoral mobility between academia and industry;
- Lack of transferable skills in European labour force of researchers; and
- No common rules or guidelines around industrial doctorates across EU.

Interviewees generally felt that the EID scheme was introduced at the right time. While other programmes existed at national and regional level before the EID scheme was proposed, these needed fine-tuning to offer an EU-level approach to better connect the academic sector with the non-academic employment market.

The EID scheme aligns with the rationale of the comparator programmes analysed in this study. The objectives of these programmes were (see full details in Annex 3):

- To promote joint training and strengthen collaboration between industry and academia;
- To develop PhD candidates' skills to meet the needs of industry; and
- To foster industrial competitiveness and the research environment.

⁵ <https://www.vitae.ac.uk/researchers-professional-development/about-the-vitae-researcher-development-framework>

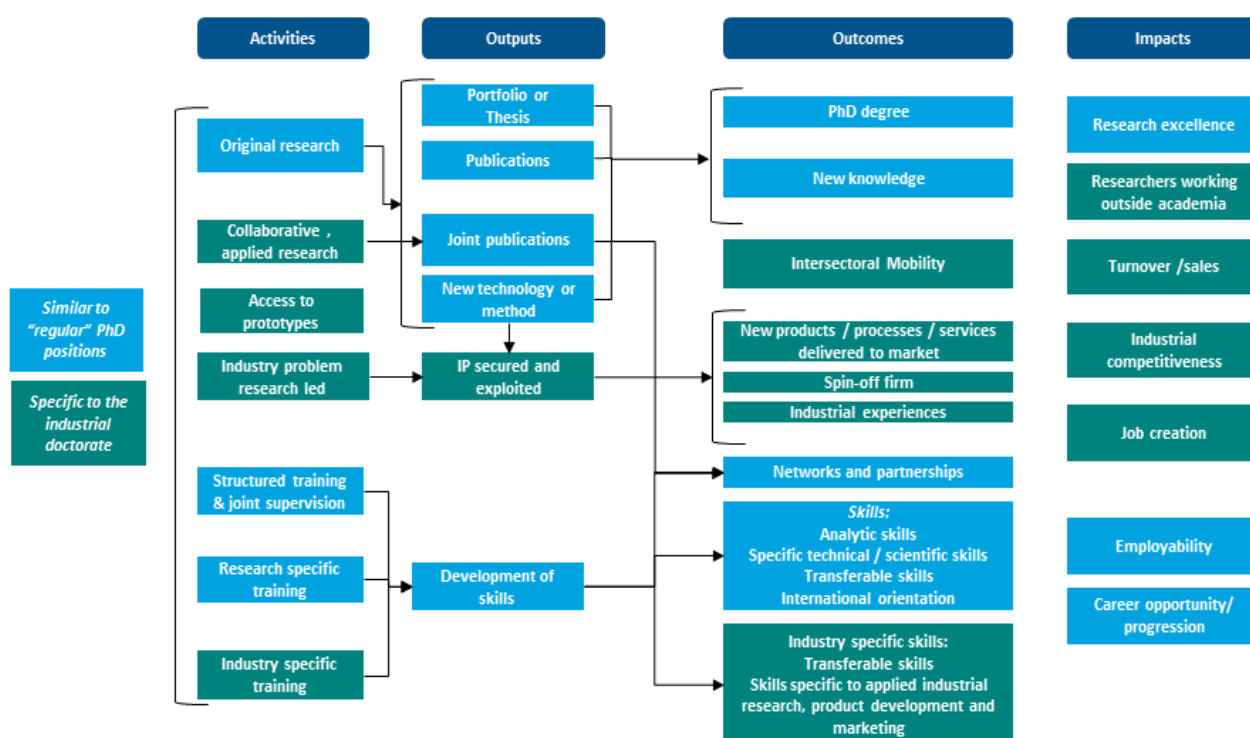
Stakeholders also believe the EID scheme offers a logical progression from complementary activities focusing on curricula in schools and on specific modules for Bachelor and Master students focusing on transferable skills and employability. The EID scheme was launched in 2012 following the introduction in 2011 of the principles for innovative doctoral training developed by the European Commission working group on doctoral training. This was based on examples of national programmes for industrial doctoral training from the Netherlands (TU/e Impulse), Denmark and France.

Before 2012, only a minority of the ITNs funded under FP7 offered fellows the opportunity to spend a significant amount of their PhD studies working in the non-academic sector. At the same time, a number of competitor regions such as Japan and the US saw a much larger proportion of PhD graduates ending up working in industry, compared to the EU average (Figure 2.2).

It was also important to focus on specific transferable skills that interviewees felt were not covered by national programmes at the time. The principles of innovative doctoral training have mandated a strong focus on leadership skills, intercultural skills, communication and presentation skills across ITN actions, including EID projects.

A basic logic model for the EID scheme is presented in Figure 2.3 below.

Figure 2.3 **Logic model EID scheme**



Source: Technopolis&ICF

Between FP7 and Horizon 2020, the setup of the scheme changed slightly. As the requirement of industrial participation was difficult to meet for some scientific disciplines, this was extended to include the entire non-academic sector in Horizon 2020. The number of participating organisations was also changed from two to a minimum of two, to allow for more complex research programmes to be implemented under the EID scheme.

The distinction of EID from other types of ITN actions is not clear cut. Under so-called European Training Networks (ETN, another type of ITN action) it is possible for non-academic partners to host fellows for a comparable amount of time as under EID projects.

3 Relevance of the EID scheme

Study fieldwork confirmed the relevance and pertinence of the issues set out above. It also confirmed that the EID scheme objectives are generally clearly set out. Stakeholders raised the following:

- Most established universities offer training in various transferable skills – stakeholders felt that while the EID scheme does not necessarily enable training otherwise unavailable, it generates structure and raises awareness of training offers along the ‘value chain’ from basic research, applied research towards business relevant activities such as product development, manufacturing, marketing & sales and finance.
- Industrial doctorates are often arranged on a bilateral and institutional level. Many larger companies have schemes for industrial doctorates that differ widely in focus and quality of training. Stakeholders agreed with the idea of structured doctoral training with non-academic participation.
- Generally, stakeholders were concerned about the trend to turn doctoral training into skills training – the main aspect of a PhD should be to conduct independent scientific work. Any training offered should complement the research focus of a PhD project and allow some flexibility to arrange training and skill development to suit the individual's career path.
- Stakeholders also highlighted that EID projects, and ITN projects more generally offer PhD candidates access to networks of senior researchers otherwise unavailable. Access to professional and scientific networks is considered key to further career prospects and help inform decisions about career paths. They felt that the quality and extent of networks in EID/ITN projects are not generally available in ‘classic’ PhD/graduate programmes.

The fieldwork also highlighted issues that need further investigation. Regarding the relevance of the EID scheme, these include:

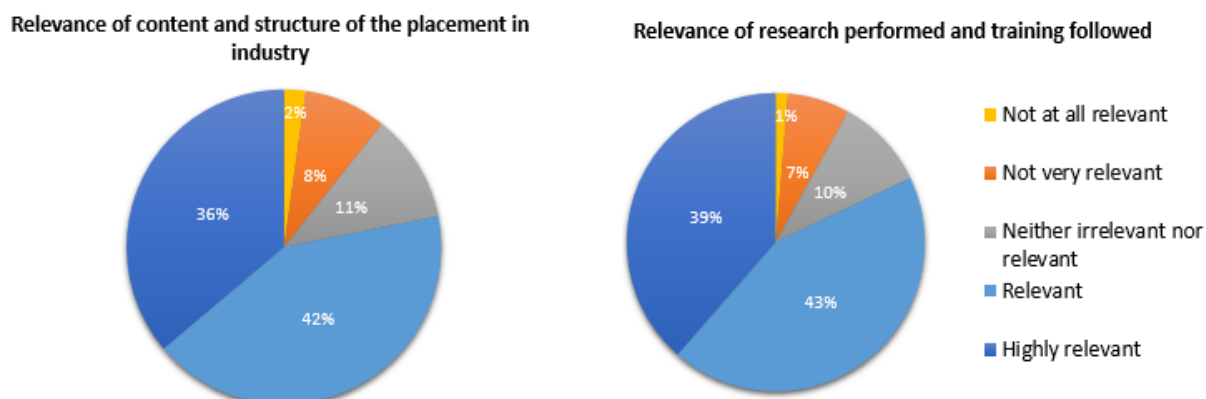
- The EID scheme is perceived as only relevant to scientific disciplines with clear potential for industrial application and a strong focus on engineering and information sciences – the involvement of non-academic stakeholders beyond this sector is often perceived to be outside the scheme remit, although it is explicitly included in the EID calls for proposals;
- Training funded by institutional unit costs⁶ is often perceived as courses/modules already available – either through other types of graduate training, lectures or through courses offered by technology transfer offices and career centres at academic institutions;
- Until the MSCA work programme 2016-2017, projects had to include an academic partner allowed to award doctoral degrees. This excluded various research organisations – including large institutions of applied research from countries including Germany and France. The EID mid-term evaluation should investigate whether abandoning this rule has created a more diverse group of academic participants.

Most EID fellows surveyed found the content and structure of the industrial placement, research and training provided by their academic institutions were either relevant or

⁶ As stated in the Horizon 2020 MSCA Guide for Applicants, institutional unit costs may support (European Commission, H2020 Programme Guide for Applicants, MSCA, http://ec.europa.eu/research/participants/data/ref/h2020/other/guides_for_applicants/h2020-guide-appl-msca-if_en.pdf): the participation of researchers in training activities; expenses related to research costs; and management and indirect costs.

highly relevant to their research interests (78 per cent said the content and structure was relevant/highly relevant, 82 per cent said the same about relevance of research and training). Participants did not report any significant differences between the relevance of the research content in their placement and at their academic institutions.

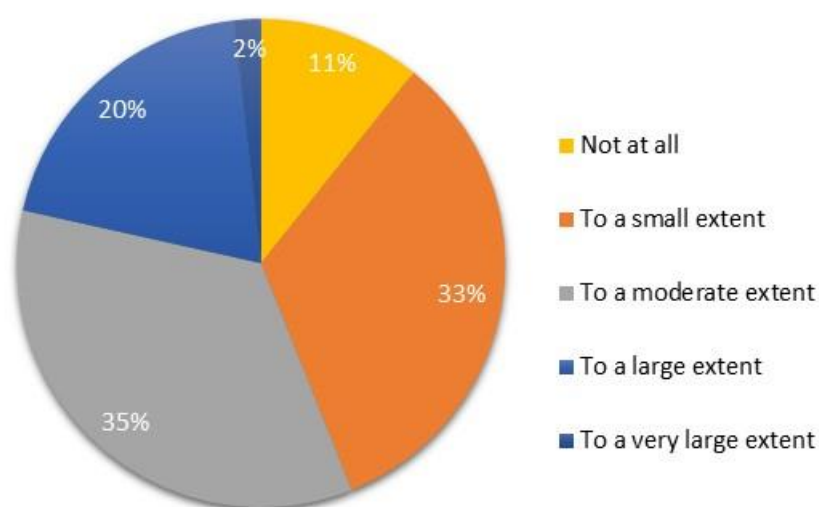
Figure 3.1 Relevance of: i) the placement in industry during EID fellowships and ii) research performed and training followed at the academic institution (EID fellows)



Sources: *European Industrial Doctorates – EID fellows, Question 19: How relevant for your research interest do you consider the content and structure of the placement in industry during your EID fellowship? And Question 20: How relevant for your research interest do you consider the content and structure of research performed and training followed at the academic institution? Respectively 224 and 223 participants replied to these questions.*

EID proposals are based on predefined research topics and also indicate tentative individual PhD projects for fellows. Survey responses indicate that to a small or moderate extent, EID placements were flexible enough to enable participants to fine-tune their research topics once the fellowship had started. Thirty-five per cent of EID fellows surveyed reported that they were free to choose their research topic to a moderate extent, while 33 per cent only felt they could choose to a small extent. A smaller proportion (20 per cent) stated that to a large extent they were free to choose their research topic.

Figure 3.2 Freedom to choose research topics during EID fellowships (EID fellows)

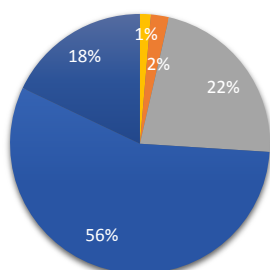


Source: *European Industrial Doctorates – EID fellows, Question 18: During your EID fellowship, to what extent were you able to freely choose your research topic? 223 participants replied to this question.*

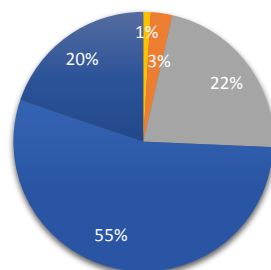
Generally, (56 per cent) EID fellows considered the content of EID research in industry challenging. Eighteen percent reported that placements were highly challenging, with a similar proportion (22 per cent) finding it to be neither challenging nor unchallenging. Respondents did not consider EID research in industry to be any more or less challenging than research performed at their academic institutions.

Figure 3.3 **Level of challenge posed by research performed (EID fellows)**

How challenging is research performed in academia?



How challenging is research performed in industry?



■ Not at all challenging
■ Not very challenging
■ Neither unchallenging nor challenging
■ Challenging
■ Highly challenging

Source: European Industrial Doctorates – EID fellows, Question 21 How challenging do you consider the content of the placement in industry? 222 participants replied to this question. European Industrial Doctorates – EID fellows, Question 22: How challenging do you consider the content of research performed at the academic institution? 223 participants replied to this question.

4 Review of EID activities

This section presents a review of EID activities. It discusses demand for EID funding and the project portfolio funded. EID scheme activities are compared to the ITN scheme as a whole and, where data was available, to the four comparator programmes investigated.⁷ It contains the following sub-sections:

- 4.1 discusses the main motivations of organisations and fellows to apply for EID funding;
- 4.2 discusses demand for EID funding, and compares it to demand for ITN funding overall; and
- 4.3 reviews in more detail the nature of partnerships funded.

4.1 Motivations to apply

4.1.1 Main motivations of organisations to apply for EID funding

Interviewees were asked about their main motivations to apply for EID funding and why they preferred it over similar programmes.

- Academic institutions most frequently cited access to research funding, the ability to recruit a cohort of researchers working on a specific research topic, and the possibility to strengthen existing relationships and collaborations with industry. Industrial doctorates are often perceived to be case-based research projects commissioned by the industry side – the need to structure a training programme for a cohort of researchers make EID projects very attractive vis-à-vis other industrial doctorate schemes;
- Industry participants are perceived to be mainly attracted by recruitment opportunities at very low cost, coinciding with specific development and innovation projects

Results from the case study research largely confirm these views. Project coordinators of case study projects suggested that the strong and explicit focus on structured collaboration with industry was a major motivation, together with enabling access to research funding. Training of PhD was less often mentioned by project coordinators in case study research, with a minority of coordinators conceding that training of PhD candidates was a secondary objective.

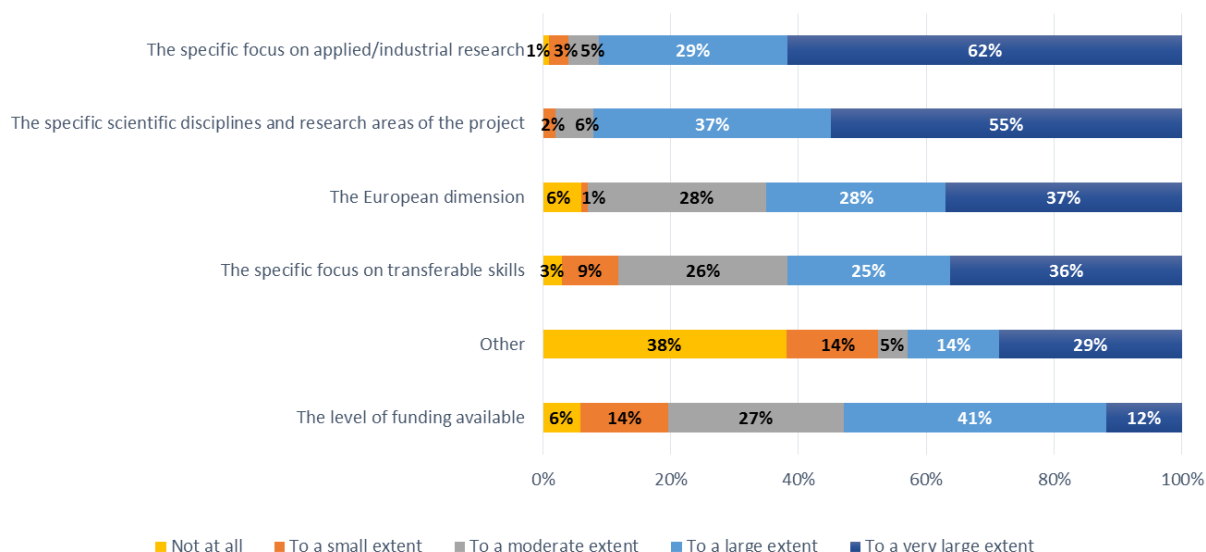
Comparator programme research suggest that motivations to participate in national programmes are similar to the initial assessment above – but these programmes usually lack an international dimension and do not allow researchers to move across different countries (see Annex 3 below).

4.1.2 Main motivation of fellows to apply

Fellows were asked which aspects of the EID scheme were most important in influencing their decision to apply, compared to alternative fellowship or PhD programmes. The specific focus on applied/industrial research and the specific scientific disciplines and research areas of the EID project were the most important reasons to apply, with 62 per cent and 55 per cent of respondents indicating that these aspects influenced the decision to apply to a very large extent.

⁷ Industrial CASE studentships, United Kingdom; CIFRE, France; Industrial graduate programme, Sweden and the Industrial PhD programme, Denmark.

Figure 4.1 **Aspects influencing fellows' decision to apply for an EID fellowship (EID fellows)**



Sources: European Industrial Doctorates – Fellows, Question 16: To what extent did the following aspects influence your decision to apply for an EID fellowship instead of the alternative, similar fellowship? 224 fellows replied to this question.

These findings were corroborated by interviews with fellows, where the specific research focus of EID projects was the main factor influencing decision to apply, with the specific focus on industrial research and the focus of training programmes on industry relevant skills coming second. For interviewees offered other PhD positions at the time of applying for an EID fellowship, industry involvement was often the decisive factor in favour of the EID fellowship.

Other aspects that influenced the decision to apply include:

- The salary is considered very competitive compared to starting salaries in industry and other PhD scholarships.
- Often PhD candidates are employed as research assistant, and cannot spend their whole working hours on the PhD project. The MSCA rules mandate that the fellowship shall only be spent on the PhD project, without any further commitments to the academic research department which awards the PhD.⁸ This is perceived as very attractive in comparison to 'regular' PhD positions.
- Fellow interviewees also suggested that the EID project enabled them to access a network of high quality, senior experts beyond that offered had they conducted their PhD in a 'regular' programme at a single academic institution.

⁸ However, teaching activities are allowed as part of the MSCA funded work, provided that time spent on teaching does not jeopardise the research activities of the fellow.

4.2 Demand and participation

This section presents an analysis of demand for EID funding and participation in EID projects in FP7 and Horizon 2020 up until March 2016. Demand and participation in EID projects were compared with similar statistics for ITN projects as a whole, considering calls for proposals of the same year.⁹

This section provides overall statistics before presenting demand for participation by calls, countries, organisation types and scientific panels.

4.2.1 Overall statistics

The overall statistics on demand for EID proposals are as follows:

- 534 EID proposals to date, representing 11 per cent of the 4,922 ITN proposals.
- 2,013 organisations participated in EID proposals to date, representing four per cent of the 51,927 organisations participating in ITN proposals during the same period.
- € 336 million were requested from the EU by EID applicants in Horizon 2020 proposals, representing four per cent of the € 8.8 billion requested by all ITN applicants in Horizon 2020 proposals.

The overall statistics on participation in EID projects are:

- 101 EID projects to date, representing 17 per cent of the 579 ITN projects funded to date.
- 281 organisations participated in EID projects to date, representing six per cent of the 4,517 organisations participating in ITN projects.
- €114 million were awarded by the EU to EID projects to date, representing six per cent of the €1.8 billion awarded to ITN projects across the two framework programmes to date.

Success rates for EID are generally higher than for ITN overall.

- The success rate by EID projects (number of projects / number of proposals) was 18.9 per cent, much higher than the corresponding success rate for ITN (11.8 per cent).
- The success rate by EID participants (number of participants/number of applicants) was 14.0 per cent, again higher than the corresponding success rate for ITN (8.7 per cent).

Success rates of private commercial firms in applying for EID funding dropped significantly in Horizon 2020 when compared to FP7, from around 19 per cent down to 8 per cent.

EID are generally smaller than ITN projects overall. The average number of applicants per EID proposal was 3.77 (compared to an average 10.55 applicants per ITN proposal) and the average number of participations per EID project was 2.78 (compared to an average 7.80 participants per ITN project). This corresponds with the requirements of the EID scheme, which mandated exactly two partners from two different countries under FP7 and was extended to a consortium of minimum of two partners from two different countries.

The average EU funding awarded per EID participant was around €405,000. This was roughly equal to the average EU funding awarded per ITN participant (around €406,000). The average EU funding per EID project was around €1.1 million. This was a smaller

⁹ FP7-PEOPLE-2012-ITN, FP7-PEOPLE-2013-ITN, Horizon 2020-MSCA-ITN-2014, Horizon 2020-MSCA-ITN-2015.

amount than the average funding per ITN project (around €3.2 million), most likely a function of the smaller consortia size in EID and number of requested person months.

Note: no information was available on the EU funding requested by FP7 applicants. Consequently, in this section, the information on EU funding requested relates only to Horizon 2020.

4.2.2 Demand and participation by calls

When reviewed by call for proposal, demand for EID funding was in line with overall demand for ITN funding.

While EID proposals represented around 12-13 per cent of all ITN proposals during the FP7 calls, they were less present in the Horizon 2020 calls (only around 9-10 per cent of all ITN proposals). Demand for EID funding, in terms of number of EID applicants, more than tripled between the 2012 and the 2015 calls. This trend was similar to the overall trend of ITN applicants.

The number of EID projects was at its highest during the 2013 call before decreasing in the 2014 and 2015 calls. This trend was similar to the one observed by ITN projects. The number of EID participants increased with time. This may be due to the increased budget allocated to the EID scheme. The same was not true for ITN participants (there was a peak in the 2013 call followed by a decrease in the 2014 and 2015 calls). As a result, the proportion of EID participants increased, with EID participants representing only four per cent of all ITN participants in the 2012 call, compared to eight per cent in the 2015 call. The difference is that EID projects were limited to two participants in FP7 and scheme rules were changed to allow larger consortia in Horizon 2020.

Table 4.1 below shows the number of EID proposals and EID applicants as well as the amount of EU funding requested by EID applicants by calls. Table 4.2 provides the same information for participation in EID projects.

Table 4.1 Number of EID proposals, number of EID applicants and amount of EU funding requested by EID applicants by calls

Call	Number of EID proposals	Number of EID applicants	Amount of EU funding requested by EID (€m)
FP7-PEOPLE-2012-ITN	125	255	no information
FP7-PEOPLE-2013-ITN	147	293	no information
Horizon 2020-MSCA-ITN-2014	105	582	134
Horizon 2020-MSCA-ITN-2015	157	883	202

Source: ICF CORDA analysis

Table 4.2 Number of EID projects, number of EID participants and amount of EU funding awarded to EID projects by calls

Call	Number of EID projects	Number of EID participants	Amount of EU funding awarded to EID (€m)
FP7-PEOPLE-2012-ITN	22	45	22
FP7-PEOPLE-2013-ITN	36	73	33
Horizon 2020-MSCA-ITN-2014	22	80	29
Horizon 2020-MSCA-ITN-2015	21	83	30

Source: ICF CORDA analysis

4.2.3 Demand and participation by countries

Demand by country was similar for EID funding when compared to overall ITN applications, but demand for EID funding seem to be slightly more concentrated in a group of ten EU Member States when compared to ITN, where other EU Member States accounted for larger shares of overall demand. Of the 2,013 applicants in EID proposals so far, 1,789 (89 per cent) were based in EU Member States¹⁰, 89 (4 per cent) in associated countries¹¹ and 35 (3 per cent) from third countries^{12,13}. Similarly, a large majority of participants in EID projects (263 out of 281, or 94 per cent) were based in EU Member States¹⁴, and 18 (6 per cent) in associated countries¹⁵. Out of the €336 million requested to the EU by EID applicants in the Horizon 2020 calls, €326 million (97 per cent) were requested by organisations based in EU Member States, and €9 million (three per cent) were requested by organisations based in associated countries. Of the €114 million awarded by the EU to EID projects, €106 million (93 per cent) were given to organisations based in EU Member States, and the €8 million left (seven per cent) were awarded to organisations based in associated countries.

Organisations participating in EID proposals were based in 40 countries¹⁶ (compared to 104 for all ITN proposals¹⁷). The following ten EU Member States provided the highest number of EID applicants since the introduction of the scheme: the UK, Germany, Spain, Italy, the Netherlands, France, Belgium, Denmark, Ireland and Sweden. These 10

¹⁰ EU Member States: countries of the EU-27 for FP7 and countries of the EU-28 for Horizon 2020

¹¹ Associated countries: Iceland, Norway, Albania, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Switzerland, Croatia, Liechtenstein for FP7; and Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland, Faroe Islands, Ukraine, Tunisia, Georgia for Horizon 2020.

¹² Third countries: countries that are neither EU Member States nor associated countries

¹³ Country information was not available for the remaining 100 applicants.

¹⁴ EU Member States: countries of the EU-27 for FP7 and countries of the EU-28 for Horizon 2020

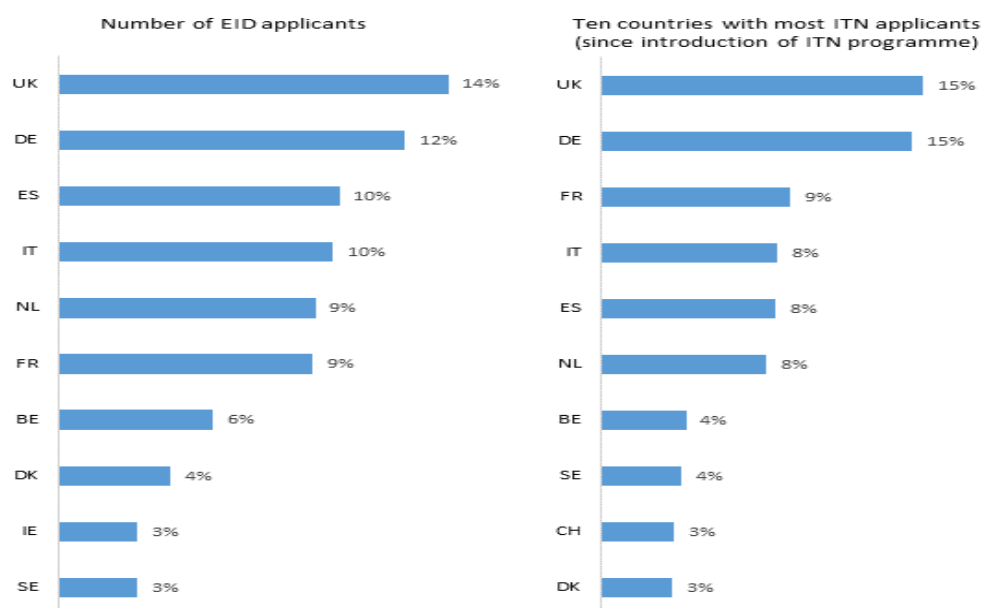
¹⁵ Associated countries: Iceland, Norway, Albania, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Switzerland, Croatia, Liechtenstein for FP7; and Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland, Faroe Islands, Ukraine, Tunisia, Georgia for Horizon 2020.

¹⁶ Note that for 100 applicants, the country of origin was not indicated.

¹⁷ Note that for 3,849 applicants, the country of origin was not indicated

countries represented 79 per cent of all EID applications and 87 per cent of all EU funding requested by EID applicants in Horizon 2020. Switzerland was the most important non-EU country in terms of demand for EID projects (representing three per cent of EID applicants). Organisations participating in EID projects were based in 20 countries (compared to 44 countries for all ITN projects)¹⁸. The 10 countries hosting the most organisations involved in EID projects were: the Netherlands, the UK, Germany, Italy, Spain, France, Belgium, Denmark, Switzerland and Sweden. These countries represented 85 per cent of all EID participations and 87 per cent of all EU funding awarded to EID participants. Figure 4.2 compares the top countries with most applicants for EID and ITN funding. Spain and Italy, as well as the Netherlands, show higher demand for EID funding in comparison.

Figure 4.2 **Top 10 countries with most applicants for EID/ITN funding**

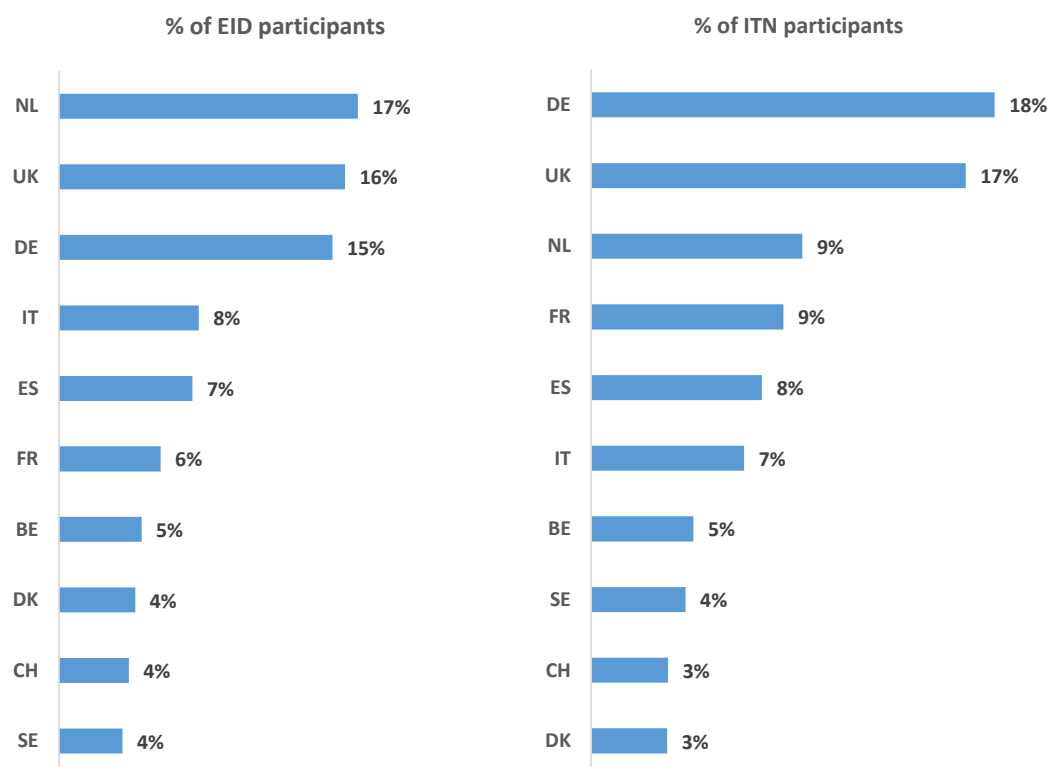


Source: ICF CORDA analysis

Figure 4.3 provides an overview of participants by country in EID and in ITN projects overall. The Netherlands has been very successful in terms of participations in EID (17 per cent), almost two times the proportion of Dutch participations in ITN overall (nine per cent).

¹⁸ These 20 countries were AT, BE, CH, CZ, DE, DK, EE, EL, ES, FI, FR, IE, IL, IT, NL, NO, PL, PT, SE and UK.

Figure 4.3 **Proportion of participants by top ten country, EID and ITN overall**



Source: ICF CORDA analysis

4.2.4 Demand and participation by organisations types

Overall and in accordance with the project objectives of the EID scheme, EID applicants and participants. Table 4.3 below shows the number of EID applicants and the amount of EU funding requested by EID applicants in Horizon 2020 by organisation type. Table 4.4 provides the same information for participation in the scheme.

Private commercial organisations (PRC) represented most the majority of EID applicants (61 per cent), followed by Higher or secondary education organisations (HES) (31 per cent). But HES represented a much larger proportion of the EU funding requested than PRC (61 per cent compared to 28 per cent), likely an indication that researchers in proposals are more often recruited by universities than businesses. Research organisations (REC) and Public bodies (PUB) played a less important role in EID than in ITN proposals.

Private commercial organisations (PRC) together with Higher or secondary education organisations (HES) represented 91 per cent of all EID participations and 89 per cent of all EU funding awarded. While there were almost the same number of participants from PRC and HES organisations, the amount of EU funding awarded to HES organisations was more than twice the funding awarded to PRC organisations. As EU funding awarded via unit costs is directly linked to researcher recruitment, at least part of this split is probably due to HES organisations recruiting and employing most EID fellows.¹⁹ HES organisations were relatively less present in EID projects (45 per cent of participations) than in ITN

¹⁹ EID differs from other MSCA actions in budget distribution, as one individual participant can potentially recruit all fellows within a project, but fellows will be spend a minimum of 50 per cent of their time in the non-academic sector. In other MSCA actions, recruitment (and therefore EU funding made available for living allowance) have to spread more evenly between different beneficiary organisations.

projects as a whole (58 per cent), as would be expected. Research organisations (REC) had a less important role, and no participants came from public bodies (PUB). REC organisations were also under-represented in EID projects (nine per cent of participations) compared to ITN projects as a whole (18 per cent) – confirming that the EID scheme until recently was not attractive to REC, given that until 2015, academic participants had to be able to award PhD degrees.

Table 4.3 Number of EID applicants and amount of EU funding requested by organisation types

Organisation type	Number of EID applicants	Amount of EU funding requested by EID applicants (€m – Horizon 2020 only)
All organisation types	2,013 (100%)	336 (100%)
Private commercial organisations (PRC)	1,228 (61%)	93 (28%)
Higher or secondary education organisations (HES)	619 (31%)	204 (61%)
Research organisations (REC)	134 (7%)	26 (8%)
Public bodies (PUB)	10 (<1%)	1 (<1%)
Other (OTH)	22 (1%)	12 (3%)

Source: ICF CORDA analysis

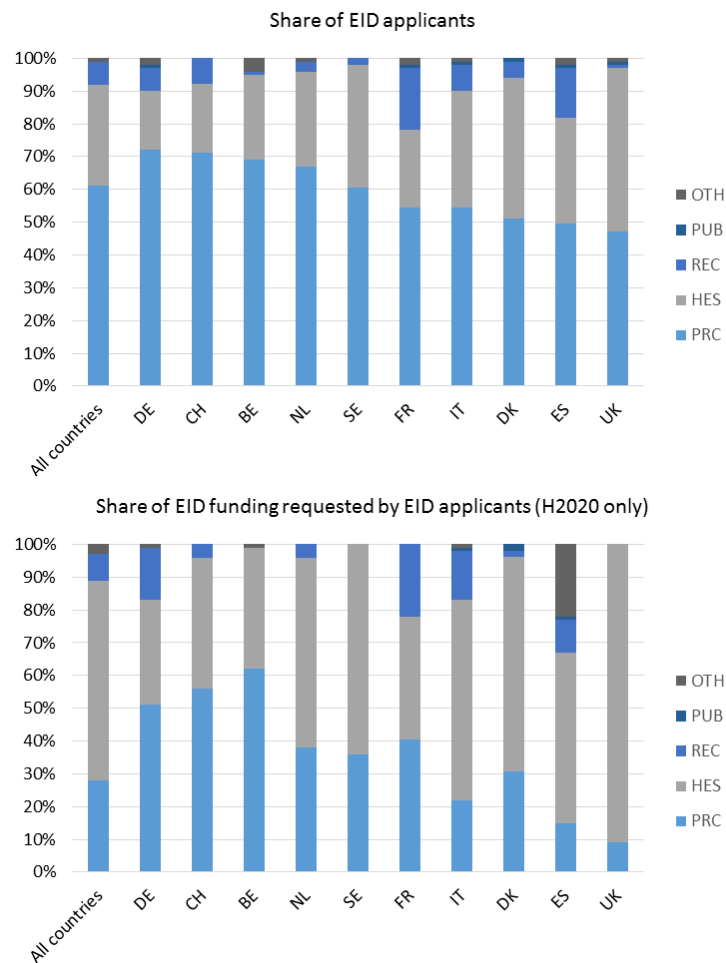
Table 4.4 Number of EID participants and amount of EU funding awarded by organisation types

Organisation type	Number of EID participants	Amount of EU funding awarded to EID projects (€m)
All organisation types	281 (100%)	114 (100%)
Private commercial organisations (PRC)	129 (46%)	31 (27%)
Higher or secondary education organisations (HES)	127 (45%)	70 (62%)
Research organisations (REC)	24 (9%)	12 (11%)
Public bodies (PUB)	0 (0%)	0 (0%)
Other (OTH)	1 (<1%)	0 (0%)

Source: ICF CORDA analysis

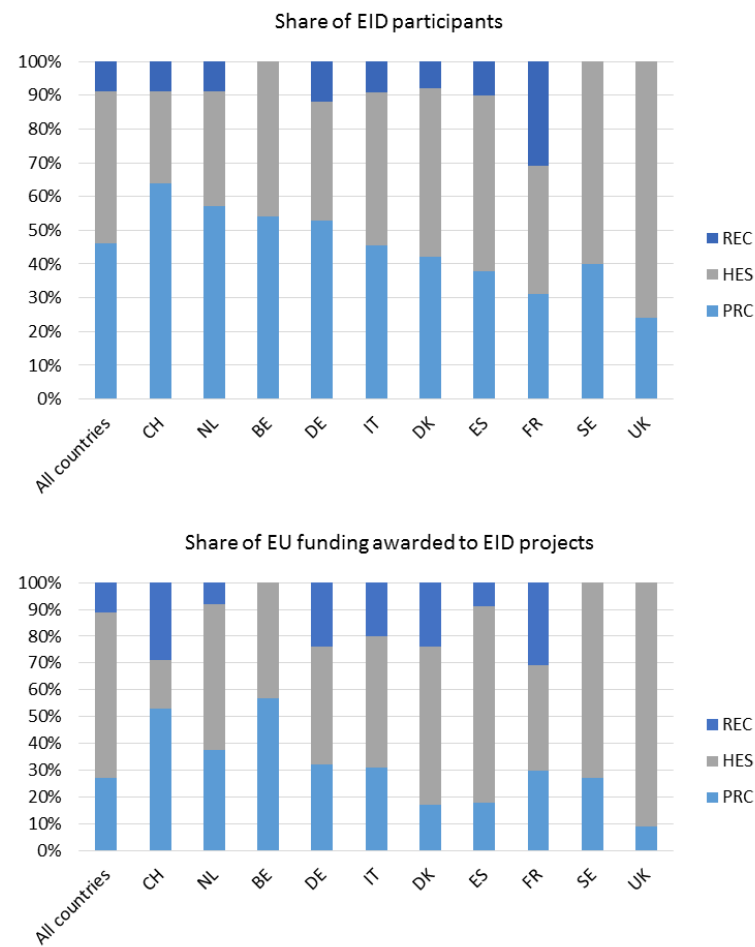
Differences were apparent between countries. For example, in the UK, HES organisations were more important than average; but PRC organisations were under-represented. The opposite was true for German and Swiss participants, where HES organisations were under-represented, while PRC organisations were more important than average. In addition, in Belgium, Sweden and the UK, there were no REC organisations participating in EID projects. While REC organisations represented only a small share of applicants and participants in EID proposals, in countries such as France their importance was much higher. These differences between countries are likely a result of different national research & innovation systems. For example, UK universities are performing strongly in the EU framework programmes overall, while research organisations play a prominent role in France and Germany.

Figure 4.4 **EID applicants and EU funding requested, by organisation types and by countries (all countries and top ten countries)**



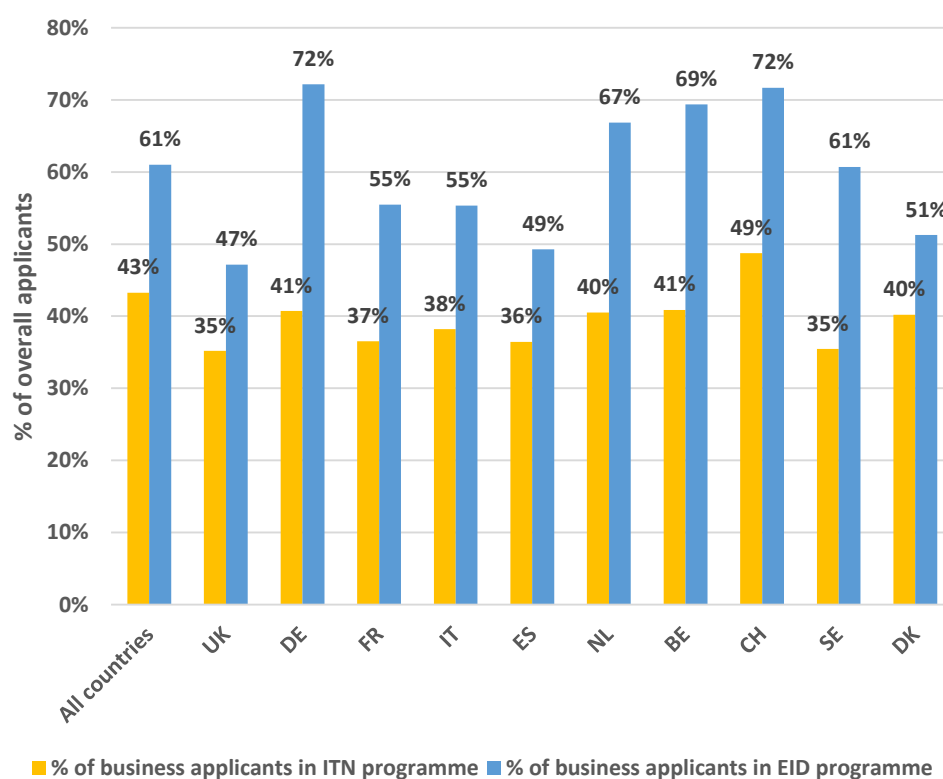
Source: ICF CORDA analysis

Figure 4.5 **EID participants and EU funding awarded to EID projects by organisation types and by countries (all countries and top ten countries)**



Given the specific focus of the EID scheme on collaboration between the academic and non-academic sector, it is interesting to look at differences in demand from businesses in more detail. Figure 4.6 presents proportion of business applications from all applications for ITN and EID proposals, for a selection of countries. This suggests that, in this group of countries, EID mobilised the largest additional demand from businesses in Germany (+31 per cent), Netherlands (+27 per cent), Belgium (+28 per cent) and Sweden (+36 per cent). It is also noticeable that Italy (+17 per cent), Spain (+13 per cent), the UK (+12 per cent) and Denmark (+11 per cent) saw additional demand below the average additional demand for all applicant countries (18 per cent), either because the ITN scheme already met existing demand from businesses or because businesses that could benefit from an EID project were unaware of the funding opportunity.

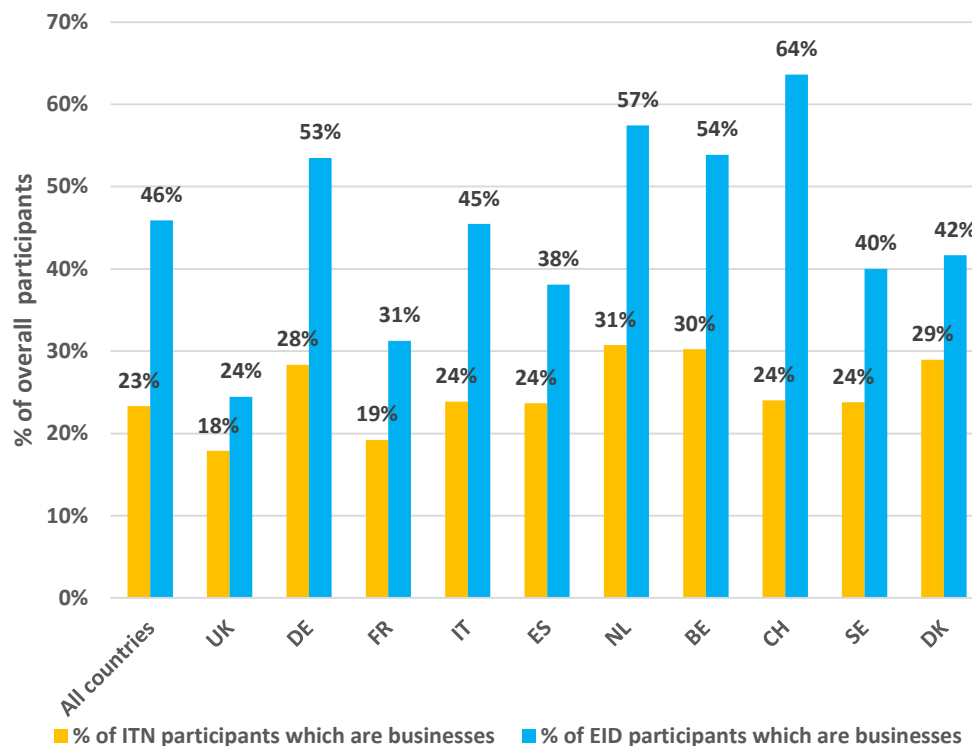
Figure 4.6 **Demand from businesses by country (PRC applicants in EID/ITN proposals)**



Source: ICF CORDA analysis

Figure 4.7 presents the differences in business participation between EID and ITN projects overall. It is obvious that the EID scheme results in less additional business participation in the UK and France, compared to other countries such as Germany, the Netherlands and Switzerland. This pattern coheres with additional business demand presented in Figure 4.6 above.

Figure 4.7 **Proportion of business participants in EID and ITN, by country (all countries and top ten countries)**



Source: ICF CORDA analysis

Insights from comparator programmes suggest that the mix of academic and industrial partner organisations, and the specific attributes of industrial partner organisations, depend on the specific focus on individual programmes or funded projects. The blue box below presents an example from the UK comparator programme investigated.

Box 1 UK comparator programme: Biotechnology and Biological Sciences Research Council (BBSRC) Industrial CASE studentships²⁰

Grant holders, i.e. those who receive financial support, can be academic research organisations and other public institutions such as NHS Trusts. The non-academic partners are usually companies with 'an established UK-based research and/or commercial production capability.'²¹

The list of the awarded ICP studentships shows that for the 2015/16 academic year, most of the industrial partners are large multinational companies in the scientific field involving large pharmaceuticals:

- AstraZeneca: Partnership Awards 2015/16: 7
- Bayer: Partnership Awards 2015/16: 3

²⁰ The BBSRC programme specifically fund PhD in the field of bioscience. Six other Research Councils exist in the United Kingdom which fund studentships in other scientific fields. The Councils expressed their commitment towards promoting collaborative PhD training through sharing a joint vision for collaborative training, see: <http://www.rcuk.ac.uk/documents/skills/rcdvision-pdf/>

²¹ *ibid*

- GSK: Partnership Awards 2015/16: 22
- Knowledge Transfer Network: Partnership Awards 2015/16: 10
- MedImmune: Partnership Awards 2015/16: 6
- Nestle: Partnership Awards 2015/16: 2
- Oxitec: Partnership Awards 2015/16: 2
- Syngenta: Partnership Awards 2015/16: 10
- UCB: Partnership Awards 2015/16: 3
- Unilever: Partnership Awards 2015/16: 6

4.2.5 Demand and participation by scientific panels

Overall and as expected, scientific disciplines with a clear potential for industrial application dominated EID applications and projects.

As shown in Table 4.5 and in Table 4.6, demand for and participation in EID funding were strongest in the scientific panels of Information science and Engineering (ENG), Life sciences (LIF), Chemistry (CHE) and Environment and geosciences (ENV). This confirms anecdotal feedback from the interview programme, when it was suggested that scientific disciplines with a clear application potential in industry are most interested in EID funding.

This is in line with findings from the comparator programmes' analysis, which mainly focussed on natural and technical sciences (such as ICT, chemistry and pharmacology) (see also Annex 3).

The scientific panel ENG had the largest role in EID proposals and projects. It represented, respectively:

- 42 per cent of proposals, 46 per cent of applicants since the launch of the EID scheme and 57 per cent of EU funding requested in Horizon 2020. In the studied calls, this panel was less prominent for ETN proposals, for which it represented 28 per cent of all proposals, applicants and EU funding requested. This difference in demand from the engineering panel suggests that the EID scheme attracted demand specifically from research areas with clear short-term application potential in industry.
- 37 per cent of projects, 39 per cent of participants since the launch of the EID scheme and 40 per cent of EU funding awarded. This panel represented only around 29 per cent of all ITN projects, participants and EU funding awarded.

The proportion of scientific panel LIF was lower in EID proposals and projects than in ITN as a whole. While this panel represented only 25 per cent of EID proposals, 21 per cent of applicants since the launch of the EID scheme and 20 per cent of EU funding requested in Horizon 2020, it represented 28 to 29 per cent of ITN proposals, applicants and EU funding requested. Furthermore, this panel represented 22 per cent of EID participants, 19 per cent of EU funding awarded, but it represented 30 per cent of ITN participants and 29 per cent of EU funding awarded.

The relative importance of the scientific panel CHE was similar between EID and ITN proposals, although this panel represented a higher share of EID projects than ITN projects as a whole. While this panel represented 21 per cent of EID participants and EU funding awarded, it represented only around 13 per cent of ITN participants and EU funding awarded.

There were less than 10 EID projects for each of the following panels: Physics (PHY), Economic Sciences (ECO), Environment and Geosciences (ENV), Mathematics (MAT) and Social Sciences and Humanities (SOC)²².

Table 4.5 Number of EID proposals, number of EID applicants and amount of EU funding requested by EID applicants by scientific panels²³

Scientific panel	Number of FP7 and Horizon 2020 EID proposals	Number of FP7 and Horizon 2020 EID applicants	Amount of Horizon 2020 EU funding requested by EID (€m)
All scientific panels	532 (100%)	2,006 (100%)	336 (100%)
Information science and Engineering (ENG)	226 (42%)	916 (46%)	152 (45%)
Life sciences (LIF)	131 (25%)	415 (21%)	68 (20%)
Chemistry (CHE)	92 (17%)	316 (16%)	46 (14%)
Environment and geosciences (ENV)	37 (7%)	175 (9%)	28 (8%)
Physics (PHY)	16 (3%)	41 (2%)	7 (2%)
Economic Sciences (ECO)	8 (2%)	34 (2%)	7 (2%)
Mathematics (MAT)	10 (2%)	41 (2%)	6 (2%)
Social Sciences and Humanities (SOC)	12 (2%)	68 (3%)	21 (6%)

Source: ICF CORDA analysis

²² The limited presence of SOC projects is most likely due to a perceived lack of potential for industrial application in the social sciences and humanities, and consequentially lower demand for funding under this scientific panel.

²³ Information on scientific panels was not available for 2 proposals and 7 applicants.

Table 4.6 Number of EID projects, number of EID participants and amount of EU funding awarded to EID projects by scientific panels

Scientific panel	Number of FP7 and Horizon 2020 EID projects	Number of FP7 and Horizon 2020 EID participants	Amount of Horizon 2020 EU funding awarded to EID (€m)
All scientific panels	101 (100%)	281 (100%)	59 (100%)
Information science and Engineering (ENG)	37 (37%)	106 (38%)	24 (40%)
Life sciences (LIF)	28 (28%)	61 (22%)	11 (19%)
Chemistry (CHE)	21 (21%)	62 (22%)	12 (21%)
Environment and geosciences (ENV)	8 (8%)	30 (11%)	7 (12%)
Physics (PHY)	3 (3%)	6 (2%)	2 (3%)
Economic Sciences (ECO)	1 (1%)	2 (1%)	1 (2%)
Mathematics (MAT)	2 (2%)	12 (4%)	2 (3%)
Social Sciences and Humanities (SOC)	1 (1%)	2 (1%)	0 (0%)

Source: ICF CORDA analysis

Differences were visible between countries (see Figure 4.8 and Figure 4.9 below). For example, only 37 per cent of Italian organisations applied in the ENG panel compared to 78 per cent of Danish organisations. While on average, the scientific panel SOC represented six per cent of EU funding requested by EID applicants in Horizon 2020, up to 22 per cent of the funding requested by Spanish organisations was in the SOC panel.

Belgium had no participants in the ENG panel, but had a higher than average proportion of EID participants and of EU funding awarded in the LIF and CHE panels. Conversely, Switzerland had no participants in the LIF panel, but had a higher than average proportion of EID participants and of EU funding awarded in the ENG and CHE panels. MAT panel represented only four per cent of participants and three per cent of EU funding awarded, while in the ECO panel the figures were one per cent and two per cent, respectively. Although based on very low numbers, the UK and Sweden participated in the ECO panel, while Italy and Spain had relatively more participation MAT panel projects.

Figure 4.8 **Share of EID applicants and EU funding requested by EID applicants by organisation types and by countries (top ten countries)**

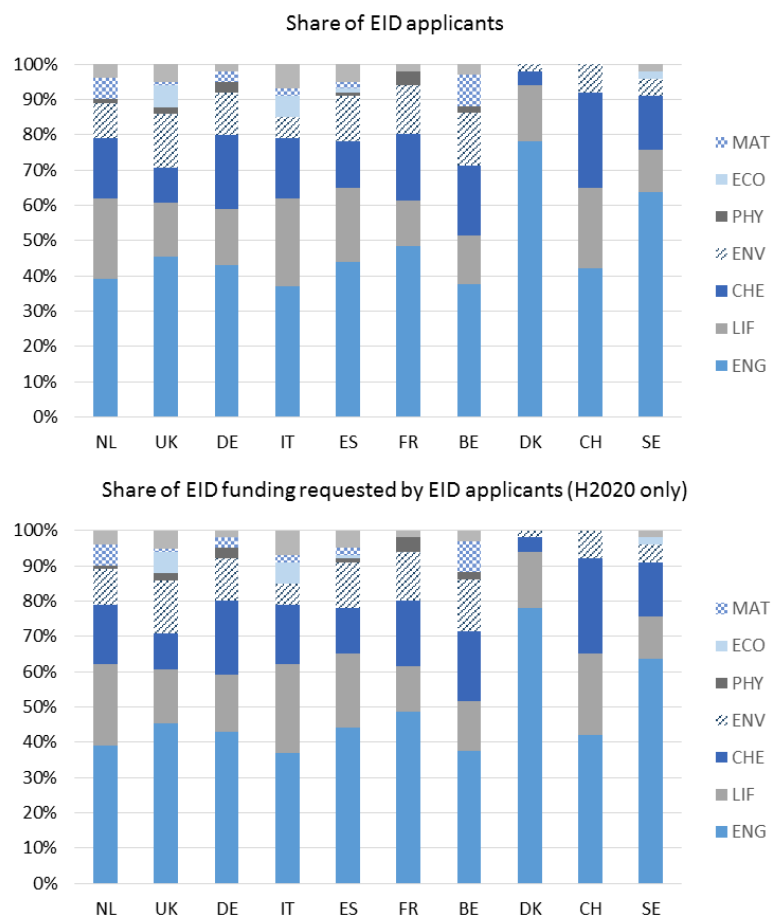
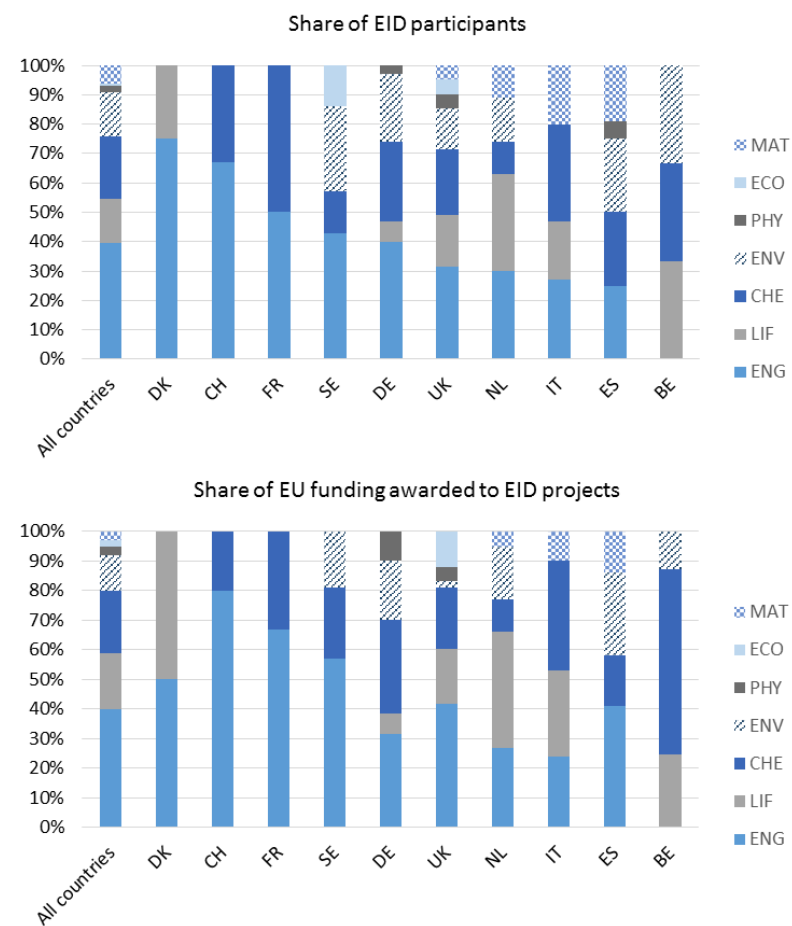


Figure 4.9 **Share of EID participants and EU funding awarded to EID projects by organisation types and by countries (all countries and top ten countries)**



Source: ICF CORDA analysis

Insights into the comparator programmes suggest similar focus areas. For instance, the Swedish comparator programme illustrates a strong focus on engineering and life science disciplines. Box 2 presents an overview of the graduate schools funded by the Swedish programme so far, together with their thematic focus

Box 2 Comparator programme Sweden – Swedish Knowledge Foundation²⁴

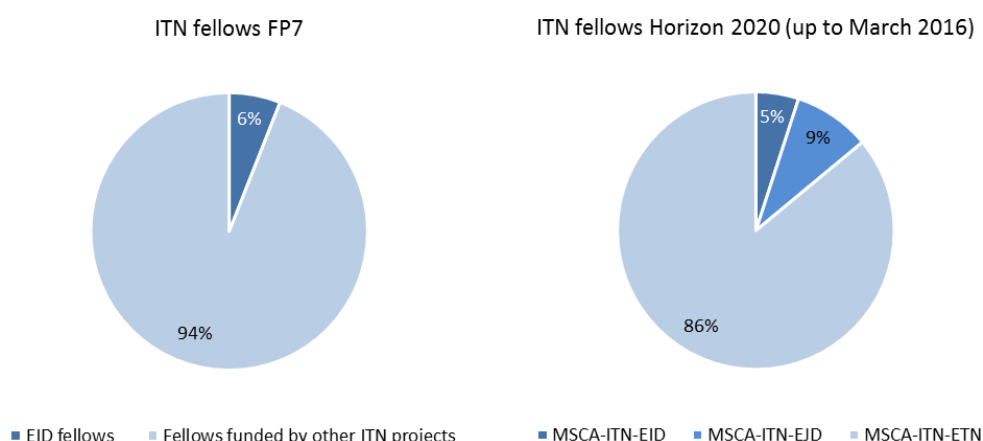
Around 30 Industrial Graduate Schools were involved in the Industrial Graduate Programme in 2016, covering a wide field of scientific disciplines and topics.²⁵ The sectors covered by the programme include:²⁶ Applied IT Software Engineering, Biotechnology, Construction, Management, Medical bioinformatics, Food, Surface Chemistry, Robotics and Rock Engineering

4.2.6 Fellows

This section presents an analysis of EID data regarding researchers recruited as EID fellows. The data on EID fellows was compared to ITN scheme data overall. It covers calls for proposals from 2012-2015 across FP7 and Horizon 2020.²⁷

Figure 4.10 presents a breakdown of fellows by ITN scheme – it shows that both in FP7 and in Horizon 2020 up to date, fellow funded by EID projects represented a similar proportion of the overall researcher population funded by ITN projects (six per cent and five per cent respectively).

Figure 4.10 ITN fellows in FP7 and Horizon 2020, by scheme



Source: ICF CORDA analysis

²⁴ The description of the programme and its rules are available at the following sources: Knowledge Foundation (2016) Forskarutbilda (Doctoral training), <http://www.kks.se/verksamhet/Forskarutbilda/Startsida.aspx> and Knowledge Foundation (2016) Industrial Graduate Programme 16, <http://www.kk-stiftelsen.se/medel/SiteAssets/Utlysningar/F%C3%B6retagsforskarskolor%2016/Call%20for%20proposals%20Industrial%20Graduate%20Schools%2016.pdf>

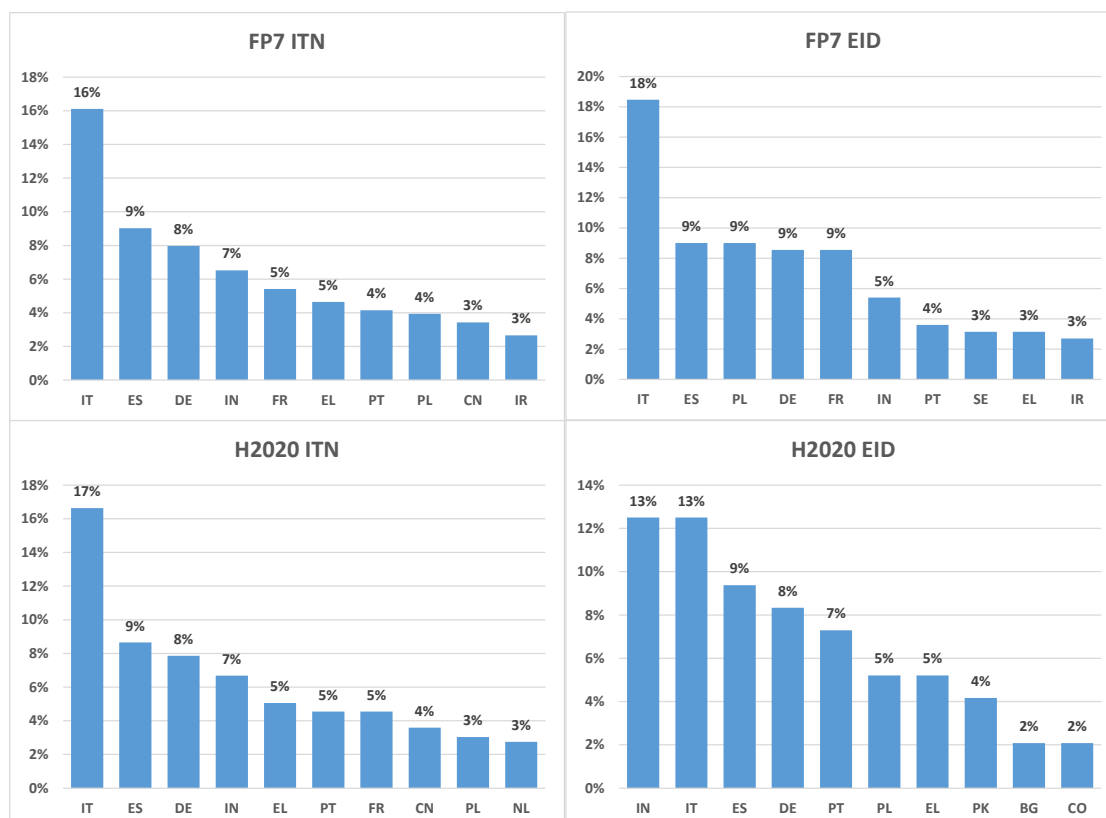
²⁵ Ibid

²⁶ Industrial Graduate Schools – University-Industry Interaction for Development of Absorptive Capacity

²⁷ FP7-PEOPLE-2012-ITN, FP7-PEOPLE-2013-ITN, Horizon 2020-MSCA-ITN-2014 and Horizon 2020-MSCA-ITN-2015, based on a CORDA export dated March 2016. The analysis covers only those researchers for which researcher recruitment reports were submitted.

Looking at the nationalities of researchers funded in EID and ITN, Italian researchers made up a large proportion of researchers funded under both ITN and EID, across FP7 and Horizon 2020 so far. They represented 18 per cent of all researchers funded under EID projects in FP7, and so far represent 13 per cent of all researchers funded under EID projects in Horizon 2020. This follows the general trend in ITN projects, where Italian researchers are the most represented. Indian, Chinese and Iranian researchers are the most prominent groups of researchers from third countries – while researchers from large research performing EU Member States such as France and the UK are less prominent (Figure 4.11).²⁸

Figure 4.11 **Nationality of fellows funded, ITN and EID up to date – top ten countries**



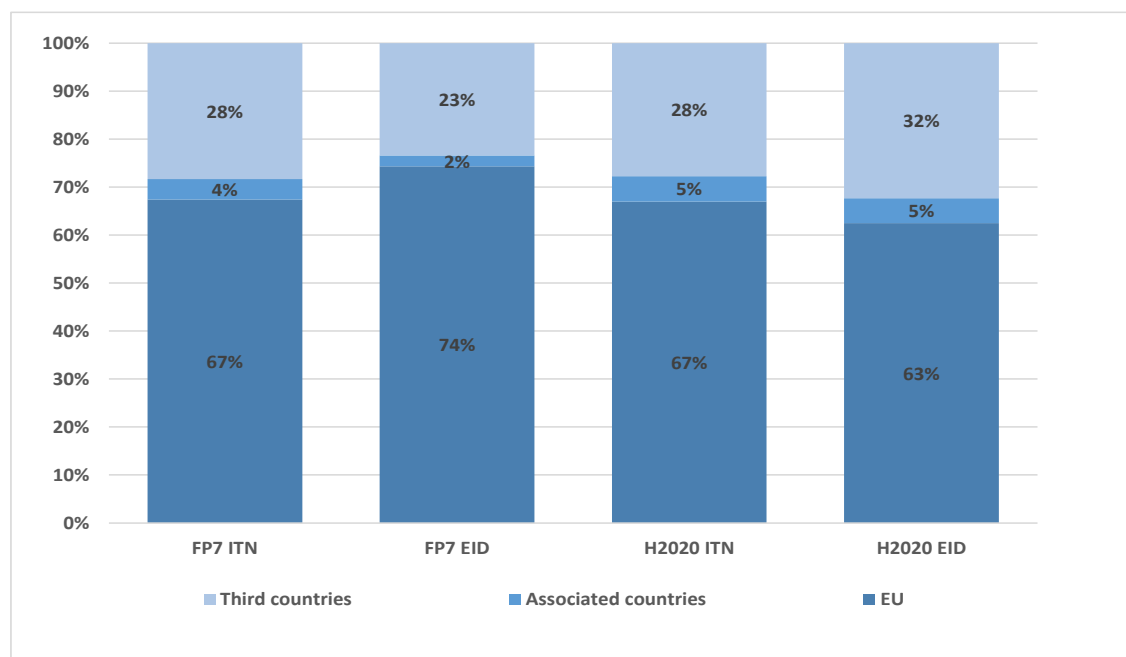
Source: ICF CORDA analysis

Researchers funded in EID projects are predominantly citizens of EU Member States, although their share of the overall EID fellow group decreased from FP7 to Horizon 2020 by 11 per cent – most likely a result of Horizon 2020's focus on international participation (Figure 4.12).²⁹

²⁸ Possible explanations might include the fact that researchers from these countries find themselves in a well-equipped national research and innovation system, and can find alternative means to conduct an industrial PhD.

²⁹ See the rules for funding from non-EU countries and international organisations, http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-3cpart_en.pdf

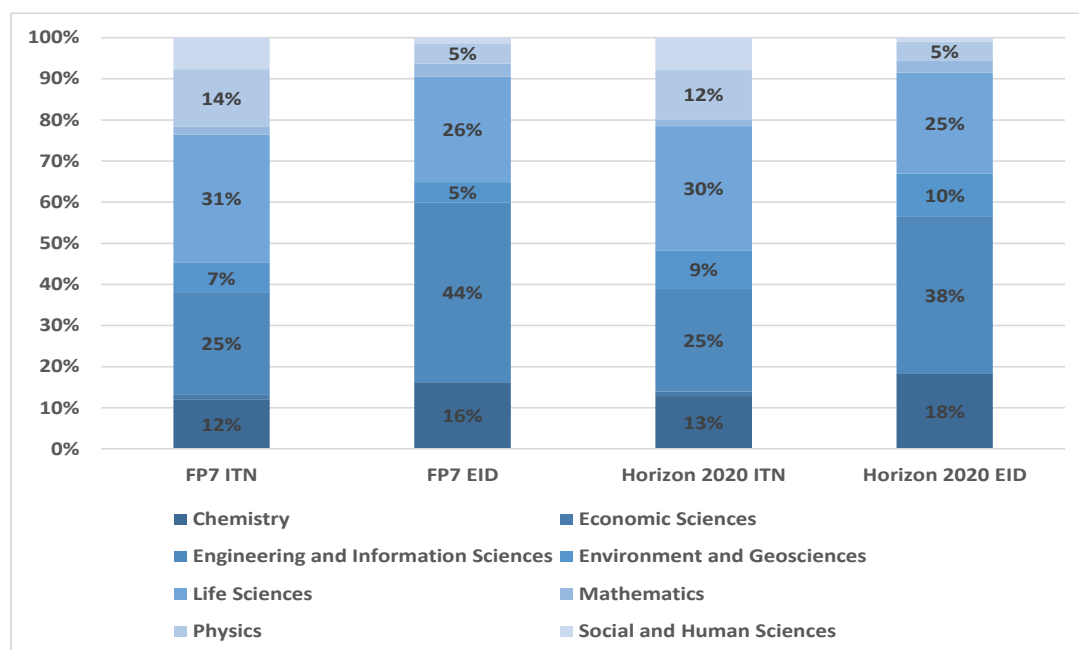
Figure 4.12 **Nationality of fellows by EU, associated countries and third countries**



Source: ICF CORDA analysis

The scientific disciplines represented by EID fellows largely represent the main areas under which EID projects are funded. Similar to the analysis scientific panels of EID projects in section 4.2.5 above, EID fellows predominantly indicate Engineering and Information Sciences (44 per cent under FP7 and 38 per cent under Horizon 2020 so far) and Life Sciences (26 per cent in FP7 and 25 per cent in Horizon 2020) as their main research areas. Engineering and Information Sciences is significantly more dominant in the research of EID fellows than for ITN fellows overall, both in FP7 and in Horizon 2020 so far (Figure 4.13). Again, this is as expected, given that EID projects and industrial doctorates are most popular in areas of research with direct industrial application/potential for industrial application.

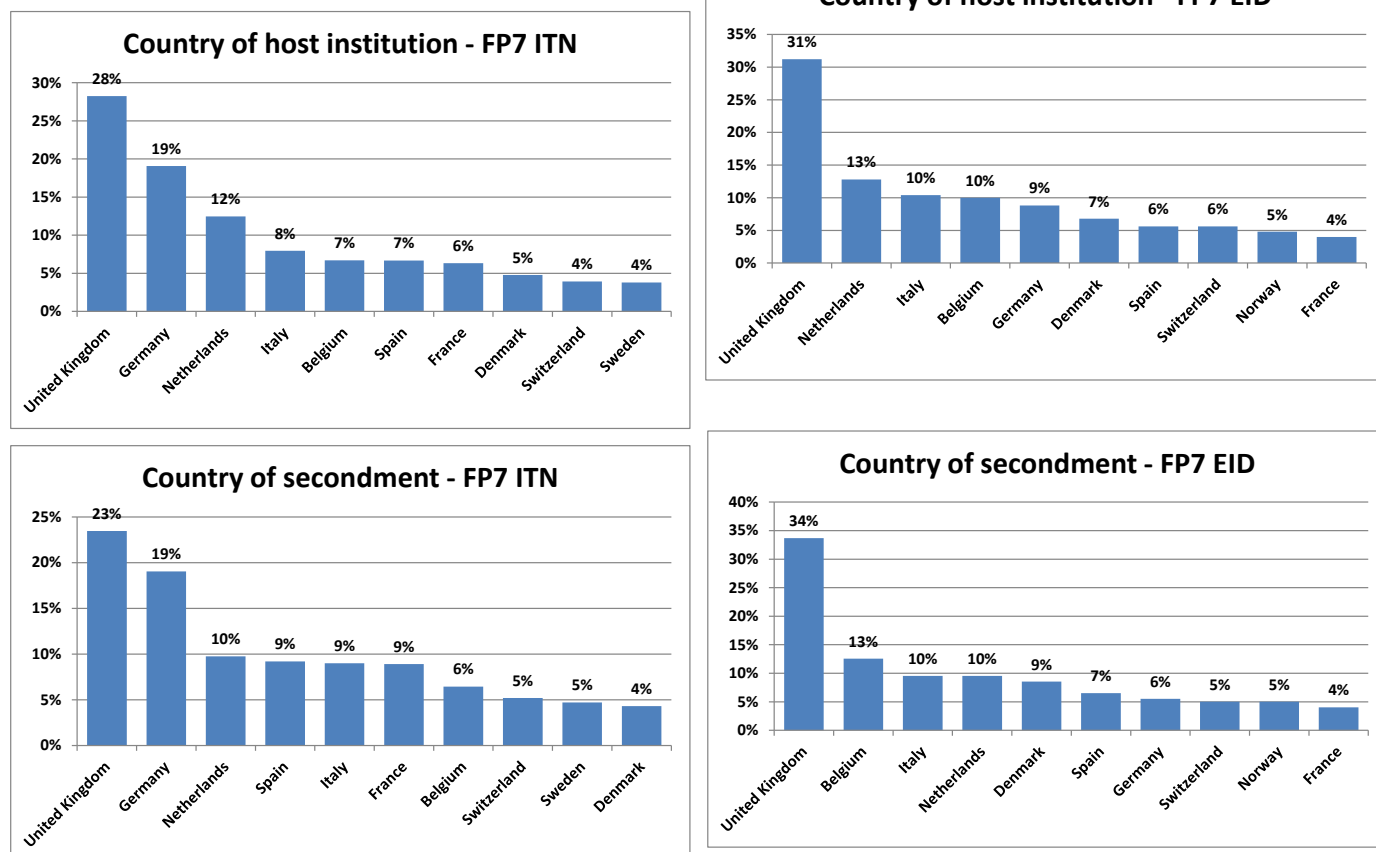
Figure 4.13 **Fellows by scientific panel**



Source: ICF CORDA analysis

This section closes with a short analysis of host institutions and secondment institutions of fellows. Figure 4.14 presents the top 10 countries with the most host institutions and destinations for secondments, for FP7 fellows in EID projects and ITN projects overall. First, it is interesting that host institutions from the Netherlands played a significantly more important role for EID fellows than in ITN projects overall. Furthermore, Belgium, Italy and the Netherlands played a stronger role in receiving fellows for secondments in EID projects compared to ITN projects. The UK offered the largest number of host institutions and secondments throughout both ITN and EID projects.

Figure 4.14 **Country of host institutions and country of secondment, ITN and EID fellows in FP7**



Source: ICF CORDA analysis

The largest number of host institutions outside of the EU were based in Switzerland and Norway, both for EID fellows and ITN fellows overall. Switzerland was the most popular non-EU destination for secondments of ITN fellows overall, and the most frequent non-EU country for secondments of EID fellows. When comparing EID mandatory secondments to the non-academic sector with other ITN secondments, non-academic organisations from the Netherlands have offered the most mandatory EID secondments (25 per cent), followed by Germany (13 per cent), Switzerland and Belgium (11 per cent). The most ITN secondments in the non-academic sector were also offered in the Netherlands (18 per cent), followed by Germany (15 per cent), the UK (13 per cent) and Belgium (11 per cent).

4.2.7 Success rates

This section presents an analysis of success rates in EID projects in FP7 and Horizon 2020, up until March 2016. Success rates in EID projects were compared to success rates in ITN projects as a whole.

This section provides overall statistics before presenting success rates by calls, countries, organisation types and scientific panels.

4.2.7.1 Overall statistics

The overall statistics on success rates in EID projects were as follows³⁰:

- The success rate by EID projects (number of projects/number of proposals) was 18.9 per cent, much higher than the corresponding success rate for ITN (11.8 per cent).
- The success rate by EID participants (number of participants/number of applicants) was 14.0 per cent, again higher than the corresponding success rate for ITN (8.7 per cent).
- The success rate by Horizon 2020 EID funding (amount of EU funding awarded/amount of EU funding requested) was 17.6 per cent, again higher than the corresponding success rate for ITN (9.7 per cent).

Table 4.7 below shows the success rates by EID projects, EID participants and EID funding, by calls.

Both the success rates by EID projects and EID participants rose between the 2012 and 2013 calls, before dropping significantly in the 2014 and 2015 calls. This is in line with overall success rate for the first two years in Horizon 2020 being substantially lower than towards the end of FP7. The success rate by funding was higher in 2014 than in 2015.

Table 4.7 Success rates by EID projects, by EID participants and by EID funding, by calls

Call	Success rates by EID projects	Success rates by EID participants	Success rates by EID funding (Horizon 2020 only)
FP7-PEOPLE-2012-ITN	17.6%	17.6%	no information
FP7-PEOPLE-2013-ITN	24.5%	24.9%	no information
Horizon 2020-MSCA-ITN-2014	21.0%	13.7%	21.8%
Horizon 2020-MSCA-ITN-2015	13.4%	9.4%	14.8%

Source: ICF CORDA analysis

4.2.7.2 Success rates by countries

A summary of the success rates by EID participants and by EID funding in Horizon 2020 is provided in Table 4.8 and Figure 4.15 below. Norway, the only country of the associated countries apart from Switzerland³¹ that applied for EID funding, was more successful than EU Member States on average³², both in terms of EID participants and EID funding in Horizon 2020. This was a notable difference compared to all ITN projects, where associated countries scored slightly less well than EU Member States both in terms

³⁰ Taking into account CORDA data made available up to March 2016.

³¹ Associated countries: Iceland, Norway, Albania, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Switzerland, Croatia, Liechtenstein for FP7; and Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland, Faroe Islands, Ukraine, Tunisia, Georgia for Horizon 2020. The only country associated to Horizon 2020 participating in EID projects in Norway, which saw 25 applicants and 6 participations so far.

³² EU Member States: countries of the EU-27 for FP7 and countries of the EU-28 for Horizon 2020

of participants and funding – likely a function of the comparably smaller numbers of EID applicants.

For some individual countries, half of the applications were successful (Estonia, Israel and Slovakia). While the UK, Germany and Spain were the top three countries in terms of the number of applications, their success rates by EID participants were not among the best (16.1 per cent, 17.3 per cent and 10.4 per cent respectively).

Estonia was the most successful country in terms of funding in Horizon 2020, receiving the full amount of EU funding requested. This is likely a function of the small number of Estonian participations in proposals overall. The second most successful country was Poland, followed by Finland. Some of the countries received none of the EU funding they requested (e.g. Israel³³, the Czech Republic). While the UK, Spain and Italy were the top three countries in terms of the amount of EU funding requested, their success rates by EID funding were not among the best (14.9 per cent, 7.4 per cent and 14.5 per cent respectively).

Table 4.8 Success rates by EID participants and by EID funding, by countries

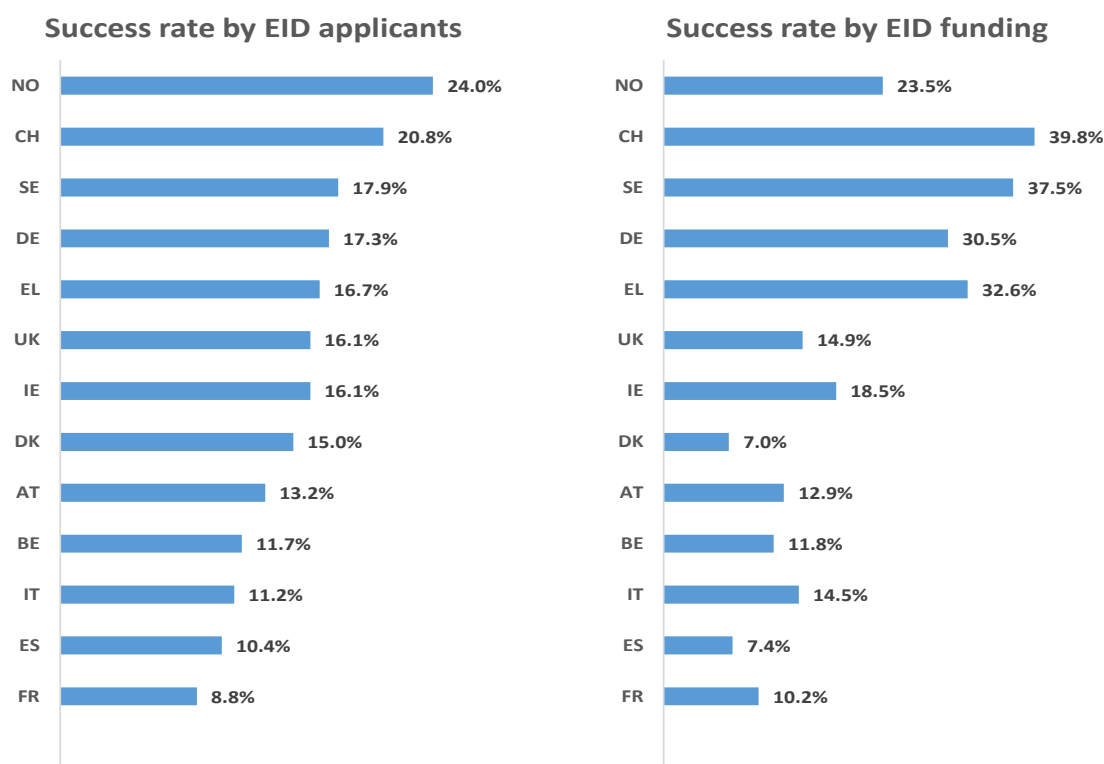
Country	Success rates by EID participants	Success rates by EID funding (Horizon 2020 only)
All countries	14.0%	17.6%
EU Member States	14.7%	17.4%
Associated countries	20.2%	27.1%
Third countries	0%	n/a

Source: ICF CORDA analysis

Due to the size and nature of the EID scheme, success rates were highly variable across participating countries. When only countries with a high demand are considered (i.e., those with more than 20 applicants) to exclude extreme success rates due to low numbers, it emerges that success rates by applicants were the highest for Norway (24.0 per cent), Switzerland (20.8 per cent) and Sweden (17.9 per cent) (see Figure 4.15). Success rate by funding were the highest for Switzerland (39.8 per cent), Sweden (37.5 per cent), Greece (32.6 per cent) and Germany (30.4 per cent).

³³ Whilst Israel participated in one project, no organisation from Israel recruited fellows so far and therefore none received EU funding.

Figure 4.15 **Success rates by EID participants and by EID funding, by countries with over 20 applicants³⁴**



Source: ICF CORDA analysis

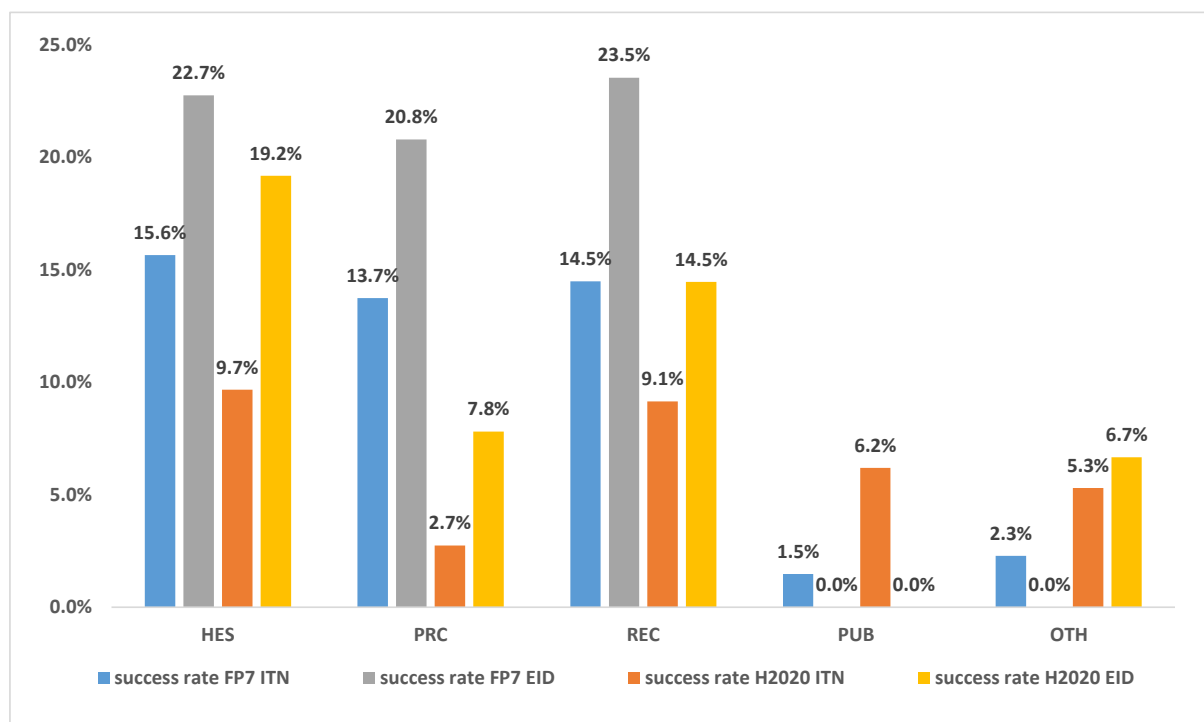
4.2.7.3 Success rates by organisations types

Figure 4.16 below shows success rates for the EID scheme and for the ITN scheme overall in FP7 and Horizon 2020, disaggregated by organisation type. Overall, success rates have decreased significantly in Horizon 2020 compared to FP7. Apart from public organisations and OTH, success rates in EID were higher than for the ITN scheme overall. Higher education organisations, private commercial companies, and research organisations display a higher success rate in EID compared to the ITN scheme overall, both in FP7 and in Horizon 2020 to date.

It can also be noted that private commercial organisations suffered the largest decrease in success rate from FP7 to Horizon 2020 – and their success rates in Horizon 2020 up until now are far behind that of higher education organisations and research organisations. While this might be displaying a structural trend across the current framework programme – it is alarming in the EID scheme given its specific focus on industrial involvement.

³⁴ It should be noted that the success rate by EU funding reflects to some extent the recruitment strategies of consortia. A high success rate in EU funding is a result of a high number of successful proposals, and a large number of fellows being recruited in the respective country.

Figure 4.16 **Success rates by participations, different organisation types in FP7 and Horizon 2020 (ITN and EID applicants/participants)**



Source: ICF CORDA analysis

Across the two framework programmes up until now, differences in success rates were visible between countries. Overall, the Netherlands performed very strongly. PRC from the Netherlands had a success rate twice as high as the overall programme average. With all countries accounted together, HES had a success rate by EID participants of 20.5 per cent, compared to 17.9 per cent for REC organisations. In some countries such as in the Netherlands, REC was more successful than HES organisations (success rates by participants of 30 per cent and 67 per cent respectively). Another example relates to success rate by EID funding in Horizon 2020: with all countries taken together accounted, HES had a success rate by EID participants of 17.3 per cent, compared to 19.9 per cent for REC organisations. In some countries however, such as in Switzerland, REC were less successful than HES organisations (success rates by funding of 60 per cent and 0 per cent respectively). More details are provided in Table 4.9 and 0 below for the 10 countries which hosted the most organisations involved in EID projects.

Table 4.9 Success rates by EID participants, by organisation types and by countries (FP7 and Horizon 2020)

	EID overall	NL	UK	DE	IT	ES	FR	BE	DK	CH	SE
HES	14%	30%	24%	33%	14%	17%	14%	21%	18%	27%	29%
REC	18%	67%	0%	28%	13%	7%	15%	0%	25%	25%	0%
PRC	11%	22%	8%	13%	9%	8%	5%	9%	12%	18%	12%
PUB	0%	n/a	0%	0%	0%	0%	0%	n/a	0%	n/a	n/a
OTH	5%	0%	0%	0%	0%	0%	0%	0%	n/a	n/a	n/a

Source: ICF CORDA analysis

**Table 4.10 Success rates by EID funding, by organisation types and by countries
(Horizon 2020 only)**

	EID overall	NL	UK	DE	IT	ES	FR	BE	DK	CH	SE
HES	17%	35%	15%	40%	14%	10%	5%	8%	8%	60%	39%
REC	20%	100%	0%	44%	0%	10%	12%	n/a	0%	0%	n/a
PRC	20%	29%	12%	20%	26%	8%	14%	14%	6%	28%	35%
PUB	0%	n/a	n/a	n/a	0%	0%	n/a	n/a	0%	n/a	n/a
OTH	0%	n/a	0%	0%	0%	0%	n/a	0%	n/a	n/a	n/a

Source: ICF CORDA analysis

4.2.7.4 Success rates by scientific panels

As shown in Table 4.11, the most successful scientific panels in terms of proposals accepted were Chemistry (CHE), Environment and geosciences (ENV), Life Sciences (LIF) and Mathematics (MAT). In terms of success rate by participants however, the most successful scientific panel was Mathematics (MAT), followed by Chemistry (CHE) and Environment and geosciences (ENV).

There were differences when comparing against all ITN projects together. A major difference was that ITN applicants to the scientific panel SOC managed to secure projects as well as EU funding, whilst no applicant from this panel won any funding under EID. Furthermore, in ITN overall Chemistry was the top panel in terms of success rate by participants, which was not the case for EID.

Table 4.11 Success rates by EID projects, by EID participants and by EID funding, by scientific panels

Scientific panel	Success rates by EID projects	Success rates by EID participants	Success rates by EID funding (Horizon 2020 only)
All scientific panels	18.9%	14.0%	17.6%
Chemistry (CHE)	22.8%	19.6%	26.7%
Life sciences (LIF)	21.4%	14.7%	16.3%
Environment and geosciences (ENV)	21.6%	17.1%	25.1%
Mathematics (MAT)	20.0%	29.3%	27.3%
Physics (PHY)	18.8%	14.6%	25.8%
Information science and Engineering (ENG)	16.4%	11.6%	15.7%
Economic Sciences (ECO)	12.5%	5.9%	19.6%
Social Sciences and Humanities (SOC)	8.3%	2.9%	0%

Source: ICF CORDA analysis

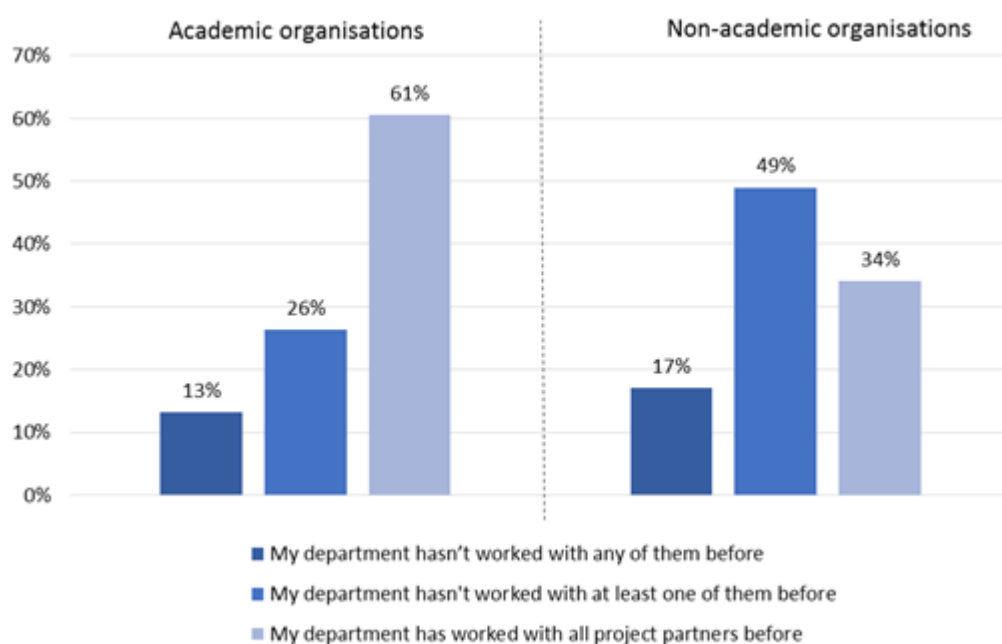
Differences were visible between countries. For example, the Netherlands were unsuccessful in securing projects or EU funding in the scientific panel PHY, but were quite successful in the scientific panel MAT (success rates by applicants and by funding of 38 per cent and 17 per cent respectively). On the opposite, Germany were unsuccessful in securing projects or EU funding in the scientific panel MAT, but was relatively successful in the scientific panel PHY (success rates by applicants and by funding of 20 per cent and 67 per cent respectively).

4.3 Nature of partnerships

4.3.1 Novelty of partnerships

EID participants were asked whether the project helped foster new collaborations, involving at least one or more partner they had never worked with before. Thirty-nine per cent of academic respondents stated that their projects involved at least one or more partners with whom they had not previously collaborated. A significantly greater proportion of non-academic participants (66 per cent) cited that they had been engaged in new collaborations through the EID scheme.

Figure 4.17 **New collaborations fostered by the EID scheme (academic and non-academic participants)**



Sources: *European Industrial Doctorates – Academic participants, Question 24: Are there EID project partner organisations with which your department hasn't worked before?* 38 participants replied to this question.

European Industrial Doctorates – Non-academic participants, Question 23: Are there EID project partner organisations with which your department hasn't worked before? 47 participants replied to this question.

Most of the small number participants who responded to a question on how they identified project partners (eight of 15 academic respondents and 16 of 31 non-academic respondents) reported that they had identified project partners through prior collaborations. A small number were also identified through other means such as personal contacts and recommendations of those involved in the projects, as well as scientific conferences. No participants stated that they had identified partners through the European Commission participant portal.

Case study research corroborated this. . Almost all partners in the case study projects investigated had worked together before. In many cases, collaborations had been established for years. But there were also examples where the EID scheme enabled new partnerships. The box below provides some further examples from the case study research.

Box 3 **Nature of partnerships – examples from case studies**

ALPES

The coordinator had not participated in an ITN project before, but identified the EID scheme for its very strict focus on industrial training. This suited the activities of the coordinating department at the University of Bristol, as it is very oriented towards industrial application and already had longstanding relationships with Siemens and Airbus. In fact, Airbus currently sponsors part of the coordinator's work.

ARTISAN

The collaboration between QUB and Bell Labs fostered through the scheme was newly formed. Neither partner had formally worked together prior to the scheme, although the key personnel in the organisations were acquainted with each other

through their professional networks. Bell Labs' technical expertise matched perfectly with QUB's research interests, making the company an ideal partner choice for QUB.

COOPERA-TB

The University of Birmingham had well-established links with GSK through other FP7 projects. The Coopera TB project provided an opportunity to strengthen these links further and develop early stage researchers who would gain significant exposure to an academic and industrial setting.

CRANE

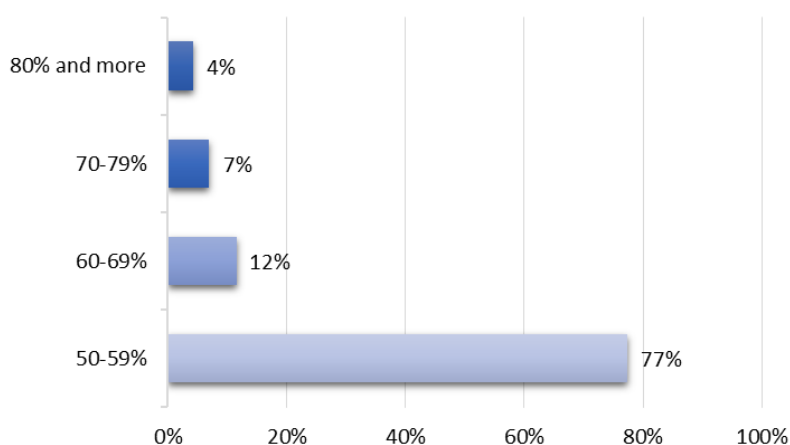
The collaboration between the lead partners was supported by the strength of the expertise of both organisations in the field of aircraft acoustics. Siemens considered ISVR to be among the leading global experts in sound research and was keen to work closely with the Institute to draw and build on its expertise.

Both ISVR and Siemens enjoyed good relations in the past, through some (though limited) prior collaboration via Innovative Training Networks (ITN). The CRANE project provided an opportunity to strengthen this collaboration.

4.3.2 Time spent in non-academic host organisation

The vast majority of EID fellows surveyed (77 per cent) spent between 50-59 per cent of their fellowship in their non-academic host organisations. A very small proportion (four per cent) spent in excess of 80 per cent of their time at their industry hosts.

Figure 4.18 **Proportion of the fellowship spent by fellows in a non-academic host organisation (EID fellows)**



Sources: *European Industrial Doctorates – EID fellows, Question 11: What proportion of your fellowship have you spent/are you spending in a non-academic host organisation??* 217 participants replied to this question.

4.3.3 Collaborative links

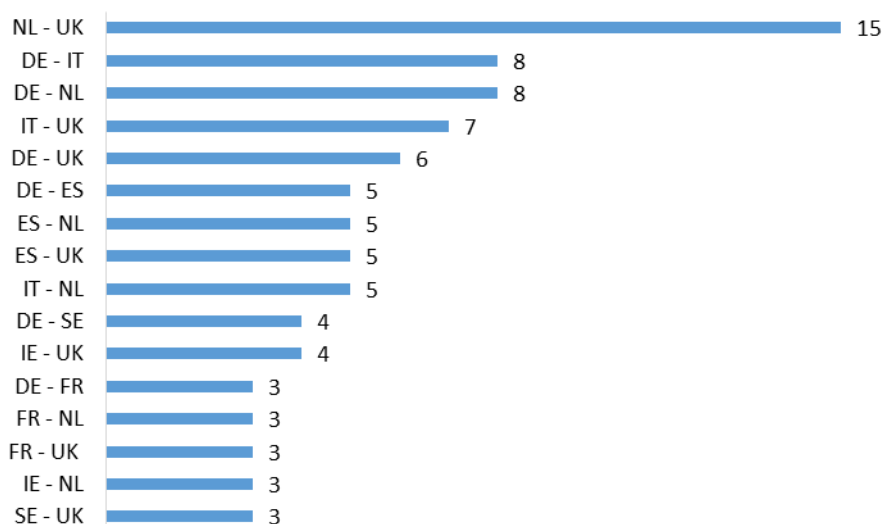
This section looks at the collaborative links between countries and types of organisations within EID projects.

4.3.3.1 Country links

Figure 4.19 below presents the most frequent links between countries within EID projects. Out of 101 projects, there were 15 where at least one participant from the Netherlands collaborated with at least one participant from the UK. Other frequent links included Germany/Italy and Germany/Netherlands (eight projects each), Italy/UK (seven projects) and Germany/UK (six projects).

Overall, the main collaborative links were similar to those within all ITN projects. However, the top two collaborative links within ITN projects were France/UK and Germany/France. These links were not as frequent within EID projects.

Figure 4.19 **Most common links between countries within EID projects**



Source: ICF CORDA analysis

4.3.3.2 Organisation links

Out of 101 projects, there were 85 where at least one participant from an HES organisation collaborated with at least one participant from a PRC organisation. Other frequent links included PRC/REC (16 projects) and HES/REC (14 projects).

The main collaborative link between HE –PRC was the same when considering all ITN projects (81 per cent of ITN projects had at least one participant from each type of organisation). However, the links between HES and REC and between PRC and REC were much more present in all ITN projects than in EID projects only (64 per cent and 56 per cent of all ITN projects had links between HES and REC and between PRC and REC respectively).

5 Appropriateness of EID funding and implementation

This section offers a first review of the research regarding the appropriateness of how the EID scheme is being implemented currently. The section triangulated findings from the online surveys with insights from the interview programme.

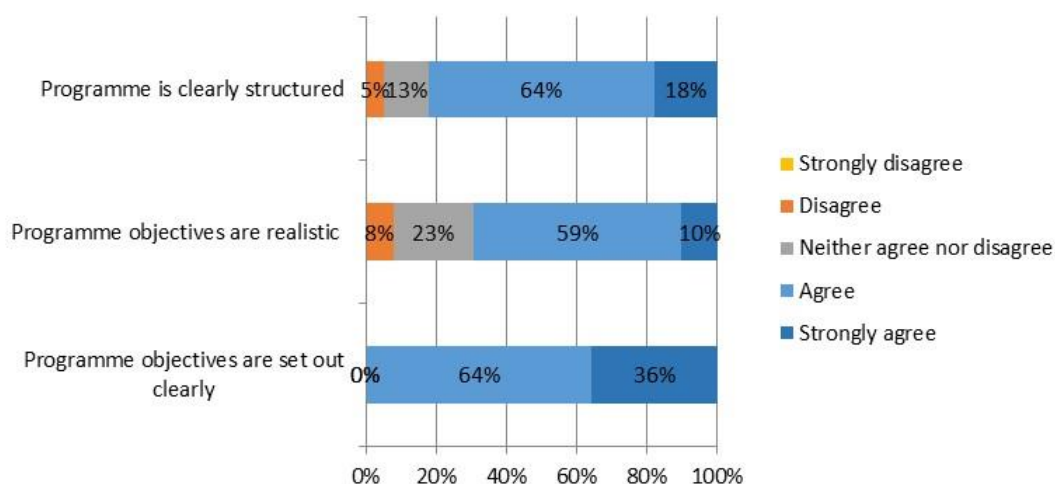
5.1 Objectives and structure

Most organisations that had participated in the EID fellowship felt that the objectives and structure of the scheme were clearly set out and realistic. This was consistent for both academic and non-academic participants, and by large confirmed through the interview programme and case study research.

Eighty-two per cent of academic respondents either agreed or strongly agreed that the scheme was clearly structured, and a marginally higher proportion of non-academic organisations (87 per cent).

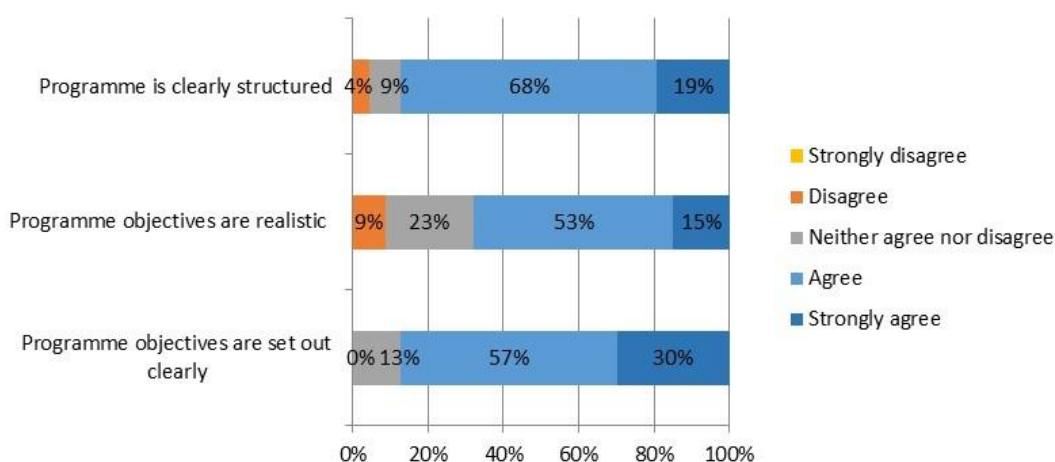
Most organisations, close to 70 per cent of respondents (both academic and non-academic organisations), also agreed or felt strongly that the objectives of the scheme were realistic. The overwhelming majority of organisations also believed or strongly agreed that the objectives were set out clearly (100 per cent of academic organisations and 87 per cent of non-academic organisations).

Figure 5.1 **Views on how scheme objectives and structure were clear and realistic (academic participants)**



Source: *European Industrial Doctorates – Academic participants, Question 12: To what extent would you agree with the following statements about the MSCA EID programme?* 39 participants replied to this question.

Figure 5.2 **Views on how scheme objectives and structure were clear and realistic (non-academic participants)**



Source: European Industrial Doctorates – Non-academic participants, Question 12: To what extent would you agree with the following statements about the MSCA EID programme? 47 participants replied to this question.

5.2 Funding

Most participants who responded (65 per cent of academic organisations and 77 per cent of non-academic organisations) considered the level of funding provided by the EID scheme to be adequate for the achievement of the scheme objectives (Figure 5.3). Most respondents (90 per cent) also felt that the type of funding provided to be sufficient to achieve the scheme objectives.³⁵

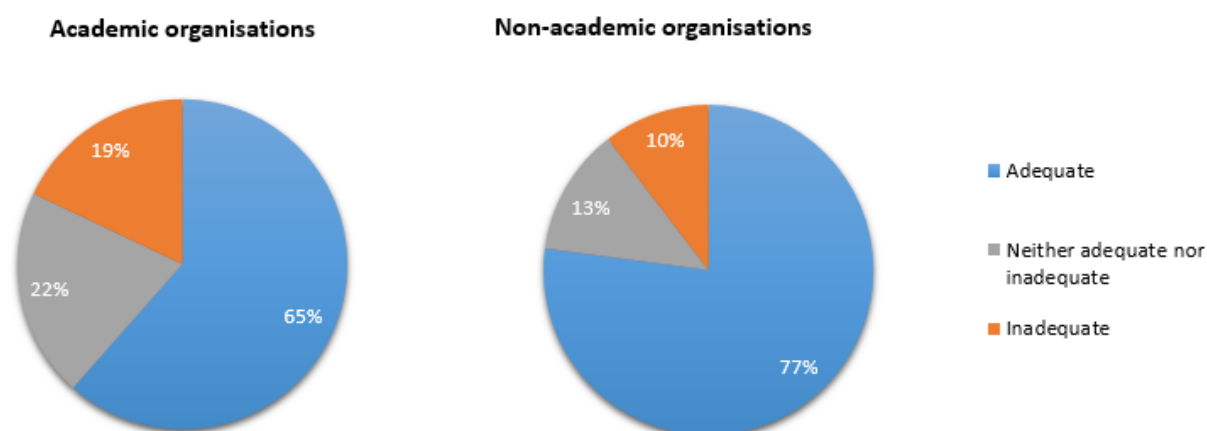
Among academic organisations that deemed the level of EID funding to be insufficient, a common concern related to the duration of the EID scheme funding. Respondents said that while PhD programmes in their universities were required to last four years, EID scheme funding covered only three years, necessitating alternative funding streams to bridge this gap. A number of respondents thus recommended an extension of the scheme duration to four years.

Of non-academic organisations that did not feel EID scheme funding was sufficient, some said that the funds did not cover the material costs of research such as laboratory expenses. More generally across the survey, a few non-academic participants commented that funding was disproportionately directed to PhD salaries and universities, in particular disadvantaging SMEs.³⁶ There were additional concerns that the duration of the scheme and associated funding were too short and inadequate, given that significant time was used for training and other developmental activities undertaken by EID fellows. Some SME respondents were particularly concerned.

³⁵ No non-academic organisations replied to the question on adequacy of the type of funding. All responses therefore relate to academic participants.

³⁶ It should be noted that recruitment can be undertaken by any member of the consortium and institutional costs may be shared between consortium partners – therefore these comments do not point out a deficit in the programme rules, but rather the need to design effective and sensible consortia agreement which allow to cover project costs in a fair and proportionate manner.

Figure 5.3 **Views on the appropriateness of funding levels (academic and non-academic participants)**



Source: *European Industrial Doctorates – Academic participants, Question 18: How adequate was/is the level of funding for the achievement of the programme objectives? 37 participants replied to this question.*

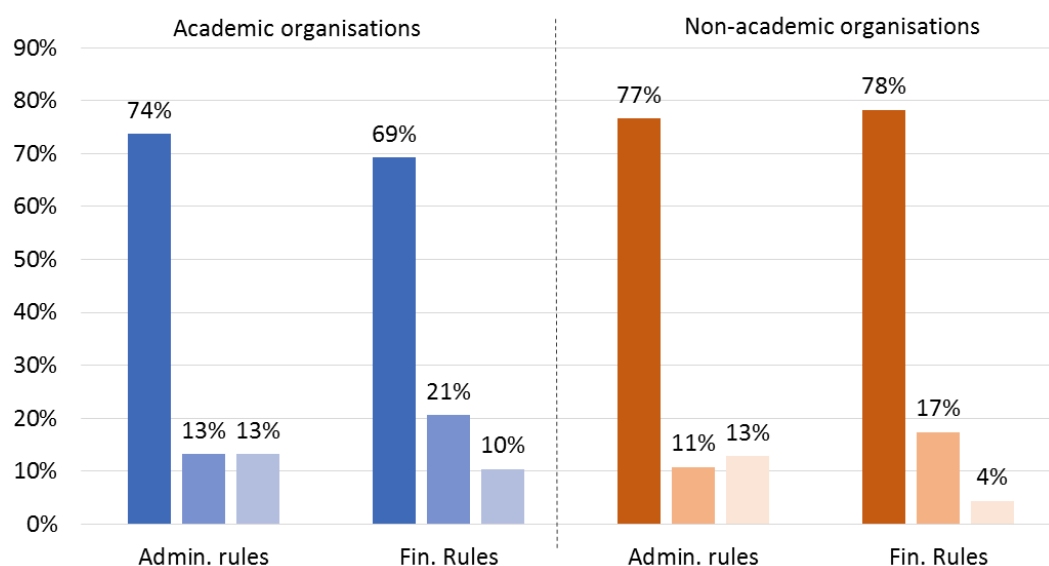
European Industrial Doctorates – Non-academic participants, Question 18: How adequate was/is the level of funding for the achievement of the programme objectives? 48 participants replied to this question.

5.3 Administrative and financial rules

The administrative and financial rules of the EID scheme do not appear to impede the appropriateness and effectiveness of the scheme. The majority of participant organisations that responded to the survey deemed both the administrative and financial rules of the EID scheme to be appropriate (Figure 5.4). This was true of both academic and non-academic organisations, although the proportion of non-academic organisations that found administrative and financial rules to be appropriate (77 per cent and 78 per cent respectively) was marginally higher all round than the proportion of academic organisations replying the same (74 per cent and 69 per cent). Most unsuccessful applicants surveyed (74 per cent) also felt that administrative rules were appropriate (Figure 5.5).

Among the minority of respondents who did not consider administrative rules to be appropriate (i.e. those either stating 'inappropriate' or 'neither appropriate nor inappropriate'), reasons cited included the inherent difficulty in designing standard administrative rules applicable to different local contexts (e.g. the varied lengths of PhD programmes in different countries); the strictness of the eligibility criteria regarding the mobility of EID fellows and VISA problems relating to the recruitment of researchers from third countries (given the ambiguity between student and employment status). Two respondents recommended that the Commission should implement provisions to better support such VISA applications.

More widely, respondents were also asked to provide recommendations to improve the EID scheme. Some (including academic and non-academic participants) suggested that the scheme could be improved by increasing the flexibility of rules relating to how their budgets should be allocated and requirements for EID fellows to spend specific proportion of their time between their host and partner organisation. Respondents felt that the scheme could be more effective if participants had more freedom to decide how time and budgets were allocated. Views on the appropriateness of administrative rules and financial rules (academic and non-academic participants)

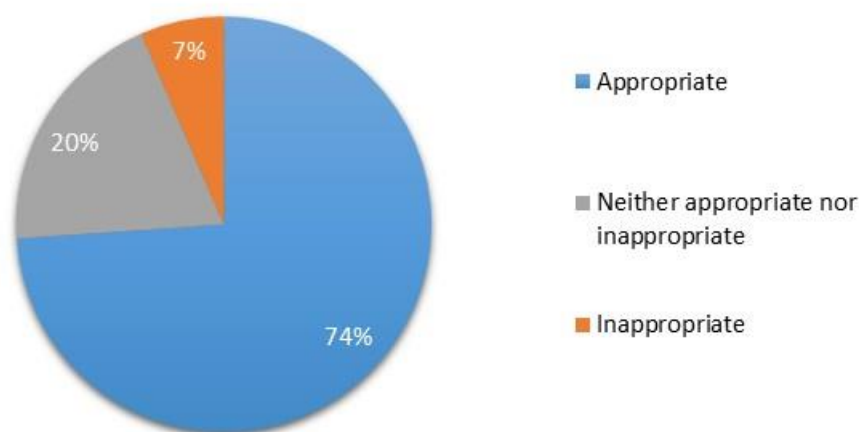


The darker the colour shade of the bar, the more appropriate the rules. The lightest colour representing inappropriate.

Sources: European Industrial Doctorates – Academic participants, Question 20: How appropriate were/are the administrative rules applicable? And Question 21: How appropriate were/are the financial rules applicable? Respectively 38 and 39 participants replied to these questions.

European Industrial Doctorates – Non-academic participants, Question 19: How appropriate were/are the administrative rules applicable? And Question 20: How appropriate were/are the financial rules applicable? Respectively 47 and 36 participants replied to these questions.

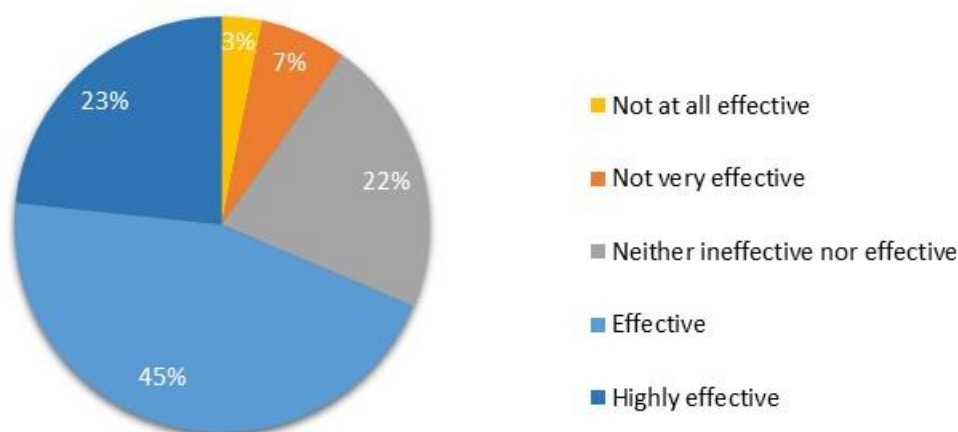
Figure 5.4 **Views on the appropriateness of administrative rules (unsuccessful applicants)**



Source: European Industrial Doctorates – Unsuccessful applicants, Question 13: How appropriate were/are the administrative rules applicable? 46 participants replied to this question.

EID fellows broadly felt that the scheme had in place effective and appropriate arrangements to exploit the results of the project for their career development. Sixty-eight per cent of EID fellows surveyed considered these arrangements to be either effective or highly effective. Less than 10 per cent stated little or no effectiveness.

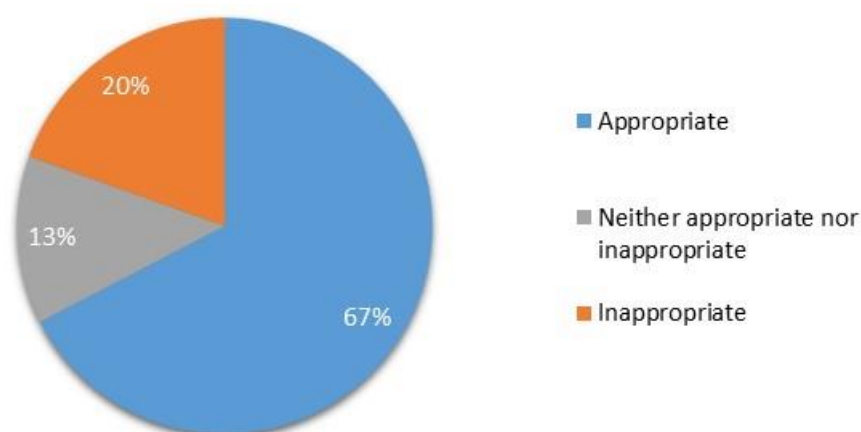
Figure 5.5 **Effectiveness of the arrangements for exploiting project results (EID fellows)**



Source: European Industrial Doctorates – EID fellows, Question 24: How effective for your career do you consider the arrangements for exploiting the results of the project? 223 participants replied to this question.

Among unsuccessful applicants, most who responded considered EID evaluation and selection procedures to be appropriate (67 per cent).

Figure 5.6 **Appropriateness of the EID evaluation and selection procedures (unsuccessful applicants)**



Source: European Industrial Doctorates – EID unsuccessful applicants, Question 14: How appropriate are the EID evaluation and selection procedures? 46 participants replied to this question.

5.4 Conflicts between EID rules and requirements and national regulations or organisational practices

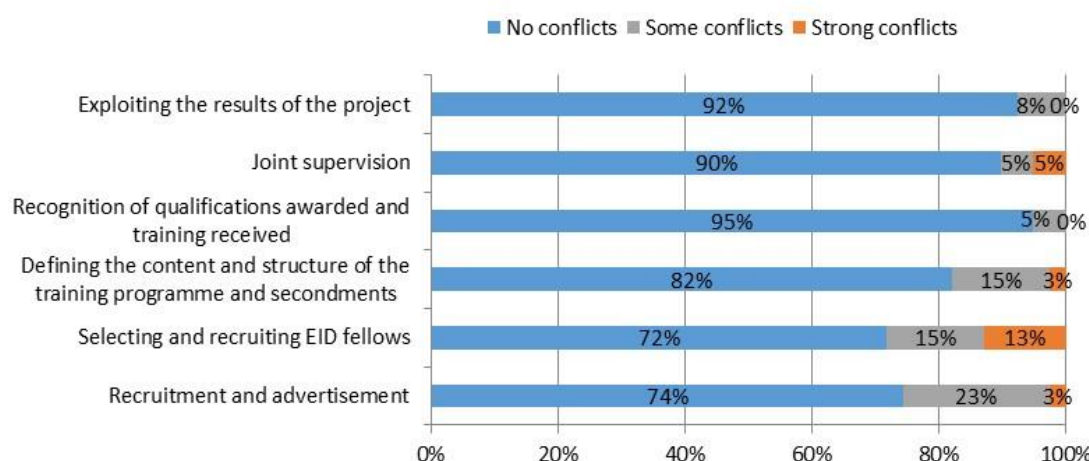
Most EID participants (both academic and non-academic participants) did not report any conflicts between different EID rules and requirements and national regulations.

More than 90 per cent of academic respondents considered there to be no conflicts between EID rules and national regulations with regards to the recognition of

qualifications awarded and training, joint supervision, and for exploiting project results. In comparison a slightly higher number of academic respondents reported either some or strong conflicts between EID and national rules relating to the selection and recruitment of EID fellows (28 per cent), as well as recruitment and advertising (23 per cent).³⁷ Non-academic participants responded similarly to academic organisations, although on the whole an even smaller proportion of respondents noted conflicts with regards to different areas of EID rules and requirements.

Some respondents who reported conflicts mentioned that national requirements with regards to salaries and recruitment procedures were not always in line with EU funding rules. This issue is not specific to EID, but is also observed more in general with the ITN scheme. These conflicts included differences between general national/internal salary requirements for researchers and salaries required to be paid to EID fellows under the terms of the scheme. Such differences created disparities and potential equality issues between standard salaries paid to students on conventional doctoral programmes and those on EID fellowships. Some conflicts were noted in relation to nationality requirements under the EID recruitment process and equal opportunities policies in the context of national employment laws. As cited more widely, respondents also felt that differences in length between standard doctoral programmes (typically four years) compared with the three years under the EID fellowship, caused some conflicts with internal rules and management issues.

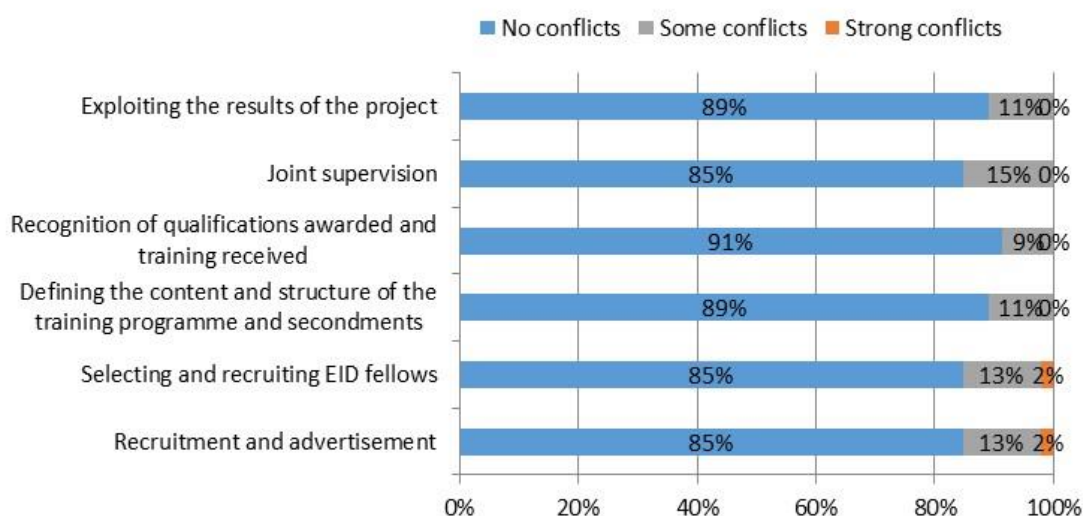
Figure 5.7 Presence of conflicts between EID rules and requirements and national regulation (academic organisations)



Source: *European Industrial Doctorates – Academic participants, Question 22: Please indicate specific conflicts between EID rules and requirements and national regulation applicable exist in the areas below. 39 participants replied to this question.*

³⁷ It was not possible to distinguish precisely which of these two aspects was prevailing across the 23% of responses who felt there were conflicts with national regulation. Qualitative evidence from the case study work suggests that EID requirements for broader (international) advertising have not caused specific conflicts with national regulation, but there were conflicts in individual cases with regards to recruitment.

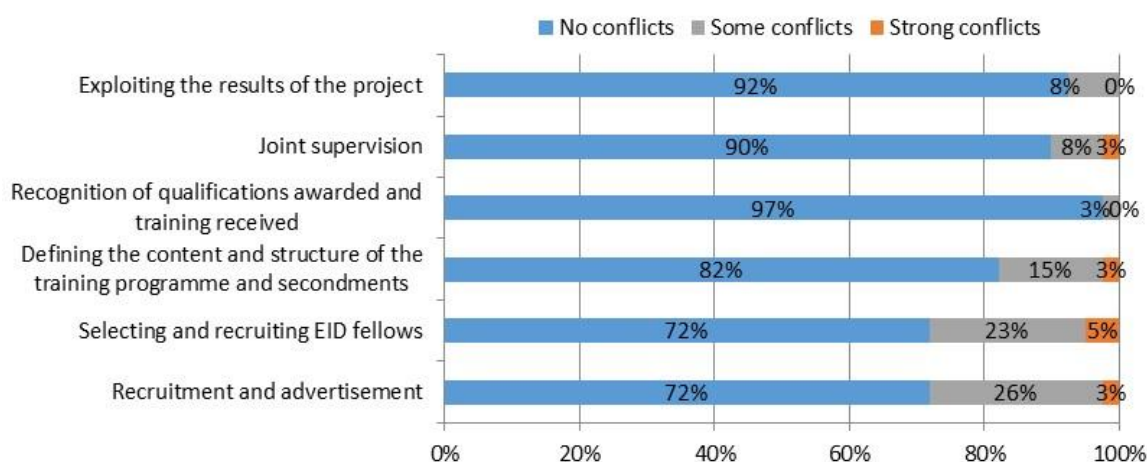
Figure 5.8 **Presence of conflicts between EID rules and requirements and national regulation (non-academic organisations)**



Source: *European Industrial Doctorates – Non-academic participants, Question 21: Please indicate specific conflicts between EID rules and requirements and national regulation applicable exist in the areas below. 46 participants replied to this question.*

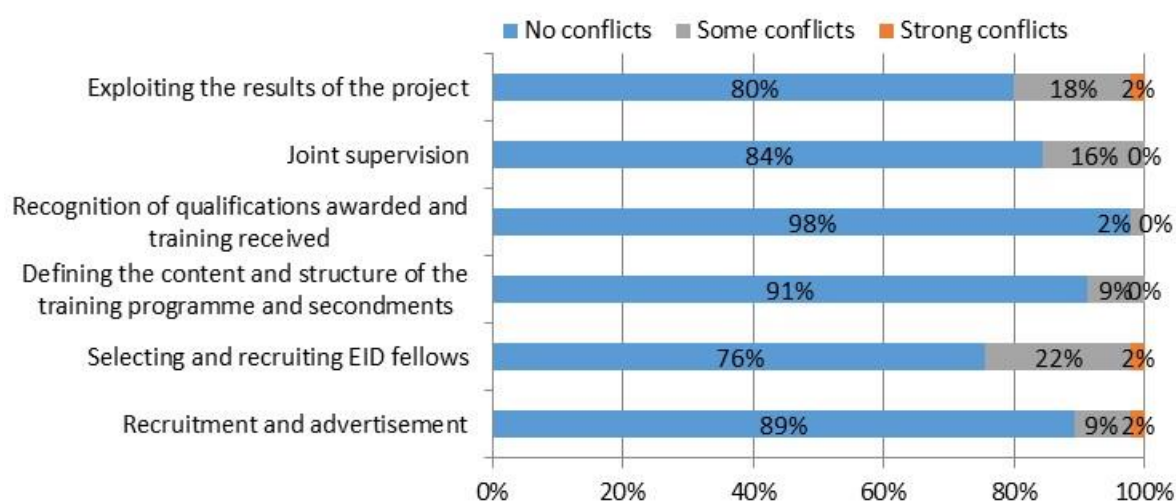
There were similar responses around conflicts between EID rules and requirements and organisational practice. Most respondents (academic and non-academic participants) did not report conflicts between any of the respective EID rules and requirements. Where either some conflicts or strong conflicts were reported, it was generally most notable around the selection and recruitment of EID fellows (28 per cent of academic participants and 24 per cent non-academic participants). Among academic participants, around 29 per cent of respondents perceived some conflicts around recruitment and advertising, although this was less prominent an issue for non-academic organisations (11 per cent). A higher proportion of non-academic organisations reported some or strong conflicts around joint supervision and exploiting project results (16 per cent and 20 per cent respectively, compared to 11 per cent and 8 per cent for academic participants).

Figure 5.9 **Presence of conflicts between EID rules and requirements and organisational practice (academic organisations)**



Source: *European Industrial Doctorates – Academic participants, Question 23: Please indicate specific conflicts between EID rules and requirements and national regulation applicable exist in the areas below. 39 participants replied to this question.*

Figure 5.10 **Presence of conflicts between EID rules and requirements and organisational practice (non-academic organisations)**



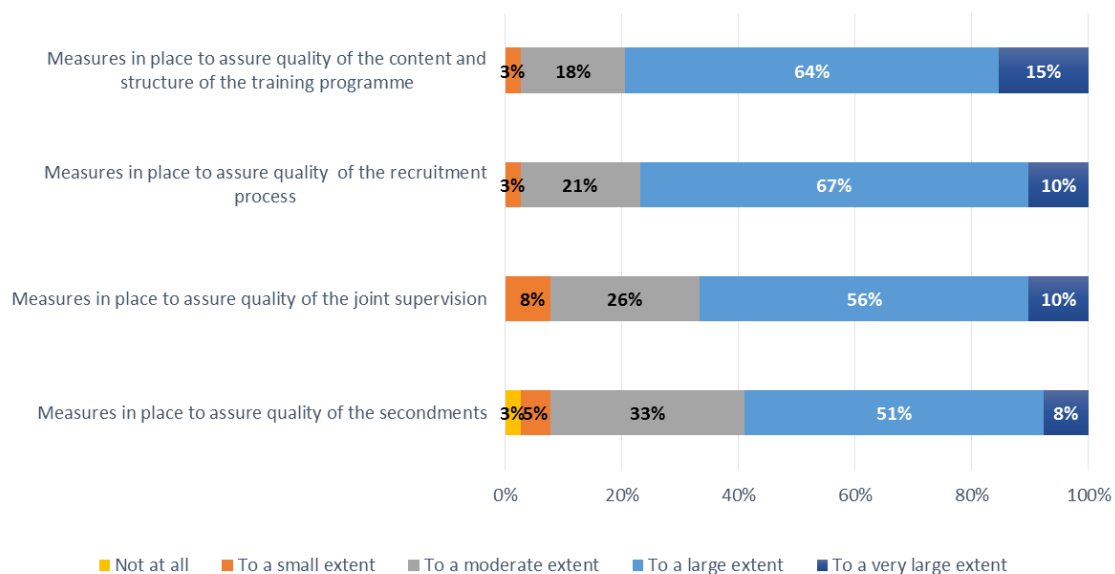
Source: European Industrial Doctorates – Academic participants, Question 22: Please indicate specific conflicts between EID rules and requirements and national regulation applicable exist in the areas below. 45 participants replied to this question.

5.5 Appropriateness of quality assurance approaches in EID

The doctoral training programmes and EID include measures to assure quality along different organisational and implementation aspects: recruitment process, secondments, training programme and joint supervision. Overall both academic and non-academic participants were satisfied with the measures in place to assure quality.

In the case of the academic organisations, the majority of respondents (on average over 70 per cent) believed that all the approaches to quality assurance were to a large or very large extent appropriate. Amongst the quality assurances measures in place, those relating to the quality of the content and structure of the training programme and recruitment process were most considered as appropriate (close to 80 per cent of respondents found these to be appropriate to a large or very large extent). The measures in place to assure quality of secondments were also considered appropriate (59 per cent) but somewhat less so than other types of measures.

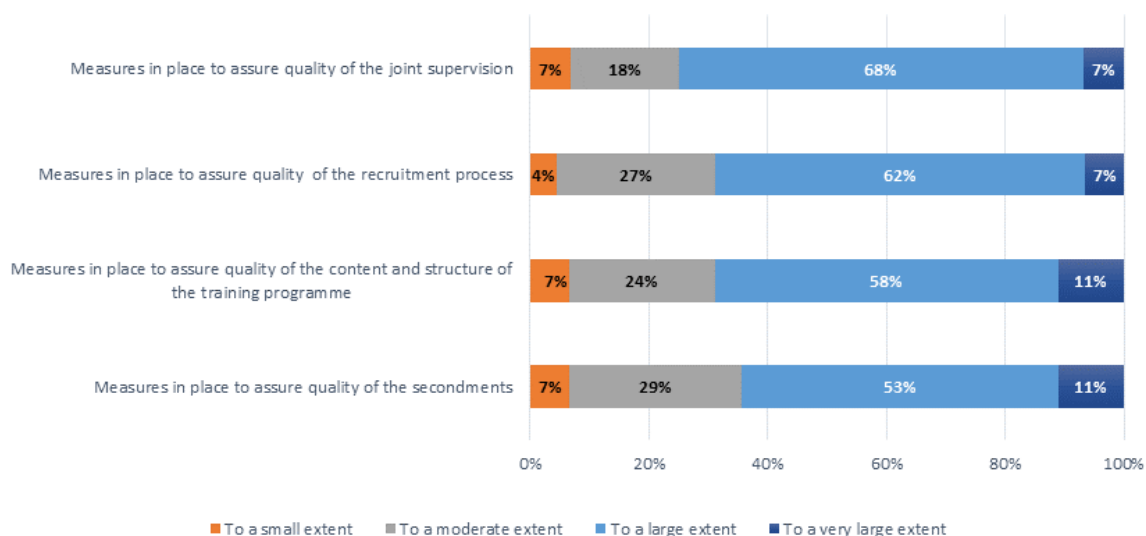
Figure 5.11 **Appropriateness of quality assurance measures (academic organisations)**



Source: *European Industrial Doctorates – Academic participants, Question 35: Do you consider the quality assurance measures to be appropriate, in the following aspects of the projects. 39 participants responded to these questions.*

Non-academic participants responded similarly to academic organisations although there were slight differences in relative terms. Seventy-five percent of respondents considered the measures in place to assure quality of joint supervision to be appropriate to a large or very large extent, closely followed by measures relating to the content and structure of the training programme and recruitment process (69 per cent each respectively). The proportion of respondents who considered quality assurance measures relating to secondments to be appropriate is the smallest compared to the other three types of measures in place on recruitment process, training programme and joint supervision.

Figure 5.12 **Appropriateness of quality assurance measures (non-academic organisations)**



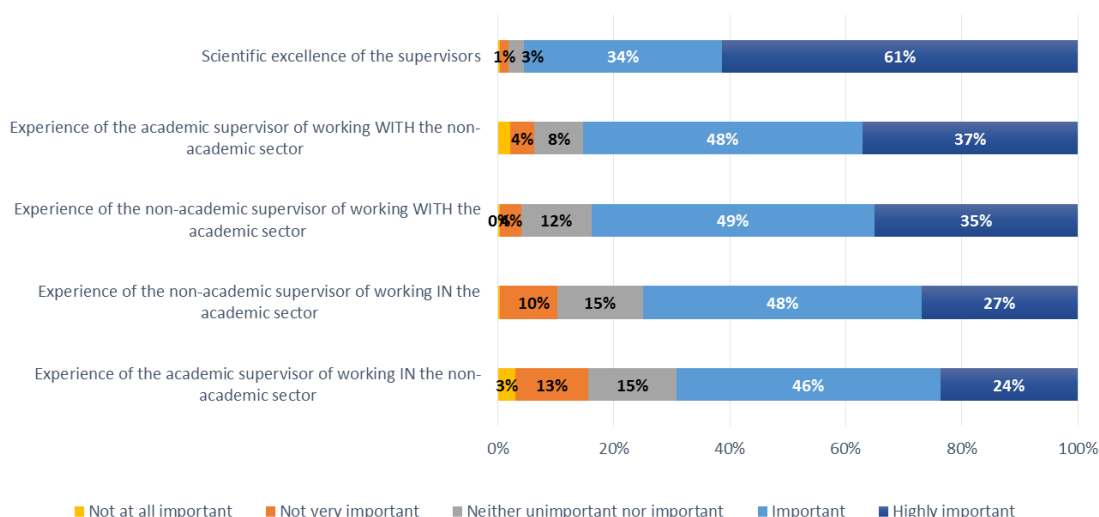
Source: *European Industrial Doctorates – Non-academic participants, Question 34: Do you consider the quality assurance measures to be appropriate, in the following aspects of the projects. 45 participants responded to these questions and 44 regarding the measures in place to assure quality of the joint supervision.*

Effective supervision is an important aspect of the EID scheme. The surveys were also used to assess the relative importance of different factors perceived to be influencing the quality of EID fellows' supervision.

In most cases, collaboration and coordination between supervisors from the academic and non-academic sectors was primarily provided by regular reviews of progress involving all supervisors (83 per cent of respondents). Other mechanisms such as regular peer review of intermediary research results by the co-supervisor not involved in the respective aspect of the research programme was also cited by a small proportion of respondents (32 per cent).

EID fellows considered the scientific excellence of supervisors as the most important factor determining the quality of supervision, with 61 per cent of respondents deeming it to be highly important (and a further 34 percent indicating it to be important). This was closely followed by the experience of non-academic/ academic supervisors working with the academic/ non-academic sector (around 85 per cent of respondents citing this as either important or highly important).

Figure 5.13 **Importance of different aspects for the quality of EID fellow's supervision (EID fellows)**



Source: European Industrial Doctorates – EID fellows, Question 26: In your view, how important are the following aspects for the quality of EID fellow's supervision? Respectively 222, 223, 224, 223, 224 participants responded to these questions.

5.6 Issues and challenges identified

This section provides an overview of issues and challenges highlighted by survey respondents and interviewees during the fieldwork.

5.6.1 Expert evaluation

Overall, the evaluation process was commended as very well designed by both applicants and evaluators interviewed. The process was seen to be well organised and managed, given the significant number of proposals to process. A review of the evaluator pool used for EID proposals suggests that overall, evaluator selection works well and the pool has the right mix of academic excellence, technical and scientific skills and working experience outside academia. Several issues and areas for improvement were identified during the interview programme, and are listed below:

- The introduction of the remote evaluation system led to challenges in cases of disputes and disagreements within evaluation panels. It was suggested that in case of

continued dispute, reconciliation meetings to find consensus should be held face-to-face.

- It was not clear to all evaluators how the added value of the training programmes proposed could be assessed and ascertained. Further guidance during the briefing of evaluators would be welcome in this area to help select the best proposals. This specifically concerned training offered by non-academic participants.
- In the proposal template, some sections were seen to have the potential to evoke duplicate answers. The questions for outreach and gender are particularly confusing to some applicants, examples would make it easier for to grasp what is meant in this part of the template.
- There were sometimes differing approaches to how involvement of industry was assessed across an evaluation panel. While some evaluators saw the involvement of large corporations as particularly desirable, assuming they had the capacity to support PhD candidates, others disagreed. Some guidance would be welcome as to whether size of enterprises involved should form part of the assessment.
- Evaluators noted some instances of ETN proposals being resubmitted as EID projects.

5.6.2 Implementation

- The EID scheme is perceived as only relevant for scientific disciplines with clear potential for industrial application, with a strong focus on engineering and information sciences – the involvement of other non-academic stakeholders apart from the business sector is often perceived to be outside of the scheme remit, although it is explicitly included in the EID calls for proposals;
- Stakeholders suggested that timelines of the scheme evaluation procedure might be too long for some potential industry applicants, who then recruit PhDs directly. At the level of postdoctoral positions, companies are already recruiting directly on a regular basis. If the EID scheme is to stay attractive in the future, time-to-grant should be further reduced.
- Although the evaluation results for all ITN proposals are provided below the general Horizon 2020 time limits, a few stakeholders still mentioned the time delay between the expert evaluation and the announcement of evaluation results to applicants.
- Costs associated with mobility requirements are considerable, in particular for ESR with family. Further consideration could be given by the European Commission to whether costs associated with researcher mobility could be provided in lump sums (alternative to current monthly payments) to offer support at the time when fellows do actually move within the project³⁸, or whether requirements as regards intersectoral mobility can be relaxed if particular circumstances apply.

5.6.3 Implementing and managing EID projects

Interviewees indicated that they are generally satisfied with the administrative and financial rules applicable to them. A comment made many times was that EID projects are mostly built on existing networks and collaborations. Good personal communication between the main partners and a good working environment within the consortium are considered key to success.

Beyond this, the following points were highlighted by interviewees and survey respondents as potential issues/challenges in managing EID projects:

- It can be difficult to arrange agreements on how to share background IP, and how this is being used and circulated in the consortium – industrial partners can be

³⁸ To avoid large lump sum payments at the beginning of a project, this could be limited to a maximum of three researchers months paid out at once.

nervous about sharing high-value background IP, and might be tempted to share less valuable IP and therefore reduce the quality of the research programme. It is vital that consortia agree upfront on IP arrangements;

- Collaborative supervision is critical to the success of collaborative doctorates such as those supported through EID. But joint supervision can be challenging and might pose risks for PhD candidates, if roles and expectations are not clearly set out at the start. In principle, it should be the responsibility of the organisation registering the PhD candidates to ensure that responsibilities are clear, and that supervisors are well prepared. There may be scope to include offers to train prospective supervisors in EID projects.
- There were calls for stronger incentives to be placed individual supervisors. The provision of high-quality joint supervision was seen by all stakeholders as crucial, and was reported in some cases to be challenging to ensure.
- Requirements of joint supervision and secondments can be difficult to meet for SMEs – they often cannot provide capacity for weekly supervision and guidance, nor meet reporting requirements. Therefore SMEs are often participating as partner organisations, rather than as beneficiaries.
- There are some issues with regards to joint supervision, if the non-academic supervisor does not hold a PhD or hold a professorship. Some academic institutions only allow full professors to sit on PhD boards and conduct assessments.
- There were some concerns relating to the duration of funding for the scheme, particularly in countries where the standard length of doctoral programmes was longer than the three years of funding provided under EID fellowships. Respondents felt that extending the scheme funds could help alleviate the difficulty of providing bridge funding.
- Some SMEs, in particular, also noted that funding received was not always adequate to cover the material expenses of research, calling for a greater flexibility in how budgets are allocated and/or increase in funding – the MSCA programme offers complete flexibility to distribute institutional unit cost funding across the consortium. This suggests that such issues can be avoided by drawing up a consortium agreement that recognises the specific situation of SME. The comparator organisations' analysis identified further measures in place to encourage SME participation through a flexible budget scheme (see box 4 below).
- There were calls for greater flexibility in how fellows were required to split their time between academic and non-academic partner organisations in line with the practical realities of the work. This was particularly true where the non-academic partner did not provide adequate supervision or training. Several stakeholders felt that there should be more flexibility in implementing the mobility requirements, particularly when issues with joint supervision, the training offered, or access to crucial equipment and laboratories are encountered, to ensure that PhD candidates can complete their work within time, and at the highest standard with best supervision possible – the focus of the scheme should be on benefits to candidates/PhD candidates, and not on enforcing programme rules in such circumstances
- A significant number of stakeholders suggested an extension to 48 months.
- There were some issues about Visa regulations for the recruitment of fellows from third countries. Given the ambiguity of the fellows' immigration status organisations did not know whether fellows were to be declared either as students or employees. There were also challenges in obtaining residence permits and work permits across two EU Member States or more, when fellows were not EU citizens.

To also encourage the involvement of smaller companies in the scheme, the BBSRC makes a distinction between the payment obligations towards the academic partner (contribution of £1,400 per annum) for companies below (contribution not compulsory)

and above 50 employees (contribution is compulsory) for the academic-led DTP-based CASE studentships only. The previous stipend top-up mandatory requirement was discontinued for both DTP and CTP based CASE studentships.

Box 4 Box 2 UK comparator programme: BBSRC Industrial CASE studentships

To encourage participation by smaller companies, the UK comparator programme applies different funding options based on the size of participating organisations: companies with fewer than 50 employees are not subject to payment obligations towards the academic partner, while financial contribution is compulsory for companies with more than 50 employees.

6 Added value

This section provides an analysis of the added value of the EID scheme, vis-à-vis:

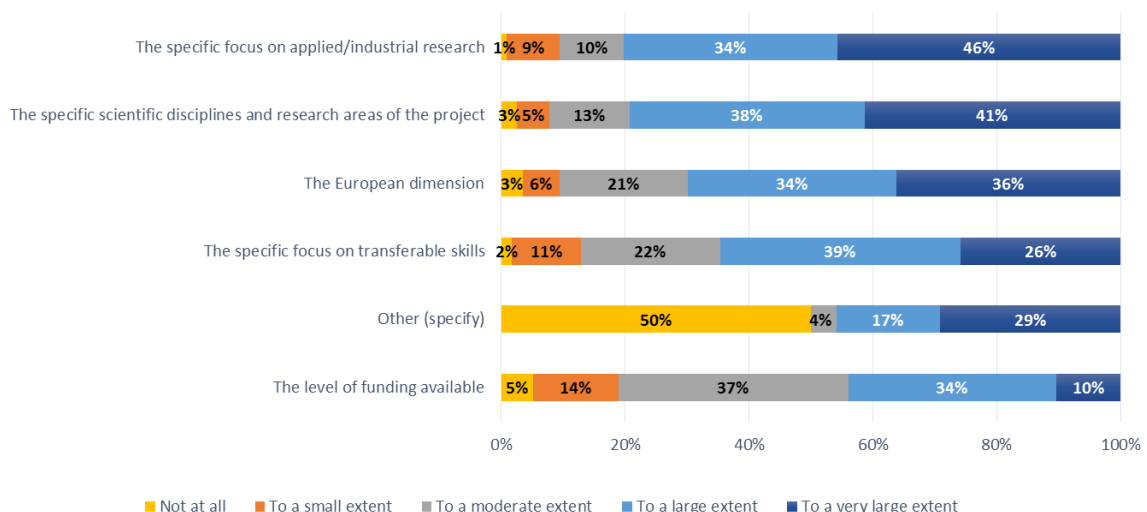
- Other European programmes
- National comparator programmes; and
- Other PhD programmes that applicants have considered or were offered a place. .

The section assesses the added value to beneficiary organisations and EID fellows of having projects funded under the EID scheme. Participant organisations were asked if they would you have gone ahead with their EID project without any funding from the EID scheme and what form projects this would have taken. Specific motivations behind EID fellows' decision to apply were also looked at, to assess whether participants felt that the EID fellowship offered additional and/or different benefits to other programmes.

6.1 Researcher level

At individual level, 67 per cent of EID fellows stated that they had also considered applying to traditional doctoral programmes. The most important factors cited by EID fellows as having influenced the choice of EID fellowships over other traditional programmes was the specific focus on applied or industrial research and the specific scientific disciplines and research areas of the project. Close to 80 per cent of EID fellows who responded considered these two aspects to have largely or very largely influenced their choices. The European dimension of the EID fellowship and focus on transferable skills were also important, with respectively 70 per cent and 65 per cent of respondents stating that these considerations had a large or very large influence on their programme choice. The level of funding available through the EID scheme was less significant than other factors, however it was frequently mentioned as well (only 44 per cent of respondents considered this important to a large or very large influence).

Figure 6.1 **Main aspects influencing the EID fellows' decision to participate in the EID scheme instead of a more 'traditional' doctoral programme (EID fellows)**

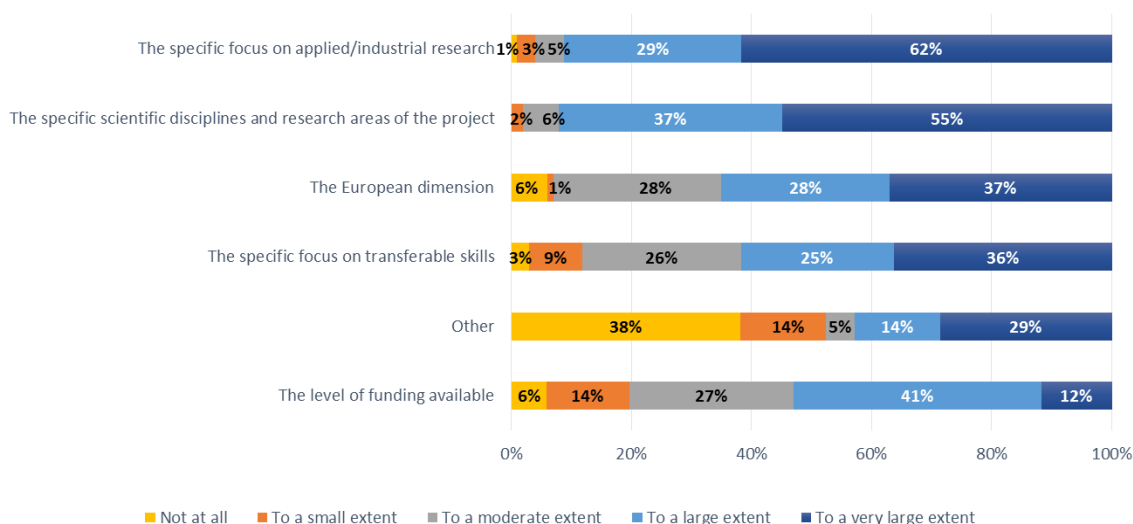


Source: *European Industrial Doctorates – EID fellows, Question 13: To what extent did the following aspects influence your decision to apply for an EID fellowship instead of a more 'traditional' doctoral programme?* 116 participants responded to these questions.

Only 12 per cent of the EID fellows surveyed had considered applying for or starting a doctoral fellowship funded by a programme other than EID, but with similar emphasis on industry involvement. EID fellows cited the specific focus on applied or industrial research and the specific scientific disciplines and research areas of EID projects as chief reasons

for selecting EID fellowships over other similar programmes (more than 90 per cent said these factors were influential to a large or very large extent).

Figure 6.2 **Main aspects influencing the EID fellows' decision to participate in the EID scheme (EID fellows)**



Source: *European Industrial Doctorates – EID fellows, Question 17: To what extent did the following aspects influence your decision to apply for an EID fellowship? 112 participants responded to these questions, except for the European dimension with 100 responses.*

Further evidence collected during the case study work confirms the general picture from survey responses. Principal reasons for participating in the EID project were mostly related to the specific research topic, a focus on industrial collaboration and placements in the non-academic sector. Most fellows interviewed also noted the quality of the non-academic partners as a strong reason behind their interest. The attractive remuneration was not a primary reason for the majority of fellows interviewed.

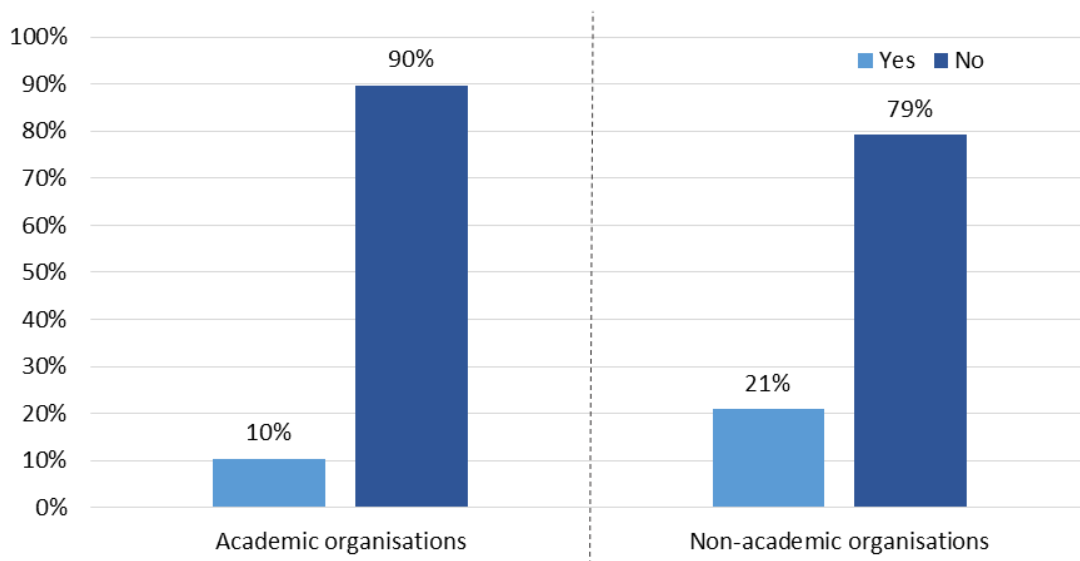
Interviews suggested that in terms of training content, the main added value delivered by the EID compared to 'regular' PhD programmes or graduate schools at the same institution was to help candidates gain a strong understanding of how their research could impact industry, and how this might further their career opportunities.

In terms of added value, most fellows agreed that it was the combination of applied technical and scientific training plus high quality supervision that provided added value, when compared to similar PhD candidates at the same institution. But the added value differed depending on the specific career plans of fellows. Most interviewees agreed that the EID scheme offers particular benefits for PhD candidates who were planning a career in industry at the outset, before the fellowship started. Requirements as regards mobility and joint supervision were perceived by a minority of fellows as non-supportive of a prospective career in academia. It appears that the added value of the skills acquired during an EID for a future academic career was not fully grasped by the fellows. Hence the added value and impact of these skills should be further explained and emphasised to the fellows so that they become aware of them and can make the best use of them in their future job applications. For instance, hiring a former EID fellow may help academic labs to more easily and efficiently establish public-private partnerships, the EID fellow having experienced the working methods used in the private sector (i.a. relating to project management with its deliverables/ milestones, standard operating procedures, quality assurance, communication etc); this is an argument former EID fellows could put forward during their job applications to an academic lab.

6.2 Organisational level

EID funding is important to the viability of the projects under the scheme for all participants, regardless of organisational type. On average, 84 per cent of respondents (including academic and non-academic organisations) stated that they would not have gone ahead with their project without any funding from the EID scheme. A slightly higher proportion of academic organisations agreed (90 per cent), compared to 79 per cent of non-academic respondents, indicating that companies were marginally more likely to go ahead with projects without EID funding than academic institutions. Among organisations that were unsuccessful in securing EID funding, 76 per cent of respondents stated that they were unable to go ahead with their projects.

Figure 6.3 **Viability of projects in the absence of funding from the EID scheme (academic and non-academic participants)**

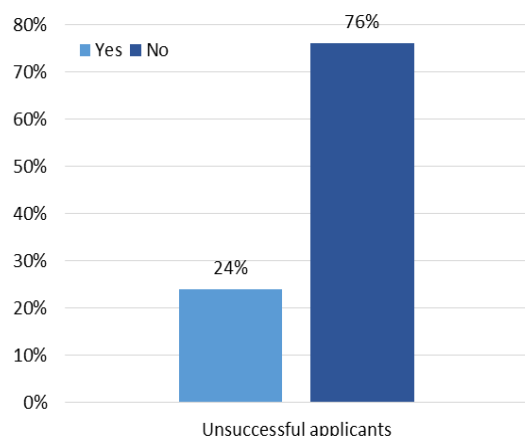


Source: *European Industrial Doctorates – Academic participants, and European Industrial Doctorates – Non-academic participants, Question 16: Would you have gone ahead with your EID project in the absence of any funding from the EID programme? Respectively 39 and 48 participants responded to this questions.*

Among academic participants, only two from 39 organisations surveyed reported that their department had applied for funding from another body or programme for the project now funded through the EID scheme.

The value of EID projects undertaken by the 14 organisations (four academic, 10 non-academic) that stated they would have gone ahead with their projects without funding from the EID scheme is €18.7 million. This represents a minimum deadweight loss to the Commission, given that these projects would have likely been financed by alternative means.

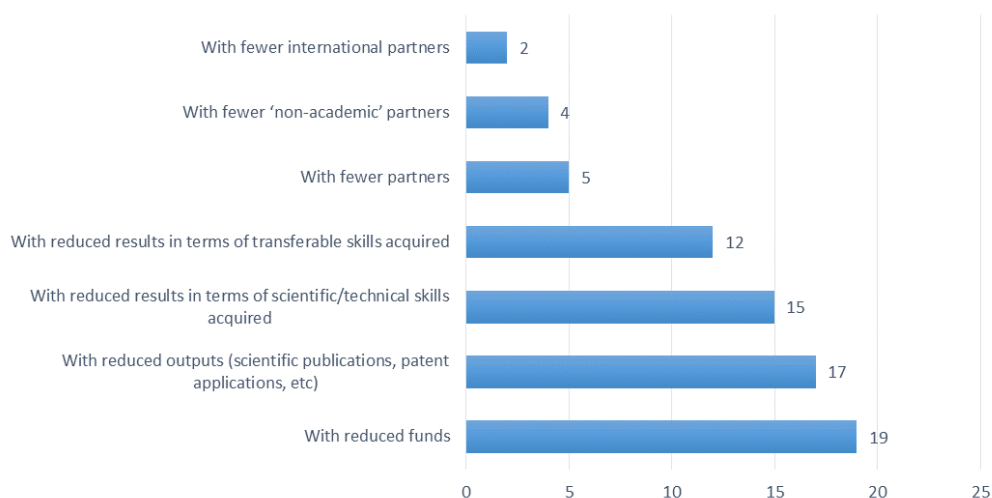
Figure 6.4 **Viability of projects in the absence of funding from the EID scheme (unsuccessful applicants)**



European Industrial Doctorates - Unsuccessful applicants, Question 6: Considering the most recent application for EID funding: Have you gone ahead with the project (or any similar activity) given the absence of any EID funding? 46 participants responded to this question.

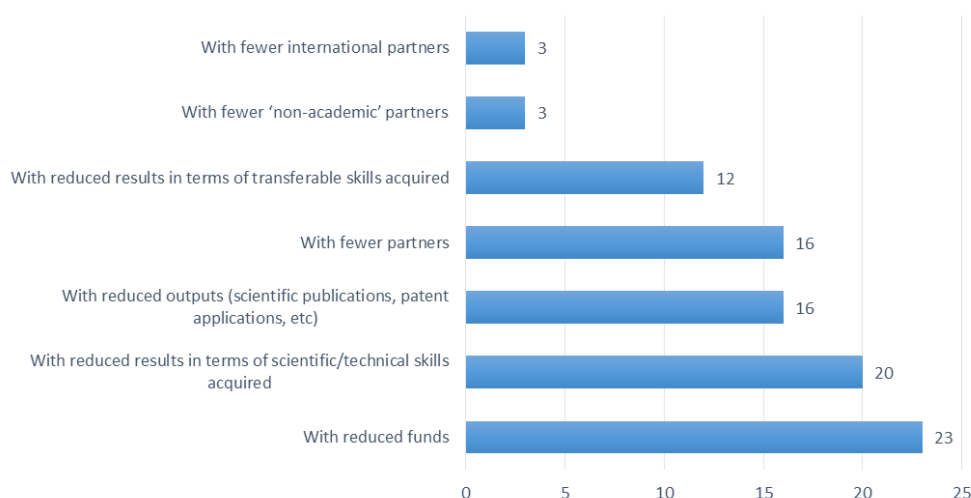
Survey participants were also asked about the likely form the projects would have taken if they had gone ahead without funding. Both academic and non-academic participants suggested that the most likely impact would be a continuation of projects with reduced funds. Respondents also widely mentioned that projects would have suffered a reduction in outputs and results in terms of scientific or technical skills acquired. A slightly higher proportion of academic organisations stated that projects would have reduced results in terms of skills acquisition compared to reduced scientific outputs, whereas the opposite was true of academic participants. A more notable difference between academic and non-academic related to the perceived impact on number of partnerships associated with the projects without EID funding. Sixteen non-academic participants stated that projects would have had fewer partners, compared to five academic respondents.

Figure 6.5 **How projects would have gone in absence of EID funding (academic participants)**



Source: European Industrial Doctorates – Academic participants, and European Industrial Doctorates – Question 17: If the project had gone ahead in some form anyway, would this have been. 29 participants responded to this question.

Figure 6.6 **How projects would have gone in absence of EID funding (non-academic participants)**



Source: *European Industrial Doctorates – Non-academic participants, and European Industrial Doctorates – Question 17: If the project had gone ahead in some form anyway, would this have been.* 39 participants responded to this question.

Insights from the EID projects selected for case study research confirmed that the EID scheme offered strong added value, in particular in countries where no projects of comparable size or with comparable thematic focus would have been funded.

Box 5 Case study - ALPES

The Fluid and Aerodynamics Research Group at the University of Bristol coordinates the ALPES project. The group has a strong focus on applied research, and strong existing collaborations with the ALPES project partners and associated partners (LMS, Siemens and Airbus). There was therefore a clear option of the PhD results being taken up by industrial partners.

The Industrial Doctorates programme is a unique funding programme to recruit excellent PhD candidates, and fund a cohort of PhD candidates to work on a well-defined research theme – supervised essentially by one principal investigator.

Another major advantage of the scheme was its international focus. Existing relationships with LMS (based in Belgium), Airbus (with key teams based in France) and Siemens mandated that the PhD training programme would take place across three countries.

There is no comparable programme in the UK for aerospace engineering and computation.

The review of comparator programmes also revealed that several national programmes allow for cross-border collaboration. Therefore the European dimension should not be considered a distinct added value of the EID scheme. For example, the Danish Industrial Researchers programme allows for the participation of foreign universities and provides funding for their contributions (see A3.1 for details).

7 Preliminary review of results and impacts

This section provides a first overview of results and impacts of EID projects, as reported through the online survey. The section is organised in three main parts:

- Section 7.1 presents a first overview of results and impacts at the researcher level;
- Section 7.2 presents a first overview of results and impacts at the organisation level; and
- Section 7.3 presents an overview of first outputs in terms of publications, patent applications and innovation

7.1 Researcher level results and impacts

7.1.2 Career paths

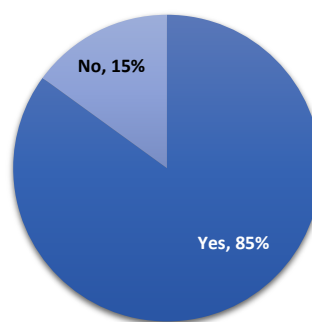
Regarding career paths, case study research offers a mixed picture.³⁹ Some fellows reported that they did already plan to work in industry before the fellowship, and continued to do so. Other fellows suggested that they were initially planning a career in academia, but changed their plans and are now considering concrete offers from industrial partners. The survey results suggest a much clearer message. They indicate that 85 per cent of all fellows who responded were planning to work in the non-academic sector at the end of their fellowship. Together with the main motivations of fellows for applying to the EID fellowships, this suggests that most researchers supported were very interested in working in the non-academic sector at the start of their fellowship – while a smaller proportion had initially planned to work in academia.

Because none of the EID projects have yet finished, it is difficult to assess the career paths question with certainty and this present study cannot present final results. The study team recommends that career paths after the fellowship should be investigated in more detail during the planned mid-term evaluation of the scheme.

7.1.3 Employment

A notable proportion of both academic organisations (47 per cent) and non-academic organisations (49 per cent) considered retaining their EID fellows. A smaller though not insignificant proportion of respondents were unsure whether they would retain their EID fellows (44 per cent of non-academic organisations and 38 per cent of academic organisations). This uncertainty could be partly because the majority of projects surveyed were far from completion at the time of study research.

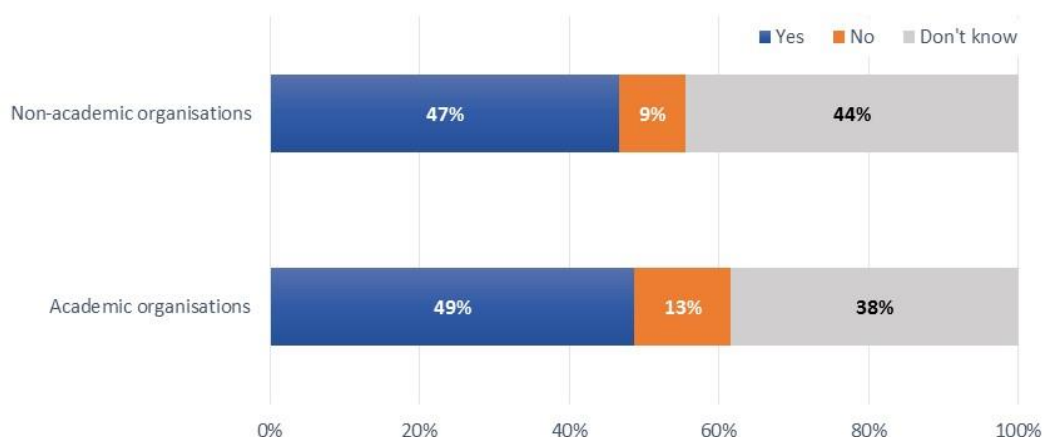
Figure 7.1 **Fellows planning a career outside academia**



Source: *European Industrial Doctorates – EID fellows, Question 27: Do you aim at working as a researcher in the non-academic sector after completion of your PhD?* 117 participants with ongoing fellowships.

³⁹ . Some comparator programmes suggest a clearer picture in terms of impact on career paths. From a survey of BBSRC students in the UK found that 41 per cent of candidates with an industrial studentship were more interested in industry than before the placement. See BBSRC (2013), Evaluation of BBSRC's Industrial Case scheme. <http://www.bbsrc.ac.uk/documents/1306-ind-case-evaluation-report-pdf/> [accessed 10th October 2016].

Figure 7.2 **Proportion of EID beneficiaries or partner organisations considering retaining their EID fellows**



Source: *European Industrial Doctorates – Academic participants, Question 43: Are you planning to retain EID fellows in the future?* 39 participants replied to this question.

European Industrial Doctorates – Non-academic participants, Question 43: Are you planning to retain EID fellows in the future? 45 participants replied to this question.

At the level of individual researchers, 85 per cent of EID fellows surveyed aimed to work as researchers in the non-academic sector after completing their PhD. Comparator programme research also found that participation in other industrial doctorate programmes improved fellows' motivation to pursue a career in the industrial sector (see, for example, details on the UK comparator programme in Annex 3, section A3.4).

Of all individual respondents, eight per cent had received a job offer from their non-academic host organisation, and a further eight per cent had a job offer from their academic host organisation.

Thirty-seven of the 224 EID fellows surveyed had completed their fellowships. Of these, only one had been hired by his/her non-academic host organisation. Additionally, three fellows were hired by their academic host (see Table 7.1 below). Of those with an ongoing fellowship, a small number had received a job offer by their non-academic (14 of 177) or academic host (15 of 177) (Table 7.2).

Table 7.1 Employment of EID fellows in academic and non-academic organisations (completed fellowships)

	EID fellows who got hired by the non-academic host organisation	EID fellows who got hired by the academic host organisation
Yes	1	3
No	23	18
Did not respond	13	16
Total	37	37

Sources: *European Industrial Doctorates – EID fellows, Question 35: In case the project is over, did you get hired after the duration of the project in the non-academic (e.g. industry) organisation you had worked in during your EID?* 37 participants who had completed their fellowships.

European Industrial Doctorates – EID fellows, Question 37: In case the project is over, did you get hired after the duration of the project in the academic organisation you had worked in during your EID? 37 participants who had completed their fellowships.

Table 7.2 Employment of EID fellows in academic and non-academic organisations (ongoing fellowships)

	EID fellows who got a job offer from the non-academic host organisation	EID fellows who got a job offer from the academic host organisation
Yes	14 (8%)	15 (8%)
No	149 (84%)	148 (84%)
Did not respond	14 (8%)	14 (8%)
Total	177	177

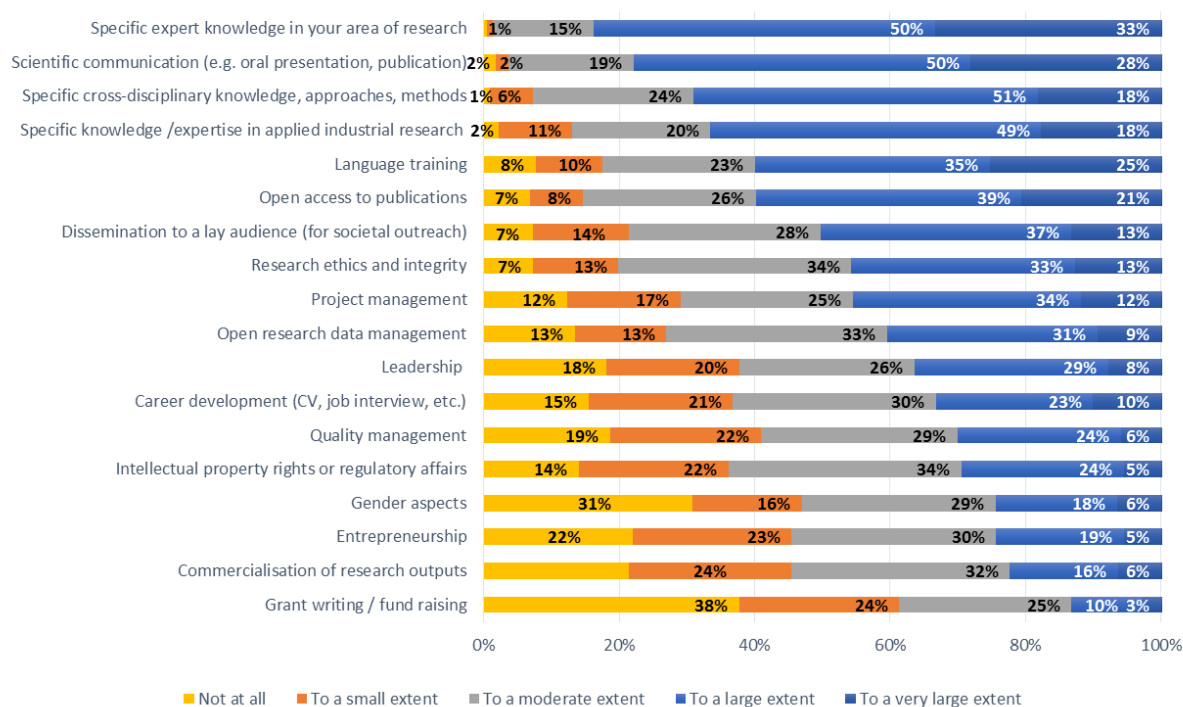
Sources: European Industrial Doctorates – EID fellows, Question 36: In case the project is undergoing, did you already receive a job offer from the non-academic (e.g. industry) organisation you have been working in during your EID, for after the end of your EID? 117 participants with ongoing fellowships. European Industrial Doctorates – EID fellows, Question 38: In case the project is undergoing, did you already receive a job offer from the academic organisation you have been working in during your EID, for after the end of your EID? 117 participants with ongoing fellowships.

Retention rates of EID fellows appear similar to other PhD candidates within the same academic organisations. An estimated 313 PhD candidates (excluding EID fellows) had successfully completed their PhD programme in the last year in the 39 academic organisations surveyed. Of these, 22 per cent (68 candidates) had been retained by their departments in the last six months.

7.1.4 Skills

EID fellows acquired and built on various skills through the EID scheme. The most widely cited skills benefit was the specific expert knowledge gained by fellows in their research areas, with 83 per cent of EID fellows surveyed indicating that they had acquired these skills to a large or a very large extent. Scientific communication skills (such as oral presentations and publications) were also widely mentioned, with 78 per cent saying they had acquired these to large or very large extent through the scheme. Specific cross-disciplinary knowledge, approaches and methods, and applied industry-relevant research expertise were also commonly cited as important skills benefits acquired through the scheme (69 per cent and 67 per cent respectively). A breakdown of cited skills benefits is provided in Figure 7.3 below.

Figure 7.3 **Skills acquisition during EID fellowships (EID fellows)**



Source: *European Industrial Doctorates – EID fellows, Question 29: Please indicate to what extent you have acquired skills in the areas below during your EID fellowship?* Respectively 44, 217, 215, 219, 220, 221, 219, 221, 220, 220, 220, 221, 220, 222, 221, 220, 222 participants replied to this question.

The comparator programme analysis also found that national programmes had important results in terms of increased interdisciplinary, cross-sectoral research. However, cross-disciplinary approaches did not always represent the main focus or stated objectives of these programmes (see box 6 below).

Box 6 **Interdisciplinary, cross-sectoral research in comparator programmes**

French comparator programme – CIFRE

The CIFRE programme has adopted a 'bottom-up' approach to project selection and does not have any particular thematic restrictions. It does not set any particular focus on interdisciplinary research. But a survey of PhD candidates found that 82 per cent acquired skills in terms of interdisciplinary work during their PhD training.

Swedish comparator programme – Swedish Knowledge Foundation

The programme's objectives include better knowledge exchange and an increased rate of innovation through academia-industry collaboration and long-term relationship building. Interdisciplinary approach *per se* is not a stated objective of the scheme, but the mode of implementation supports the development of interdisciplinary research projects. The students work on real industrial problems, and the cohort approach applied throughout the implementation means interdisciplinary approaches are a common feature of the PhD projects undertaken.

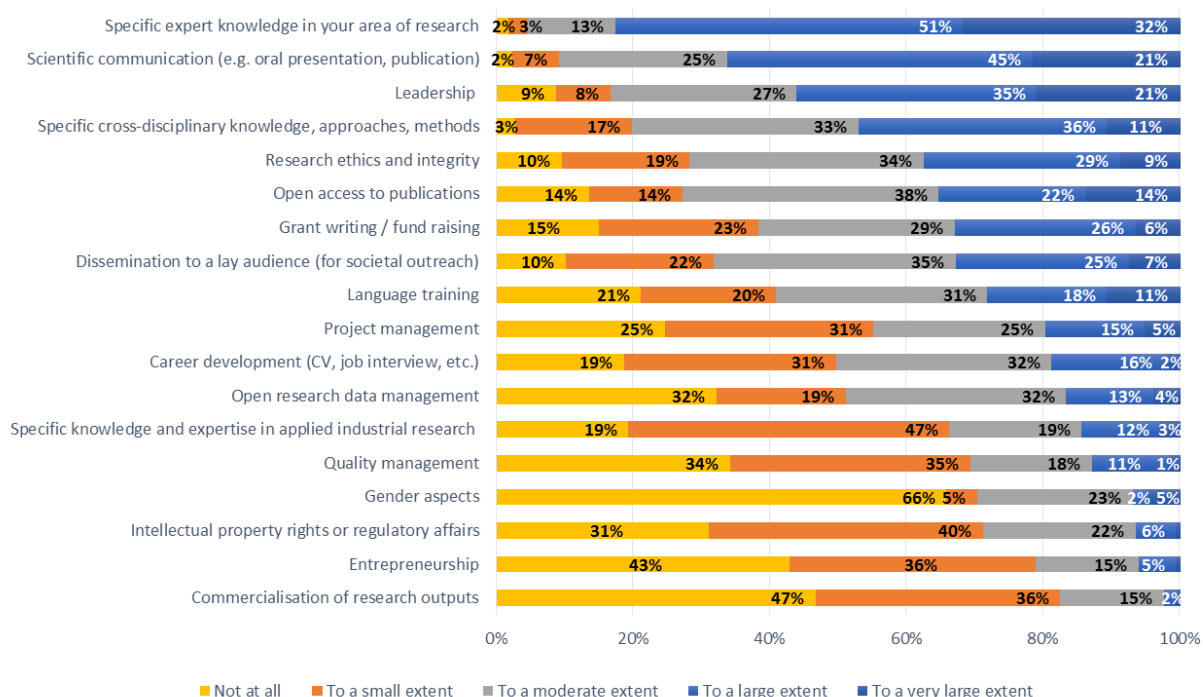
The skills developed by participants on the scheme were acquired through different types of training including theoretical training or on the job training, and academic or non-academic (industrial) training.

On the job training developed skills relating to cross-disciplinary knowledge, methods and approaches, commercialisation of research outputs, language training and gender

aspects. Specific expertise in select research areas, career development skills and open research data management were *inter alia*, developed through more theoretical modes of training. EID fellows reported that they had developed specific skills such as transferable skills, quality management and dissemination skills to a lay audience mainly through non-academic training, although they did report that specific knowledge and expertise in applied industrial research had been developed through academic training. EID fellows reported that it would not have been possible to acquire some of these skills through traditional doctoral programmes with less emphasis on industry involvement, in particular skills relating to commercialisation of research outputs, entrepreneurship, intellectual property rights or regulatory affairs, specific expertise in applied industry-relevant research and project management.

Most notably, 83 per cent of respondents felt that they would only have been able to acquire skills relating to commercialisation of research outputs to a little or negligible extent through traditional doctoral programmes; 79 per cent said the same for entrepreneurial skills; and 71 per cent for intellectual property rights. Conversely, other skills were deemed to be easily acquired through traditional programmes, in particular specific expertise in select research area and scientific communication skills. Seventy-three per cent of respondents considered that specific research area expertise could be acquired to a large or very extent through traditional programmes and 66 per cent said the same of scientific communication skills.

Figure 7.4 **Skills acquisition in more 'traditional' doctoral programmes with less emphasis on industry involvement (EID fellows)**



Source: European Industrial Doctorates – EID fellows, Question 30: In your view, to what extent you would have been able to acquire these skills in more 'traditional' doctoral programmes with less emphasis on industry involvement? Respectively, 44, 211, 213, 216, 217, 219, 217, 219, 219, 219, 218, 219, 217, 217, 218 participants responded to this question.

Insights from the comparator programme research confirm that there is a set of skills distinct to industrial training (box 7 below; additional details are available in Annex 3).

Box 7 Skill development: insights from comparator programmes

UK comparator programme - Biotechnology and Biological Sciences Research Council (BBSRC) Industrial CASE studentships⁴⁰

A very high proportion of students, academic supervisors and industry supervisors said that the industry placement benefitted student training and skills development. Most agreed that the placement led to the acquisition of skills that would not be acquired in an academic setting. A major benefit was the training in specific technical skills or methodologies, including the use of specialised equipment, and it was advantageous to receive this training from highly-skilled industry staff. A variety of broader skills were also developed during the placement including commercial awareness.

French comparator programme – Industrial Agreement of Training through Research (CIFRE)

A survey of PhD candidates who took part in the CIFRE programme found that most candidates acquired skills in teamwork (61 per cent), interdisciplinary work (82 per cent), the ability to work within a network (64 per cent) and international work (55 per cent). A CIFRE partner indicated that business-related skills were developed through cooperation with companies.

Danish comparator programme – the Industrial Researcher Programme

A survey of partner companies for this programme revealed that 73 per cent of businesses thought that industrial PhD candidates are 'business minded and thus a good candidate for the business world after completing the education'.

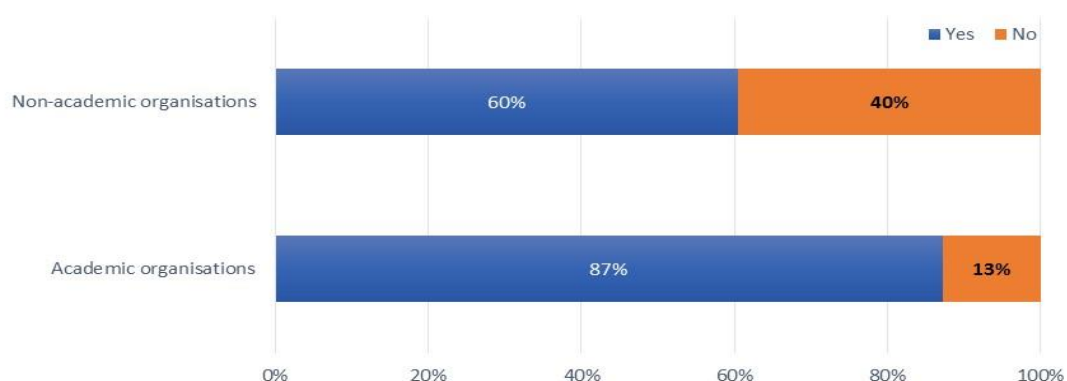
7.2 Organisational level results and impacts

7.2.1 Partnerships

As noted in section 4.4, the EID scheme appears to have fostered new collaborations: thirty-nine per cent of academic organisations and 66 per cent of non-academic organisations reported collaboration with new organisations. Early evidence also suggests that the EID scheme extended collaboration between partner organisations. Most non-academic and academic organisations participating in the EID scheme have concrete plans to continue their partnership with other partner organisations involved in the EID project. However, a notably higher proportion of academic organisations (87 per cent) had plans to continue their partnerships compared to 60 per cent of non-academic organisations.

⁴⁰ The BBSRC programme specifically fund PhD in the field of bioscience. Six other Research Councils exist in the UK which fund studentships in other scientific fields. The Councils expressed their commitment to promoting collaborative PhD training through sharing a joint vision for collaborative training, see: <http://www.rcuk.ac.uk/documents/skills/rcdvision-pdf/>

Figure 7.5 **Plans to continue partnerships with academic/non-academic partner organisations (academic and non-academic participants)**



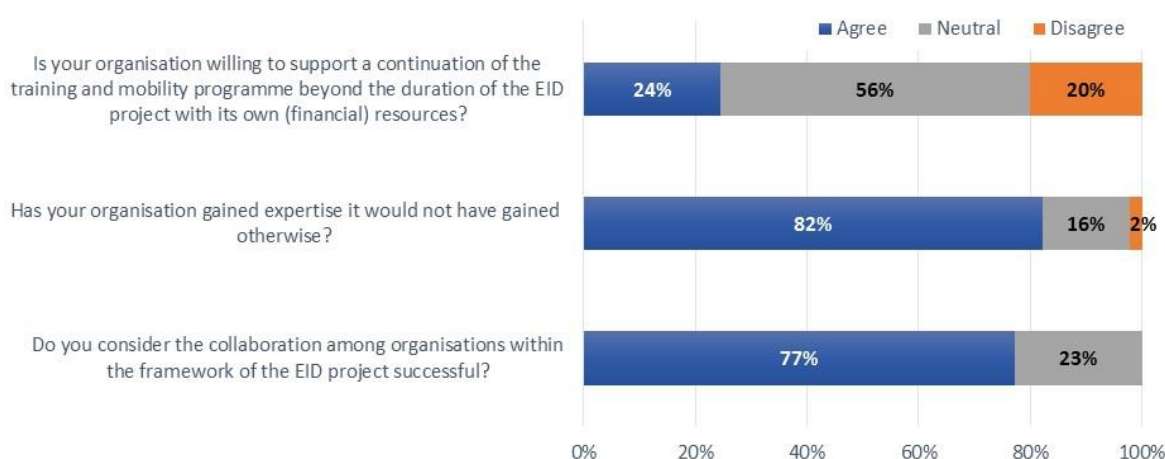
Sources: *European Industrial Doctorates – Academic participants, Question 42: Are there concrete plans to continue the partnership with academic/non-academic partner organisations involved in the EID project?* 39 participants replied to this question.

European Industrial Doctorates – Non-academic participants, Question 38: Are there concrete plans to continue the partnership with academic/non-academic partner organisations involved in the EID project? 43 participants replied to this question.

A significant majority of beneficiary organisations (77 per cent of non-academic organisations surveyed) considered the collaboration among organisations within the framework of the EID project to have been successful. Most respondents (82 per cent) also indicated that the scheme had helped them gain expertise they would not have gained otherwise.

Some non-academic organisations were willing to continue the training and mobility programme beyond the duration of the EID project from their own resources, reaffirming the positive impacts of the scheme. Twenty-four per cent of respondents said they were willing to continue the scheme through their own means, although the majority (56 per cent) were neutral in this regard.

Figure 7.6 **Beneficiary organisations' views on impacts of the EID scheme (non-academic organisations)**



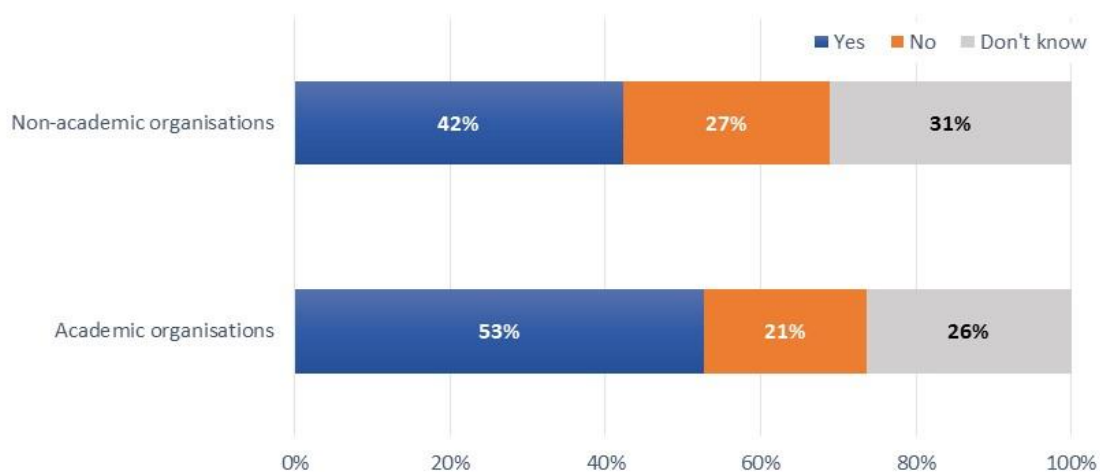
European Industrial Doctorates – Non-academic participants, Question 37: To what extent do you consider the collaboration among organisations within the framework of the EID project successful?/Has your organisation gained expertise it would not have gained otherwise?/ Is your organisation willing to support a continuation of the training and mobility programme beyond the duration of the EID project with its own (financial) resources? 45 participants replied to this question.

7.2.2 Commercial impacts

Because none of the projects surveyed had been completed and only 17 per cent were nearing completion, it is not possible at this stage to provide a full assessment of the commercial impact of the EID scheme.

Initial evidence does suggest that EID project beneficiaries (both academic and non-academic organisations) also benefitted from access to prototypes or similar facilities to apply research in a real life context that would otherwise not have been possible. The majority of academic respondents (53 per cent) stated that EID projects had enabled their organisation to obtain such access, compared to 42 per cent of non-academic organisations.

Figure 7.7 **Access to prototypes or similar facilities to apply research in a real life environment (academic and non-academic participants)**

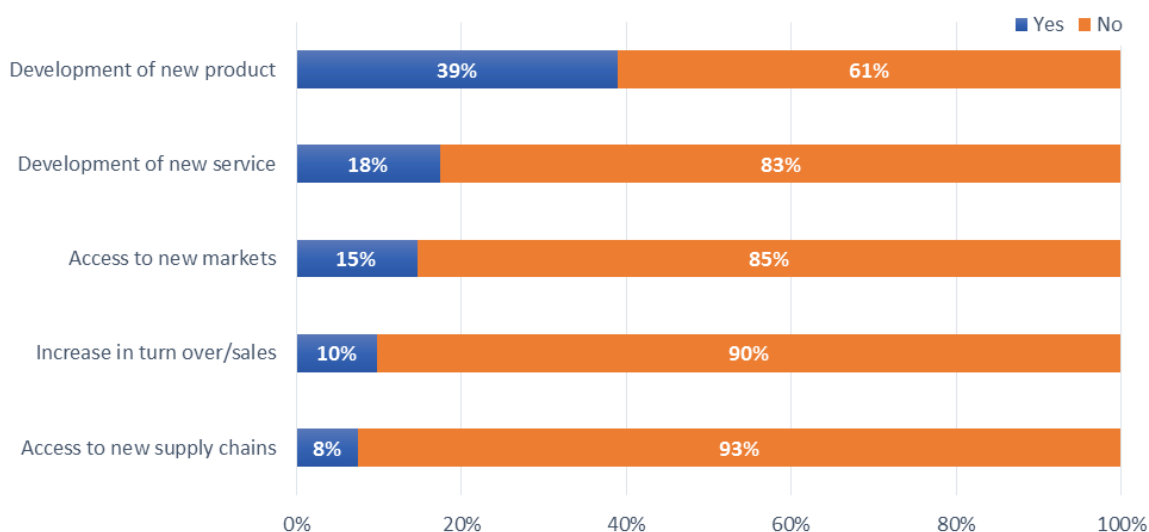


Source: *European Industrial Doctorates – Academic participants, Question 38: Did the EID project enable your organisation to get access to prototypes or similar to apply your research in a real life environment which would otherwise not have been possible? 38 participants replied to this question.*

European Industrial Doctorates – Non-academic participants, Question 36: Did the EID project enable your organisation to get access to prototypes or similar to apply your research in a real life environment which would otherwise not have been possible? 45 participants replied to this question.

Despite projects not having reached completion, some non-academic organisations already reported several other specific commercial benefits of the EID fellowships, although in most cases no clear commercial impact was noted at this stage. The most widely cited benefit was the development of new products (stated by 39 per cent of respondents). A smaller proportion of respondents also reported that the scheme had helped develop a new service line (15 per cent) and provided access to new markets (15 per cent). Only 10 per cent of respondents noted an increase in turnover or sales as result of the fellowship, and eight per cent benefitted from access to new supply chains.

Figure 7.8 **Commercial impacts from EID fellowship (non-academic participants)**



Source: European Industrial Doctorates – Non-academic participants, Question 38: Did the EID fellowship directly result in any of the following commercial impacts? 41 participants replied to this question.

7.3 Initial outputs from EID projects in terms of publications, patents, innovations

As mentioned before, given the relatively early stages of many of the projects covered in the surveys, any distinct project outputs cited by respondents are more likely to relate to the small number of projects that are nearing completion (17 per cent of those surveyed).

7.3.1 Patents and IPR

Six academic organisations (or 15 per cent) said they had made IPR applications, although this is only an initial figure, given that all projects facilitated by the organisations surveyed were still in progress at the time of study research. Together, this amounted to nine IPR applications (six new patents, one trademark, one registered design and one other form of IPR).

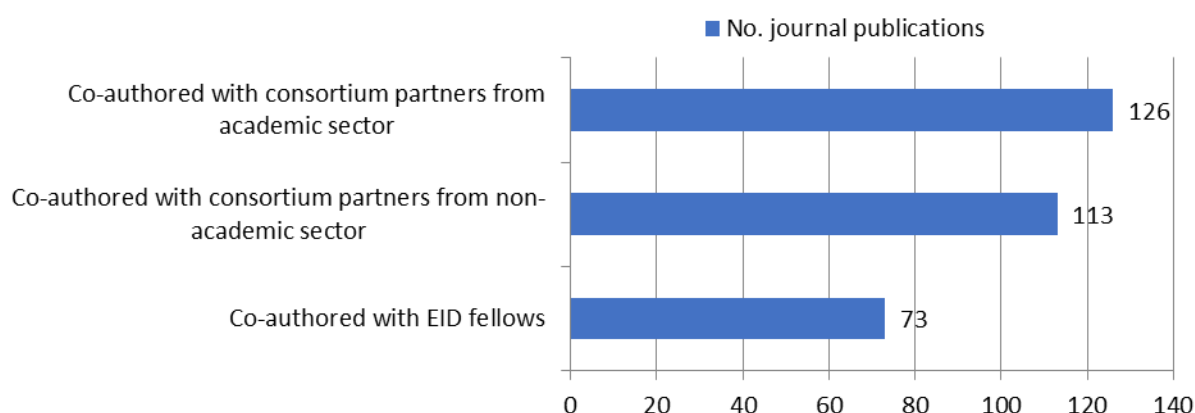
Among non-academic organisations surveyed, 14 different IPR applications were made (including two relating to registered design and 12 other forms of IPR) by eight different organisations (17 per cent of respondents).

Around seven per cent of EID fellows surveyed said they had submitted one or more patent applications, with 19 patent applications submitted in total. Five per cent of all EID fellows surveyed said they were named principal author in IPR applications. Of the 37 respondents with a completed fellowship, five (or 14 per cent) had been involved in new patent applications and four (or 11 per cent) had been involved in IPR applications where they had been named as a principal author.

7.3.2 Publications

On aggregate, around 50 per cent of all EID fellows surveyed produced or contributed to journal publications as a direct output of their fellowship. Considering only those fellows with a completed fellowship, a larger majority (25 of 37) had produced or contributed to at least one publication. Publications were either co-authored with other EID fellows, with consortium partners from academic sector and/or consortium partners from the non-academic sector. Scientific publications were also found to be important outputs of comparator programmes (see Annex 3).

Figure 7.9 Journal publications produced as a direct output of EID fellowships (EID fellows)



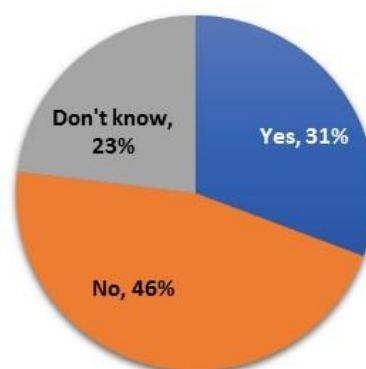
Source: European Industrial Doctorates – EID fellows, Question 32: How many journal publications did you produce as a direct output of the fellowship? 180 participants replied to this question.

7.3.3 Curriculum changes

The impacts of the EID scheme on the educational curricula within participating academic organisations are mixed. Around a third of respondents indicated that the EID projects helped foster changes in the curricula of Bachelor and Master degree programmes at their organisation (for example by integrating training on new types of skills), compared to 46 per cent who reported no changes.

Anecdotal evidence from the case study work supports this result. Where impacts were reported, the changes were most commonly associated with introducing new content or new types of training courses to curricula.

Figure 7.10 Proportion of academic participants reporting changes in curricula



Source: European Industrial Doctorates – Academic participants, Question 37: Did the EID project foster changes in the curricula of bachelor's and master's degree programmes at your organisation, for example by integrating training on new types of skills? 39 participants replied to this question.

8 Conclusions and recommendations

8.1 Rationale for the EID scheme and relevance

By and large, the scheme is considered clearly structured with clear objectives and as addressing relevant and important issues. Overall, stakeholders agree that preparing researchers better for a career outside academia is increasingly important. Feedback from fellows collected during the online surveys and fieldwork confirms that the scheme mainly caters to individual researchers aiming to improve their career prospects for working in the non-academic sector.

The fieldwork confirmed the relevance and pertinence of the issues set out above. It also confirmed that the EID scheme objectives are overall clearly set out.

- The EID scheme clearly helps to structure and raise awareness of training offers along the 'value chain' from basic research, applied research towards business relevant activities such as product development, manufacturing, marketing & sales and finance
- While industrial doctorate programmes exist on a bilateral, institutional and national level, the EID offers particular value in terms of its structured approach to collaborative doctoral training between academic and non-academic sectors and in terms of its international dimension.
- There are concerns that doctoral training could turn into skills training – the main aspect of a PhD should be to conduct scientific work independently. Any training offered should complement the PhD research area and allow some flexibility to arrange training and skill development to suit individual needs and career paths.
- The quality and seniority of peer networks that EID enables is also highly relevant. Access to professional and scientific networks is seen as key to further career prospects, and as a valuable resource for informed decisions about career paths. Stakeholders felt that the quality and extent of networks in EID/ITN projects are not generally available in 'classic' PhD/graduate programmes.

A significant majority of EID fellows surveyed found the content and structure of the industrial placement and research performed and the training offered at their academic institutions were either relevant or highly relevant to their research interests.

Case study evidence confirmed that EID projects are seen as highly relevant and pertinent to further the employability and career progression of researchers, particularly outside academia.

The fieldwork highlighted several issues that deserve further investigation by the European Commission, and in the context of the planned mid-term evaluation. Issues around the relevance of the EID scheme include:

- The EID scheme is considered only relevant to scientific disciplines with clear potential for industrial application, with a strong focus on engineering and information sciences – the involvement of other non-academic stakeholders apart from the business sector is often considered outside the scheme remit, although it is explicitly included in the EID calls for proposals.
- Training funded by institutional unit costs are often considered courses/modules that would have been accessible anyway – either through other types of graduate training, lectures or through courses offered by technology transfer offices and career centres at academic institutions.
- Until the MSCA work programme 2016-2017, projects had to include an academic partner allowed to award doctoral degrees. This excluded various research performing organisations – including large institutions of applied research from countries such as Germany and France. The EID mid-term evaluation should investigate whether

abandoning this rule has resulted in a more diverse group of academic participants hosting fellows.

- There are some concerns regarding the scheme budget and the rather low success rates under Horizon 2020, which might discourage potential applicants.

Recommendations

- The European Commission and REA should **encourage the participation of non-academic actors other than businesses** to meet the EID specific objectives of career opportunities across the non-academic sector.⁴¹
- The work programme should be amended to further emphasise the need for training that provides added value vis-à-vis alternative industrial PhD programmes those run by the applicant institutions already or other programmes available for prospective fellows.
- The mid-term evaluation should investigate in more detail whether the inclusion of academic institutions apart from institutions awarding doctoral degrees has led to a more diverse group of academic participants.

8.2 Pathways to participation

Pathways to participation at organisational level are mainly based on previous or existing collaboration. Most project partnerships existed before the EID project. Where this was not the case, partners usually connected via professional networks and recommendations. Non-academic participants were slightly more likely to work with new partners than academic participants.

The motivation to apply differed between academic and non-academic organisations. Academic organisations were mainly attracted by the research funding available, the ability to recruit cohorts of researchers working on a specific topic and the possibility of strengthening existing relationships with industry. The main motivation cited by non-academic participants was the opportunity to recruit research staff at very low to no cost through the EID fellowships and collaboration with academia.

Results from the case study research largely confirm these views. Project coordinators of case study projects suggested that the strong and explicit focus on structured collaboration with industry was a major motivation, together with access to research funding. PhD training was less often mentioned, with a minority of coordinators conceding that training of PhD candidates was a secondary objective.

EID fellows responding to the online survey were mostly attracted to the scheme because of its focus on applied/industrial research and the specific research topics and areas of the EID project they applied to. This suggests that researchers supported by the scheme already wanted to work in industry before being funded as a fellow – and that the quality and relevance of individual PhD topics proposed played a major role. These findings were corroborated by interviews with fellows in case study projects.

Other considerations mentioned during interviews that influenced the decision to apply for the EID fellowship include:

- The salary is very competitive compared to starting salaries in industry and other PhD scholarships;

⁴¹ Such as those listed in the ITN work programme 2016-2017, see http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-msca_en.pdf

- Often PhD candidates are employed as research assistants and cannot spend all their working hours on their PhD project. The MSCA rules mandate that the fellowship shall only be spent on the PhD project, without any teaching commitment that might jeopardize the fellow's research activity. This is considered very attractive compared to 'regular' PhD positions;
- Fellow interviewees also suggested that the EID project helped them access a network of high quality senior experts beyond the possibilities offered by a 'regular' PhD programme / alternative industrial doctorates at a single academic institution.

In conclusion, the pathways to participation in the EID scheme confirmed a number of assumptions and suggest certain lessons about possible effects of the scheme on its target population.

- The scheme mainly offers an opportunity to strengthen and extend existing collaborations between academic and non-academic organisations;
- The scheme mainly funds researchers who were already interested in a career in industry. By implication, the scheme does not have a big impact on changing the 'direction' of individual career paths. Anecdotic evidence does suggest that in some individual cases, the scheme spurred interest in a career outside academia;
- The EID scheme offers more attractive working conditions than alternative PhD programmes. But these favourable conditions are not largely the sole reason for choosing an EID fellowship over alternative PhD positions.

8.3 Attractiveness and demand for funding

Overall, the EID scheme is considered a very attractive option for funding structured, collaborative doctoral training. Many stakeholders commended the European Commission for setting up the scheme, which is particularly seen to meet the needs of applied research departments in academic institutions. Similarly, fellows planning a career in industry also largely considered the scheme a very attractive option.

There were some concerns that the scheme does not offer enough time to complete a PhD programme to the highest standard, and requires a lot of time to be spent on training activities not directly related to the PhD project, but aimed at developing skills and future career prospects. This was particularly true in a minority of cases where fellows were aiming for a career in academia after completing their PhD.

Demand for funding overall was substantial and in line with the large demand for ITN funding overall. The number of applicants for EID funding tripled between 2012 and 2015, also in line with overall demand for ITN funding.

Demand for funding mainly came from a small group of central European countries (UK, Germany, Netherlands and France) plus Spain and Italy. These six countries also received the largest proportion of scheme funding.

The EID scheme also encouraged additional demand from businesses, when compared to overall demand for ITN funding. This was particularly true in Germany, Netherlands, Belgium and Sweden where there was a difference of 30 per cent or more in business demand for EID funding compared to demand for overall ITN support.

In terms of scientific disciplines, demand was mainly from areas presumably with a strong focus on industrial or commercial application – information science and engineering, life sciences, chemistry and environment and geosciences represented 92 per cent of all proposals submitted for EID funding.

Overall success rates in winning EID support indicate how well demand is met by scheme support. Success rates have significantly decreased since the start of the scheme, again, mainly a function of the overall increase in interest for ITN funding. For the last call for proposals included in this study, Horizon 2020-MSCA-ITN-2015, success rates for the EID scheme were at 13.4 per cent, substantially higher than success rates for ITN funding

overall during the same period (8.2 per cent). Given these low success rates, as with the MSCA programme overall, stakeholders remain concerned that the overall demand for EID funding is not being met.

Recommendations

The European Commission should try to encourage demand/applications from a more diverse group of countries, including so-called 'widening' countries.⁴²

Given overall demand substantially exceeds the scheme budget, plus the strong overall relevance of the EID scheme, it would be reasonable to increase the budget allocated to EID funding in the next MSCA work programme.

8.4 Effectiveness of scheme implementation

Participants and applicants generally considered administrative and financial rules and overall scheme implementation appropriate and effective. There was a marked difference between the satisfaction of academic and non-academic organisations, with academic organisations more likely to consider the scheme implementation less appropriate and effective. Fellows were also largely satisfied with the scheme implementation, although there were calls for more flexibility in implementing individual fellowships and projects.

The evidence suggests that in most of the problems encountered, there were no specific conflicts between EID rules and organisational or national rules. The areas where most conflicts were reported related to fellow recruitment and selection. Most prominent were conflicts around differences between national/internal salary requirements and EID living allowances, and citizenship requirements of national labour market regulations. The three-year limit of EID fellowships also conflicts with some institutional and national set-ups for doctoral training. Similar conflicts more generally affect the ITN scheme.

Evidence generated by the online surveys and case study research suggests that the scheme could be improved by increasing the flexibility of rules around the allocation of budgets and requirement for EID fellows to spend a specific proportion of their time at different host organisations. Respondents felt that the scheme would be more effective if participants had more freedom to decide how time and budgets were allocated. There were also calls from some participants to relax mobility rules relating to recruitment of fellows, for example by allowing organisations to take on fellows from their own countries. However, these changes would be against current MSCA mobility rules.

Most participants considered measures for quality assurance appropriate but some mentioned that joint supervision, secondments and the recruitment process could be further improved.

Recommendations

Expert evaluation

While the move from face-to-face meetings to an online system works in most cases, the REA should consider introducing optional face-to-face meetings in case of disputes, because there were concerns over solving disputes via the remote evaluation process. The alternative will be to offer tele/video conferencing to evaluators.

Applicants, especially the non-academic sector would benefit from a shorter time-to-grant. This would encourage non-academic applicants, in particular those from industry who currently feel that they are better served by recruiting PhD candidates directly for secondments, or through bilateral agreements with universities.

The reasons for the time required between expert evaluations and the announcement of evaluation results are not clear to stakeholders. Although outlined in the Grant Manual on the participant portal, the European Commission and REA should make further efforts to explain and

⁴² http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-sewp_en.pdf [accessed 26th October 2016].

communicate the different steps and timetable between proposal submission and announcement of evaluation results.

In terms of scheme implementation

Joint supervision can be a challenge and can be risky for PhD candidates if roles and expectations are not clearly set out from the start. In principle, it should be the job of the organisation that has registered the PhD candidates to ensure that responsibilities are clear, and that supervisors are properly prepared for the role. There might be scope to include offers to train prospective supervisors in EID projects and prepare them for joint supervision. There are several best practices at national level that the European Commission/REA should consider to ensure the quality of joint supervision.⁴³

There are considerable costs associated with mobility requirements, particularly for ESR with family or those that are non-EU citizens. The European Commission could further consider whether costs associated with researcher mobility could be provided in lump sums (rather than current monthly payments) to offer support at the time fellows actually move within the project⁴⁴, or whether requirements around intersectoral mobility can be relaxed in certain circumstances.

There should be greater flexibility in how fellows split their time between academic and non-academic partner organisations, in line with the practicalities of the work and the problems in coordinating work across two institutions. This should particularly apply to issues over joint supervision, the training offered, or difficulties accessing crucial equipment and laboratories to ensure that PhD candidates can complete their work on time, to the highest standard and with the best supervision possible. In these circumstances, the scheme should focus on helping PhD candidates rather than enforcing programme rules in such circumstances.

National contact points should provide comprehensive instructions about the recruitment of non-EU citizens and advise on a step by step approach to applying to the respective national regulations of labour market and immigration. They should also advise on best practice in employment contracts and remuneration, helping participating organisations to navigate the various options on offer. This should help alleviate to some extent the administrative burden on host institutions and fellows themselves.

The maximum length of fellowships under EID should be extended from 36 to 48 months, given the identified mismatch between EID fellowships and some institutional and national practice. The European Commission should also consider that if such a change is not accompanied by an increase in scheme budget, the number of overall projects or number of fellows per project would have to be reduced.

8.5 Added value

The EID scheme provides clear added value vis-à-vis 'regular' PhD positions and alternative PhD programmes in several aspects, as confirmed by participating organisations and fellows.

First, it offers structured doctoral training across sectors and country borders, which few other programmes can claim. It thus offers strong added value when compared to PhD programmes carried out in one country, or one institution, as well as programmes and bilateral agreements between multiple organisations in the same country.

Second, EID funding is important to the viability of the projects under the scheme for all participants regardless of organisational type. On average, 84 per cent of respondents (including academic and non-academic organisations) said they would not have gone ahead with their project without any funding from the EID scheme, with projects slightly more likely to go ahead in the non-academic sector without EID funding.

⁴³ Such as Vitae's briefing for supervisors and Principal Investigators, and the QAA's Quality Code on Assuring and Enhancing Academic Quality for Research Degrees. <http://www.qaa.ac.uk/en/Publications/Pages/Quality-Code-Chapter-B11.aspx#.WBSSPy0rKM8> [accessed 25th October 2016].

⁴⁴ To avoid large lump sum payments at the beginning of a project, this could be limited to a maximum of three researchers months paid out at once.

According to the survey, the value of EID projects that would have gone ahead without EID funding is an estimated €18.7 million, or 23 per cent of €81 million / 64 projects covered in the online survey overall. This represents a minimum deadweight loss to the Commission, given that these projects would have likely been financed by alternative means.

On an individual level, most fellows agreed that the relevance, quality and seniority of supervisors and scientists in charge were of higher quality than in alternative PhD positions they considered. The same applied to the research focus and specific PhD projects advertised. EID fellowships offer access to a wide network of senior researchers from both inside and outside academia, something fellows considered a major advantage compared to alternative programmes. The quality of non-academic partners – often leading businesses at the forefront of new markets and technologies – added further value.

The added value of training offered hinged on the specific career plans of individual fellows. The EID scheme particularly suits PhD candidates who were already planning a career in industry before the fellowship started. A minority of fellows saw requirements around mobility and joint supervision as inappropriate to support a career in academia. This was particularly true of EID projects where the academic partner was active in fundamental research, when it was felt that a large section of the fellowship was spent on activities in industry not particularly helpful to an academic career.

Recommendations

Host institutions should highlight to applicant researchers the nature of the fellowships offered, their added value and their main difference vis-à-vis regular PhD positions when advertising the posts and during the recruitment process.

Academic and non-academic organisations participating in the scheme should also be encouraged by the European Commission to offer a comprehensive research environment to EID fellows to ensure continuity each time fellows change their host institution within the project.

8.6 Preliminary outputs and results

Of the 60 projects surveyed that provided scheme data on project end dates⁴⁵, none had reached completion at the time of the study research. Ten projects were due to end in the short-term –by the end of 2016 (17 per cent of those surveyed). The rest of the projects covered by the surveys of beneficiary organisations end in 2017 or beyond. It is therefore unlikely that most project participants could make realistic assessments of final project outputs, impacts and future prospects at this stage. The planned mid-term evaluation of the scheme should therefore revisit the assessment of scheme outputs and results presented below.

Preliminary and indicative responses from stakeholders indicate the following:

- At the organisational level, the EID scheme is an instrument to develop new and existing collaborations and networks between the academic and non-academic sector, in particular between universities and industrial players.
- At the organisational level, there is some indicative evidence that the EID scheme provides large pools of high quality PhD candidates from which participant organisations can recruit. The quality of applications was commended throughout, and the scheme could potentially result in offering participating organisations access to a larger and more relevant pool of talent, compared to alternative PhD positions advertised at the same organisations.

⁴⁵ Project end dates were not available in the case of four of the 64 distinct projects covered in the surveys.

- At the individual level, there is some initial evidence and indication that the scheme has delivered strong results for those fellows who had already planned a career in industry from the outset. These fellows generally reported that the EID fellowship has improved their career prospects and has equipped them with a skillset well matched to the technical and transferable skills required for a career in applied or industrial research. Generally, the feedback suggests that this was down to two major factors: first, the added value of having access to large international networks of senior researchers from academia and industry, second, the provision of tailored training programmes including on-the-job training not available to other PhD candidates at the same institution.
- In terms of project outputs so far, besides peer-reviewed publications, a considerable share of partners and fellows have been involved in applications for intellectual property rights (IPR). Out of all organisations responding to the survey, 15 per cent of academic partners and 17 per cent of non-academic partners had applied for IPR. Out of fellows who completed their fellowship, 14 per cent have submitted one or more patent applications.

ANNEXES

Annex 1 Interviews conducted

Table A1.1 Overview of stakeholder interviews conducted

EU/ Non-EU	Stakeholder Group	Name	Organisation	Country
EU	National policy maker	Felix Beckendorf (cross-cutting issues)	Deutsches Zentrum für Luft- und Raumfahrt (DLR)	Germany
EU	National policy maker	Chloë Somers	Research Councils UK	UK
EU	National interest group	Janet Metcalfe	Vitae	UK
EU	National policy maker	Pierantonios Papazoglou	Research Promotion Foundation	Cyprus
EU	National policy maker	Ms Kristin Kraav	Estonian Research Council	Estonia
EU	National policy maker	Mr Iakovidis Alexandros	Centre for Research and Technology Hellas	Greece
EU	National policy maker	Dr Jennifer Brennan	Irish universities association (IUA)	Ireland
EU	National policy maker	Mrs Magdalena Chomicka	IPPT PAN	Poland
EU	National policy maker	Rui Pinto Guimaraes	Marie Currie Fellows Association	Portugal

EU/ Non-EU	Stakeholder Group	Name	Organisation	Country
EU	National policy maker	Dr Ana Mafalda Dourado	NCP Portugal	Portugal
EU	National policy maker	Juliane Sauer	EURESEARCH	Switzerland
EU	National policy maker	Ms. Patrizia Jankovic	Federal Ministry of Science, Research and Economy	Austria
EU	National interest groups	Dr. Justyna Małkuch-Świtalska	POLDOC	Poland
EU	European Interest Group	Dr. Willemijn Dicke	IDEA league	Belgium
EU	European Interest Group	Conor oCarroll	European Commission Steering Group for Human Resources and Mobility	Ireland
Non-EU	Stakeholders from competitor regions	Jeff Allum	Council of graduate schools in US	United States
Non-EU	Stakeholders from competitor regions	Renee Hindmarsh	ATN Industry Doctoral Training Centre in Mathematics and Statistics (IDTC)	Australia
EU	Expert Evaluator 1			

EU/ Non-EU	Stakeholder Group	Name	Organisation	Country
EU	Expert Evaluator 2			
EU	Expert Evaluator 3			
EU	Expert Evaluator 4			
EU	Expert Evaluator 5			
EU	Expert Evaluator 6			
EU	Expert Evaluator 7			
EU	Expert Evaluator 8			

Annex 2 Case studies

The study team identified ten case study projects, out of which nine have been completed and are presented in this annex.

Table A2.1 EID case studies

Project ID	Project Acronym	Coordinator (organisation, country)
642445	AdapTT	Philips Electronics, Netherlands
607911	Alpes	University of Bristol, United Kingdom
316426	Artisan	Queen's University Belfast, United Kingdom
608243	ASIVA14	Technical University Eindhoven, Netherlands
634200	BIOCASCADES	Ruhr-Universität Bochum, Germany
606963	Coopera-TB	University of Birmingham, United Kingdom
606844	Crane	Siemens sa, Belgium
316687	JMAP	Max Born Institute, Germany
606965	Zeomorph	Oslo University, Norway

A2.2 AdapTT: Real time therapy planning for Thermal based therapy modalities in oncology care

Total project costs	€ 0.77 million
EU funding	€ 0.77 million
Project coordinator	Philips Electronics, Netherlands
Number of partners involved	3
Project start date	January 2015
Project end date	December 2018

A2.2.1 Project description

The project focusses on the advancement of assistive technology for minimally invasive cancer treatments. More specifically, the project focuses at improving the planning and guidance tools for radio-frequency based ablation treatments, by informing the treating physician on optimal placement of the needle and the outcome of the ablation.

Specific project objectives are fourfold:

- To develop a multi-scale biophysics model, which accounts for the cooling effect caused by blood vessels during RF ablation. The model should be accurate and fast enough for clinical use;
- To improve the accuracy and effectiveness of ablation treatments, by developing reliable and computationally efficient optimization routines, which can be used not only for pre-operative planning, but also during the treatment;
- To develop a reliable experimental validation methods for the biophysics model; and
- To translate the research results into a software tool, which in turn is planned to be integrated into an existing Philips clinical software platform.

Three early stage researchers has been recruited and are conducted their PhD in the framework of the project. All candidates have been hired by Philips and are enrolled as PhD candidates at RWTH Aachen.

If successful, the project is expected to benefit the research area of oncology and aid in minimally invasive cancer treatments.

A2.2.2 Pathways to participation

The project partnership consists of Philips (Netherlands) and the university hospital Aachen (Germany). After the project started, the Technical University Aachen (RWTH Aachen (AICES institute and Physics of Molecular Imaging Group) was added as a project partner. The partnership was developed from an existing cooperation between Philips and the university hospital Aachen.

The scheme was chosen over a 'standard' ITN application due to its strong focus on applied research. Furthermore, the coordinator at Philips highlighted the advantage of the small consortium. The strong bilateral relationship between Philips and the Aachen university hospital made the EID scheme a natural choice, and enabled the continuation of direction contact, bilateral guidance and helped targeting the research towards more valuable results.

The small consortium size also allows to use complementary training and research capacity of the partner organisations more effectively, according to the project coordinator.

There were no major barriers to participation, according to interviewees the proposal template and guidelines for applicants were clear. However interviewees noted that the maximum duration of EID projects which is set at 36 months caused minor confusion. Both in the Netherlands and in Germany, a PhD typically takes longer than 36 months to complete.

A2.2.3 Arrangements as regards supervision and training [maximum half a page]

As regards supervision, this was handled jointly by the two partner organisations. Each early stage researcher has one supervisor at Philips and one supervisor at the university hospital. Usually, daily to weekly meetings would take place with the supervisors, as well as review meetings twice a year as part of Philips' staff development programme.

According to the project coordinator, good supervision requires substantial efforts to set up whenever a PhD candidate moves organisation. The individual research plan needs to be developed and aligned with project objectives, and alignment and support with/of the department that is hosting the PhD candidate has to be ensured.

Overall interviewees felt that the joint supervision is working well so far, and offers added value to PhD candidates.

In terms of training, the project offers three general types of training and support for personal development.

- At Philips, the EID fellows can participate in courses from a wide range of topics, focussing on transferable skills such as presentation skills, project management and personal development;
- In addition, EID fellows hold regular employment contracts at Philips, twice a year their performance is being reviewed and training needs are identified, as well as specific training courses to follow;
- Furthermore, EID fellows benefit from academic training which consists in reading and working through academic literature, attending technical and scientific workshops or training courses and participating in scientific conferences.

All in all, in the view of fellows and the coordinator, the project offers a broad set of training possibilities. EID fellows are asked to proactively follow their specific training needs and interests.

The added value of the training offered by the project lies clearly in industry related courses, including business development, product development and development of product propositions. These are courses that PhD candidates who are not EID fellows would not have access to.

As of summer 2016, AdapTT fellows participated in the following training courses:

As regards specific research skills

- MR Pulse-sequence programming, 5 day external training
- MOREPAS 3rd Conference on Model Order Reduction for Parametrized Systems⁴⁶

⁴⁶ <https://indico.sissa.it/event/4/>

- Reduced basis summer school⁴⁷
- StarCCM+

As regards transferable skills

- Philips Research introduction for new employees
- General Business Principles
- Introduction to Data Privacy
- Export Controls & Sanctions Overview: General Awareness
- Introduction to Quality for Research
- Retreat AICES
- Body language and communication styles for female scientists, 2 day training

A2.2.4 Results

The project has not finished and therefore it is not possible to review materialised results and outputs.

At the organisational level, interviewees expect the following results if the project is successful:

- The project will help Philips as a long term recruitment process and helps funding research activities, it offers the possibility to review the performance and skills of talented young researchers for three years;
- The project enables a more long term approach to research than usually possible in industry;
- The project enables a continuation and deepening of the cooperation between the university hospital Aachen and Philips.
- The consortium has also applied for follow up funding through a further EID network, further strengthening the cooperation.

At the individual level, fellows interviewed noted that their fellowship has not ended at the time of the case study research. However,

- Up to now, fellows are very satisfied at the exposure to industrial research and development, and think that this would have not been possible at an alternative PhD position;
- The joint supervision is deemed very helpful, as fellows receive input from a larger group of people as compared to an alternative PhD track, where most likely only one supervisor would be involved. The networking opportunities and ease of access to senior scientists from Philips and the university hospital are considered a major advantage and positive outcome of the fellowships so far, and fellows believe that these networking opportunities would not have been available had they chosen an alternative PhD position.
- In terms of commercial results, intermediary outputs from one EID fellow have already been integrated in an existing piece of Philips software. Further outputs are expected to feed into new solutions in interventional oncology, and find application in Philips products.

⁴⁷ <http://www.mpi-magdeburg.mpg.de/csc/events/RBSS2016>

In terms of future careers in non-academic environments, fellows felt that it was too early to say whether the EID fellowship has a positive influence. However, fellows interviewed also indicated that they were interested in working in industry before starting the fellowship, so it can be questioned to what extent the EID support has influenced or will influence the 'direction' of their career.

A2.2.5 Good practice

No specific good practice was highlighted by interviewees. The project coordinator however noted that recruitment of EID fellows had taken more time than first anticipated. Hence he advised that for future EID projects, sufficient time had to be planned in for the recruitment phase.

Furthermore, interviewees advised the importance of defining structure and responsibility of individuals in the supervision and training arrangements beforehand. Whilst this might take time to prepare in detail, the benefits of having a clearly structured training and supervision plan in hand when EID fellows begin their fellowship clearly outweighs the costs.

A2.3 ALPES – Aircraft Loads Prediction for Enhanced Simulation

Total project costs	€ 1.3 million
EU funding	€ 1.3 million
Project coordinator	University of Bristol, UK
Number of partners involved	2
Project start date	October 2013
Project end date	September 2017

A2.3.1 Project description

ALPES is an EID project focussing on development of novel methods and procedures to improve the accuracy and efficiency of aircraft loads predictions. Under the project, five Early Stage Researchers (ESRs) are employed who are based for 18 months at the University of Bristol and then spend another 18 months at Siemens, or vice versa. The ESRs also spend time on placements at Airbus, and in the first year all of them spent a two week introductory placement with the Flight Physics department at Airbus UK in Filton, Bristol.

Overall project aims are as follows

- To develop novel methods and procedures to improve the accuracy and efficiency of aircraft loads predictions;
- To provide an industrially focused training regime for the researchers;
- To assess the methodologies developed in ALPES on industrial scale models; and
- To transfer the technical developments made in ALPES into industry.

In terms of more specific project objectives, activities focus on achieving the following:

- To improve the modelling of landing, manoeuvre and gust loads for combined high load events;
- To develop reduced order aeroelastic modelling approaches for landing, manoeuvres and gust loads;
- To develop efficient and accurate gust loads modelling techniques combining high and low fidelity methods;
- To develop improved approaches to determine worst case predictions of gust, manoeuvre and landing loads;
- To develop methods for the uncertainty quantification of landing, gust and manoeuvre loads;
- To implement the developed technologies into the aerospace industry;
- To provide a focused and relevant training experience so that the ESRs can move directly into the aerospace industry with a highly relevant knowledge and skills;
- To provide the ESRs with the necessary technical and computational skills to perform industrial standard loads calculations; and
- To provide the ESRs with technical and research skills to be able to make a contribution to research in the area of aircraft loads.

Project partners are the University of Bristol as coordinator and employing organisation of the fellows and Siemens Industry Software NV (formerly LMS International), with Airbus Operations Ltd as an associated partner. Main beneficiaries of the project are both the organisations participated, as well as the five ESRs funded.

A2.3.2 Pathways to participation

The coordinator had not participated in an ITN project before, but identified the EID scheme for its very strict focus on industrial training. This suited the activities of the coordinating department at the University of Bristol, as it is very oriented towards industrial application and already had standing relationships with Siemens and Airbus. In fact, Airbus currently sponsors part of the coordinator's work.

Furthermore, the coordinator felt that the MSCA programme attracts very good PhD candidates, and was a means to attract a large number of applications because of its very attractive salary levels. Furthermore, the coordinator was particularly interested in recruiting a 'cohort' of PhD candidates all working under the same principal investigator. It was also very attractive to have administrative overheads funded. This is something that is not possible through any other scholarship or fellowship scheme.

Whilst it would have made sense to have Airbus involved as a third beneficiary, their employment rules meant it would have been very challenging to employ individual PhDs for a period of 18 months at a specific site.

Both main beneficiaries are experienced participants in the framework programmes, hence no first time participants are involved in the project.

A2.3.3 Arrangements as regards supervision and training

A2.3.3.1 Supervision

Supervision is organised along the standards of Bristol University. Each PhD has their own plan of study, and there are annual reviews of progress involving all supervisors. In addition, each PhD holds weekly or biweekly teleconferences with his or her supervisors. In addition, all supervisors meet on a monthly basis to discuss progress or any issues that have occurred. In practice, the process is usually more formal in the first couple of months to agree a research plan and the focus of training activities.⁴⁸

Initially, it was challenging for the University of Bristol to accept PhD candidates which are not based in Bristol for a long period of their PhD. This was eventually solved, with reassurances and documentation that both industrial partners have a large proportion of PhD level staff and can provide supervisors with the necessary level of academic qualifications. There were also some reservations as to whether the academic supervisors at the University of Bristol would be able to exert effective supervision 'over distance', which was eventually solved with reassurance of the weekly catch ups and the fact that the Siemens location in Belgium where the ESRs were placed has other PhDs involved in industrial doctorates at the KU Leuven.

Overall, the supervision arrangements seem to be in line with the Charter & Code.

Fellows interviewed commended the high quality of supervision and supervisors at the University of Bristol. It was noted that the supervision from the side of the industrial partner offered less technical expertise, but was helpful in gaining understanding of transferable skills relevant to industrial application. Fellows believed that similar level of

⁴⁸ A detailed overview of supervision arrangements is provided in the project mid-term report, available on the project website: <http://www.bris.ac.uk/aerodynamics-research/projects/alpes/> [accessed 26th October 2016].

technical quality and knowledge would have been available under a 'regular' PhD at the University of Bristol.

A2.3.3.2 Training

As part of the project, the ESR are undertaking a series of trainings to improve both their technical and transferable skills. Whilst initial offers focussed on developing their technical capabilities and transferable skills, the later stage of the project offers opportunities for participation in technical conferences. Each ESR has a programme of training activities, which is aligned with their individual PhD research project and a personal development plan (PCDP) drafted at the start of the fellowship. The overall approach is to align the PCDP with the global training plan, complemented with dedicated individual training activities for individual or selected ESRs.

So far, of particular note where the following activities which could not have been attended by 'regular PhD' at Bristol university.

- A two week placement at Airbus Filton, based in the Flight Physics Department, and the possibility to spend that time gaining an understanding of the loads and aeroelasticity process in an industrial setting;
- A training in numerical simulation of multi-body systems at in Siemens, Belgium;
- A five day short course on "Introduction to Aircraft Aeroelasticity and Loads" held at the University of Bristol;
- A three day master class on Ground Vibration Testing held in Belgium by Siemens in conjunction with KU Leuven;
- A two-day course on "Nonlinear Aeroelasticity of Very Flexible Aircraft" presented by Carlos Cesnik of University of Michigan, held in Bristol; and
- An introductory course in computational fluid dynamics at the Von Karman Institute, Belgium

These technical trainings were combined with a variety of soft skills training, or training in transferable skills, which were drawn from an existing portfolio of courses at the University of Bristol and Siemens.

Overall, the main added value of the project in terms of training is clearly the development of a tailor made and structured training plan for each ESR. Furthermore, interviewees were convinced that the EID funding helped to provide funding for external tutors of very high quality. Technical trainings stand out as being not available to other PhD at the same organisations, whilst all courses and modules in transferable skills are offered to a broad range of students and staff and have not been tailored for the purpose of the project.

Fellows interviewed commented that outside of an academic environment, i.e. in an industrial staff position, none of the technical training would have been available. In addition, they were of the view that they had access to substantial additional training when compared to PhD colleagues at the same organisations.

A2.3.4 Results

At the time of the case study, the project was still ongoing. Therefore no definite review of project results can be offered. However some preliminary results are available based on interviews conducted and a review of the mid-term project report.

At the organisational level, in the view of the coordinator the results so far are twofold:

- In terms of collaborations and networks, the project has helped deepening and continuing the collaboration with Airbus and Siemens. Some of the project outputs

have already been taken up by Airbus, in particular specific algorithms and software code developed as part of the research.

- In terms of research capacity of the coordinating organisation, the very high quality of PhD candidates was commended, and the project certainly enabled recruitment of very high quality research staff.

At the individual level, preliminary results can be summarise as follows.

- A number of conference papers have been presented and accepted, many of which have been converted into journal papers. One patent application has been submitted.
- In terms of job prospects, two out of five ESR have been offered post-doc positions, whilst a third ESR is in discussions with a potential employer from industry. Two further ESR don't have concrete plans yet as their fellowship started at a later stage – however they have been in touch already with potential employers from industry
- In terms of training and skills, fellows interviewed confirmed that the project has helped them to improve their technical capabilities and skills in a way that would not have been possible outside of the ALPES project
- In one instance, a fellow reported as well that the project helped to advance along the career, and it is expected that the ALPES project will help this fellow to gain a more demanding and more senior position.

None of the results above would have, in the view of interviewees, been possible without EID support. There was no particular feedback as regards project results and impacts so far in the area of entrepreneurship.

A2.3.5 Good practice

A number of good practices were highlighted by interviewees. These include both practices that were already applied during the ALPES projects, and recommendations for possible improvements in future EID projects:

- Presence of individual research plans and personal career development plans were deemed extremely helpful by both supervisors and fellows.
- To ensure clear engagement with industrial partners, each of the ESR should have one liaison in the non-academic organisation who is not a supervisor.
- The project was extremely well supported by the coordinator's research office. This implies that an experienced and well-resourced back office is helpful in dealing with project administration and reporting.

A2.4 ARTISAN

A2.4.1 ARTISAN: Adaptive RF front-end for 4G communication systems and beyond



Total project costs	€ 1,174,367
EU funding	€ 1,174,367
Project coordinator	Queen's University Belfast (UK)
Number of partners involved	2
Project start date	November 2013
Project end date	November 2016

A2.4.2 Project description

The ARTISAN programme involves collaboration between two world-leading research groups in the field of radio frequency (RF) technology: Queen's University, Belfast (QUB) and Bell Labs, Ireland. The programme aims to train RF technology researchers to PhD level in the area of wireless infrastructure hardware.

There is a growing demand in telecommunications for low cost RF hardware solutions and wireless systems. The project's wider objective is to help meeting this demand by building the long-term research base and capability of European industry to invent and commercialize RF innovations.

A2.4.3 Pathways to participation

The project coordinator explained that the primary reason for applying to the EID scheme was that it provided an alternative pathway for recruiting PhD candidates beyond traditional routes. Alternative routes include those where candidates are either self-funded, sponsored by industry or through other national level schemes.

The collaboration between QUB and Bell Labs fostered through the scheme was newly formed. Neither partner had formally worked together prior to the scheme, although the key personnel in the organisations were acquainted with each other through their professional networks. Bell Labs' technical expertise matched perfectly with QUB's research interests, making the company an ideal choice for QUB to partner with.

Research fellows who had been recruited were motivated to apply to the scheme due to the level of industry exposure, the training it provided, the opportunities for career development and the alignment with their research interests. The strong reputation of both QUB and Bell Labs was also a major point of attraction. Fellows had also applied to other doctoral programmes, although these were mostly traditional schemes with little or no industry exposure.

The project coordinator noted some difficulties in obtaining high quality applications, which meant they had to make repeated calls for applicants. This prolonged the recruitment process and reduced the time available for meeting core research objectives. As QUB did not receive a sufficient number of applications of a desirable quality, the majority of candidates were recruited from outside the EU. The coordinator believed that the shortage of applications could be associated with the relatively specialised knowledge requirements stipulated of applicants.

Whilst the number of EU universities with courses covering the core technical areas desirable for this project appear to be diminishing, classical universities outside the EU were deemed more likely to still cover some of these aspects as part of their

undergraduate and Masters programmes. Widening the scope of recruitment to include third countries worked well, although consultees had to overcome visa and mobility related challenges. Specifically, given that the project partners were situated in two different jurisdictions (i.e., QUB in the UK and Bell Labs in the Republic of Ireland), the circumstances presented an additional administrative challenge for non-EU students who had to obtain separate visas for the academic and industrial segments of the programme.

A2.4.4 Arrangements as regards supervision and training

The programme was divided equally between time in academia and time in industry. Fellows were assigned dedicated industrial and academic mentors to check progress, discuss work and identify training and career development needs.

Fellows had significant interaction with their supervisors, and commented that they were highly satisfied with the structure and frequency of supervision. Joint meetings between the researchers, industry supervisor and academic mentor were held routinely on a fortnightly basis. Weekly meetings between fellows and industry supervisors were organised during the industrial placement. During the academic segment, weekly meetings were held between academic mentors and fellows.

Partners worked together to organise training plans. Fellows received a number of different levels of training:

- standard training provided by the university to doctoral candidates such as on non-technical writing, scientific writing and research methods;
- technical training specific to the area of study provided by both the university and industry partner including the use of laboratories, instruments, measurements and technical software in RF;
- additional training on personal development and transferable skills; and
- further technical training provided through the European doctoral schools.

Consultees indicated that the training met all their expectations and was both sufficient and well delivered.

A2.4.5 Results

A2.4.5.1 Organisational level

Consultations indicated that the EID scheme enhanced research and innovation capacity in the subject domain. The number of dedicated fellows working on applied research provided an important boost to R&I capacity.

The university's previous experience of other ITN calls required transfer of permanent staff on secondment, which caused logistical and capacity challenges. The EID scheme offered the resources and flexibility to avoid such problems.

ARTISAN developed and greatly strengthened the university's collaboration with its industry partner. Prospects for future collaborations were significantly increased and the collaboration provided opportunities for both parties to leverage the relationship to generate further research outputs in the future. The scheme helped build the university's international reputation through engagement in international events.

The project had not yielded any commercialised outputs so far, although partners discussed opportunities for patents. At least one patent application had been made, although this was unsuccessful. If opportunities for commercialisation were to exist, the university acknowledged that industry will lead on the process. On the whole, it was felt that the project enabled significant headway in the intended research space.

Whilst no research fellows had been retained through the programme, the university highlighted that, subject to the availability of funding, researchers could be recruited in future. The university also noted the high quality and significant development of fellows over the course of the programme.

A2.4.5.2 Researcher level

Research fellows felt that the scheme had greatly improved their skills, career prospects and employability, particularly in terms of working with industry. The project coordinator agreed on this point. One fellow indicated that whereas he had been initially inclined to working in academia, the fellowship had shifted his career aspirations towards industry. Fellows felt that the developmental benefits of the EID scheme would have been difficult to acquire through other programmes.

Fellows received significant exposure to a practical research driven industrial environment and a very rounded view of industrially related research. The project coordinator suggested that fellows matured significantly, possibly much more than traditional PhD candidates who do not receive such exposure. Fellows have produced high quality research papers, and have participated and presented at international seminars to corporations and thought leaders. Consultees noted that whilst research papers and outputs produced through classical programmes are also of high quality, the opportunities to understand the context of the work is significantly higher in the case of EID. Consultations suggested that by the end of the scheme, EID fellows, through their breadth of experience, acquire the same level of career development as post-doctoral fellows with several years of academic research experience.

A2.4.6 Good practice

Consultees suggested that the project had been managed and delivered well. In particular effective evaluation and advisory mechanisms were built in to guide the development and monitor progress of the programme to ensure objectives were being met. Notably, QUB drew on a custom-built advisory panel of three to four academics to look at the actual delivery of the scheme against proposed objectives. Panel members engaged in depth with fellows to assess the need for technical reorientation of projects and training, and more widely evaluate delivery of the project. Advisory panels are used widely by the university to help guide and evaluate large scale externally funded projects. This approach has proven effective in the case of ARTISAN.

A2.5 ASIVA14: Analog Simulation and Variability Analysis for 14nm designs

Total project costs	€ 0.7 million
EU funding	€ 0.7 million
Project coordinator	TU Eindhoven, Netherlands
Number of partners involved	2
Project start date	September 2013
Project end date	August 2017

A2.5.1 Project description

The project responds to needs of the electronics industry, more specifically electronic design automation (EDA), for mathematical methods. Such methods can help in accounting for a large number of design considerations, e.g. process, voltage and temperature (PVT) variation, power consumption and process constraints. Advanced numerical methods are also a prerequisite for further size reduction in electronics design down to 14 nanometer.

The ASIVA14 project thus aims at

- Creating a network of European scientists in the field of mathematics for the EDA industry and computational science, to facilitate knowledge exchange on current ideas and developments;
- Train young researchers and prepare them for a career in mathematical methods for the EDA industry.
- In doing so, combining training in transferable techniques and skills (mathematical analysis, numerical methods, stochastic simulation) with a specialist understanding of mathematical models arising from challenges and problems in the EDA industry;
- developing advanced numerical methods and algorithms for the design, verification and variability analysis of Custom ICs at nanometer technology nodes (targeting 14 nm) to be integrated within leading edge transistor-level simulators.

The project is expected to result in further effectiveness and efficiency gains in the design and verification of electronics, on particular small scale electronic devices.

A2.5.2 Pathways to participation

The project consortium consists of two partners, who combine longstanding and in-depth experience and knowledge of challenges and problems in EDA. The partnership developed on the basis of first contacts between Mentor Graphics and Technical University Eindhoven (TU Eindhoven). On the basis of first interest in cooperation, both partners were looking for funding options.

The EID scheme seemed a perfect fit, as it allowed to combine academic research with industrial activities. It also allowed to combine 'classical' activities of a PhD programme, like basic research and training in basic technologies and methods, with real world application at one of the three lead suppliers of EDA software. The consortium was interested in applying mathematical methods to real world, industry challenges, and EID was a good scheme to allow this. The coordinator, who has previous experience working in industry, considered applying for an ITN project, which he has experience with – but he felt this was not well suited for a bilateral collaboration. Another alternative would

have been to apply for funding under the Horizon 2020 LEIT collaborative projects, however these would have not allowed to fund PhD training.

As a matter of fact, the coordinator has been successful in winning funding for a second EID project in the meantime.⁴⁹

As regards barriers to participation and scheme implementation, the coordinator advised that there were in his view no major differences between the ASIVA14 project and ITN projects he has been involved in. The major difference is that more partners and as a result, more people are involved in ITN projects – this adds to the complexity of managing the project. The main

In terms of implementation, two main problems were identified by interviewees:

- 'upward' mobility from countries with lower country coefficient to countries with higher country coefficient – this is not the case in ASIVA14, but has been a problem in HYDRO. If the fellow is employed in a country with a lower country factor and spends time in a country with a higher coefficient, the salary is insufficient;
- Secondly, implementing the mobility for non-EU citizens is very difficult, as it proved to be complicated to match the 6 months stays mandated by the EID project with Schengen rules and national labour market provisions. In ASIVA14, two of three fellows were sent back to the Netherlands after 3 months as the French labour market legislation dictates. The third fellow, an Indian national, was sent back to India for some time. TU Eindhoven had to spent substantial resources on legal advice and support.

The coordinator also felt that applying for an EID is only possible if there are existing contacts and cooperation to industry – he felt that this is a challenge for many academic institutions, hence demand for EID funding is lower than for ITN overall.

As regards reasons for which fellows had chosen the EID project over an alternative PhD position, they advised that:

- The salary offered was more attractive;
- TU Eindhoven was perceived to rank high in relevant university rankings;
- The suggested topics of PhD projects were very relevant to their individual interests;
- The ASIVA14 project offered the opportunity to leave their home country; and
- The particular appeal of working with Mentor Graphics, a global leader in the EDA field.

A2.5.3 Arrangements as regards supervision and training

The arrangements regarding supervision involved joint supervision from both TU Eindhoven and Mentor Graphics for each fellow. There are weekly meetings with both supervisors, and more detailed, written performance reviews every 6 months. Every two years, there is an in-depth interview with each supervisor to review the quality of PhD work and personal development. It was noted by fellows interviews that Mentor Graphic is a global leader in the field of EDA, and has a large proportion of PhD educated staff, which helped setting up and ensuring quality of the supervision. Fellows felt that the training and supervision arrangements overall were working well.

⁴⁹ HYDRA, which started in March 2016 http://cordis.europa.eu/project/rcn/199790_de.html [accessed 23rd December 2016].

The content and structure of the training delivered so far was described by interviewees as very high quality and relevant to individual PhD projects. In terms of transferable skills, fellows reported that they so far:

- Participated in a course on scientific integrity, which is offered to all PhD candidates at TU Eindhoven;
- Have been given the opportunity to tutor first year students at TU Eindhoven;

In terms of their specific scientific and technical training, they have participated in the following activities so far:

- Module in GPU computation (TU Eindhoven);
- Various scientific conferences;
- Individual tutoring sessions with senior engineers and mathematicians at Mentor Graphics

Fellows advised that it is difficult to assess whether the type of training, i.e. training in the same technical and scientific topics, would have been available in the absence of EID support. However fellows underlined that the quality and seniority of tutors and supervisors was extremely high, and would have not been available outside of the EID project.

A2.5.4 Results

As the project was still ongoing at the time of the case study research, no definite account of project results and outputs can be given.

At the individual level, fellows advised that the fellowship has increased their interest in a career in industry. One fellow said that before the fellowship, he was intend on applying for postdoc positions, but the industry experience during the EID projects has offered a broad range of complex, real world problems which has changed his preference towards a career in industry.

A further result mentioned by fellows was access to a network of senior engineers and mathematicians from industry and academia, which would have been difficult to come by otherwise.

In addition, fellows interviewed indicated that the EID project has helped them move country, however it was not possible to say whether international mobility would have happened anyway in the absence of EID funding.

In terms of project results, one fellow has published in a peer-reviewed journal so far. Fellows interviewed reported as well that they are working on solutions which are likely to be taken up in Mentor Graphic products and processes, and add direct value to these.

A2.5.5 Good practice

The coordinator offered a couple of suggestions, which can be taken up by future applicants:

- EID proposals should describe jointly the research challenges of the project, and aligned with these a structured training and supervision programme;
- Future applicants would benefit from contacting successful applicants in the same area of research and ask for advice or guidance.

A2.6 BIOCASCADES: Sustainable and Scalable Biocatalytic Cascade Reactions Training Network

Total project costs	€ 2 787 956,64
EU funding	€ 2 787 956,64
Project coordinator	Ruhr-Universitaet Bochum, Germany
Number of partners involved	11
Project start date	2015-01-01
Project end date	2018-12-3

A2.6.1 Project description

In BIOCASCADES, nine early-stage researchers investigate the development of sustainable (chemo) enzymatic cascade reactions under the 'green chemistry' philosophy. The BIOCASCADES project combines different techniques such as compartmentalization, protein engineering and reaction engineering in order to develop commercially viable and environmentally benign one pot reactions. By avoiding intermediate downstream- and purification-steps, cascade reactions minimize production costs, energy demand and waste production and are thus expected to make a major contribution for the development of sustainable and efficient production processes.

The BIOCASCADES program provides researchers with relevant scientific and practical skills to qualify them for careers in the European biotechnology sector. Scientific skills are developed through training at leading laboratories for biocatalysis and protein engineering. Industry secondments and workshops were also organised to develop their practical and entrepreneurial capabilities. Moreover, these activities provide access to a network of researchers and practitioners, expanding researchers' scientific horizon and enhancing their labour market prospects. As a result, the doctorates are going to be experienced in collaborative research between European academia and industry, which qualifies them for careers in both domains.

The project consortium consists of leading academic laboratories for biocatalysis and protein engineering (Ruhr Universität Bochum; KTH Royal Institute of Technology; University of Oviedo; Technische Universitaet Braunschweig; Technische Universiteit Delft; Technische Universiteit Graz; Universitaet Bielefeld; Ernst Moritz Arndt Universitaet Greifswald, Austrian Centre of Industrial Biotechnology), one large industry corporation (DSM) and a network of four smaller, innovative biotech companies (Viazym; Enzmicals; Saromics; Entrechem).

By combining their expertise, project partners can achieve results that would not be possible otherwise. Through this cooperation, the biotech companies are enabled to apply their knowledge to new fields without financial risk. Academic institutions gain insights about the marketability of their research and its practical relevance. The industrial partner receives access to research in areas with opaque profitability, without bearing the full financial risk. By mitigating the risks of researching the practicality of sustainable (chemo) enzymatic cascade reactions, BIOCASCADES poses a unique opportunity for all stakeholders. The resulting network of researchers and practitioners contributes to interdisciplinary innovation, career development and recruitment. This is expected to benefit participants and the members of the consortium likewise.

A2.6.2 Pathways to participation

The Ruhr Universität Bochum (RUB) was facing a deficit between its strong industry orientation and the actual success in commercialising research results. Only few innovations were transferable into an industrial setting. Similarly, sustainable (chemo)

enzymatic cascade reactions have rather been a focus of research. Industry has devoted little attention to this research area.

As doctoral training is a motor of innovation for the RUB, the organisation was inclined in trying new funding programmes with strong industry linkage. The EID scheme stands out in this context. In contrast to the European Training Networks (ETN) or the European Joint Doctorates (EJD), the EID scheme enables the RUB to develop research and researchers in direct response to industry needs. The mandatory secondment and the shared supervision are welcome additions. Even though it does not directly save the RUB's resources, participation in the EID scheme has the potential to expand the RUB's scientific and practical network and help it attract talented and ambitious researchers.

The EID scheme poses a unique chance to research sustainable (chemo) enzymatic cascade reactions whilst assessing their marketability. Within the project, the researchers are given opportunity to learn about industry needs regarding commercialisation. Consequently, the EID scheme eases the transition from academic invention to industrial innovation for all stakeholders.

Another benefit was that the scheme brings smaller research companies, academia and large industry corporations together. For small research companies, EID provides a way to present their technology and to generate reference projects to acquire new business in the future. The scheme is unique, as its results can be made public whilst remaining relevant to industrial commercialisation.

Partners for the programme were chosen by applying three main criteria, (1) scientific expertise in the field of biocatalysis and protein engineering, (2) market access and (3) competence in PhD education. Half of the current partners stem from previous cooperation, but it was difficult at first to convince the desired industrial partner to join the project. The EID scheme features high requirements for the industrial partner. Therefore this partner hesitated at first, fearing the complex task of coordinating the doctorates' supervision and training with others. However, after discussing the details of the secondment and the shared supervision, DSM was eager to participate in the project.

The EID provides a valuable chance to assess the marketability of an academic topic. Because of the generous financial support for the projects, the business risk of the industrial partner is relatively low (20-30% of the projects are typically suitable for commercialisation). In that way, the EID scheme functions as a catalyst for innovation.

A problem issued by the coordinator was the success rate of ITN applications, as one of their applications got rejected with a score of 94%. Since the application process is very time consuming with little chance of success, they are unlikely to apply for other ITNs in the future.

A2.6.3 Arrangements as regards supervision and training

The joint supervision is typically handled by one or two academic supervisors and between one and three private sector counterparts. One fellow reported to have three to four supervisors (one of which is designated as main supervisor). In her case, two supervisors were in Graz, including DSM, a multinational biotech firm. For her next placement at the Royal Institute of Technology (KTH), a supervisor in Sweden will take over the main responsibility.

There has been a good level of collaboration and communication with the industry partner and the industry supervisors. This is largely because of the fact that the industrial and academic partners have cooperated prior to the start of the EID scheme. As the fellow stated, *"All are pursuing the same goal"*.

However, there is no clearly defined training to be followed. There are telephone updates with supervisors on an irregular basis. In addition, the fellow reports her progress to the group of supervisors each year, and discusses with them the plans for the coming year.

The host institutions in the project, in this case the University of Graz, do not impose standard training plans and the restrictions imposed by the university are limited to yearly updates with supervisors.

Overall, the fellow was pleased by the flexible supervision arrangements. The coordinator was also very satisfied with the supervision by the industrial company and most of the smaller research companies.

The coordinator emphasized the demand for proactivity of fellows. As the EID PhD process is more complex and demanding for the fellows and the supervisors, the scheme is very beneficial for highly-performing students but has the potential to be disruptive for those with lower performances. The average PhD student might struggle with the high degree of freedom in combination with the challenging coordination of a multinational research project involving industrial and academic stakeholders. Whereas lower performing students might perceive this agenda and the associated workload as overwhelming, excellent students benefit strongly from the scheme.

The training courses provided concern scientific and technical topics, as well as networking events. The modules are not narrowly focused on the fellows' respective research area, but rather conceptualised to provide valuable insights in different areas of work and disciplines. Most training courses are facilitated by the academic partners and cover topics such as biocatalysis and protein engineering (TU Delft) or science and innovation and gender retreat (TU Graz). The trainings hosted by the industrial partner (DSM) concern a midterm report meeting and a workshop on IP and project management.

As one fellow stated, the EID project offers *"training and research along the value chain, from more basic research to aspects of manufacturing and product design"*. The secondment programme enables the students to see these various aspects in different environments.

The fellows value the training offered through the EID scheme as a central advantage in comparison to other doctoral programmes. While most of the other programmes also offer high quality academic training, the learning and networking events with private sector companies make it a unique opportunity for aspiring researchers. Two fellows stated the EID was their first choice doctorate programme, because it poses the best foundation for a research career in an industrial setting.

The range of networking activities, such as workshops and conferences, were particularly well received by the fellows.

The fellows reported to experience extraordinary quality of support, supervision and training in comparison to other PhD programmes.

A2.6.4 Results

BIOCASCADES aims to contribute to industrial processes, scientific publications and patents. In addition, it is supposed to facilitate capacity building of the smaller research companies involved, by enabling them to expand their area of expertise. As the project is still in an early stage, no significant tangible achievement could be reported.

In terms of the recruitment of researchers, the scheme benefits both academic and industrial stakeholders. It provides them with suitable candidates for postdoc vacancies, or industrial researchers respectively. This dual effect on the researchers' employability is a key advantage of the EID scheme in comparison to other funding schemes. In contrast to other doctoral programmes, the training provided within EID broadens the skills of the participants, thus making them suitable for a career as project manager or researcher. The scheme's benefits in terms of employability are perceived as a major advantage by all stakeholders.

The fellows highlighted the networking component of the project to be highly beneficial, as they gained access to a valuable network of professionals, senior scientists and researchers. By giving fellows opportunity to present themselves to employers on a regular basis, they believe that the project is enhancing their career prospects significantly. As one fellow stated, the project enables the participants to access a network of senior researchers that they would have otherwise had to build themselves over many years.

Another fellow noted that the EID scheme was her only option to engage in an international industrial research career. Having been given the opportunity to leave her home country to join the BIOCASCADES project, she now feels confident to find employment at one of the partners in her area of expertise.

A2.6.5 Good practice

All interviewees believed that the application process was well structured, transparent and efficient. Out of the 460 job applications that the BIOCASCADES project received, the 15 best candidates were identified and invited for an interview.

The process was not lengthy and answers were provided quickly. After a first phone interview, all candidates participated in a workshop in Hamburg. At the workshop, all candidates presented themselves and the EID project was introduced. The first interview did not feature a lot of professional or scientific questions. In the following recruitment event, each candidate was asked to present his or her Master thesis. The second interview then involved all supervisors, to discuss the technical and scientific details of the fellowship.

A2.7 COOPERA-TB

A2.7.1 Coopera-TB: Hit to lead optimisation of novel anti-TB scaffolds through an academic-industrial partnership



Total project costs	€ 1,174,366
EU funding	€ 1,174,366
Project coordinator	University of Birmingham (UK)
Number of partners involved	2
Project start date	February 2014
Project end date	January 2018

A2.7.2 Project description

The Coopera-TB project supports the development of early career researchers in the field of tuberculosis (TB) drug development. With the growing prevalence of Multi-Drug Resistant (MDR) TB strains, there is increasing need to explore new inhibitors and scaffolds that will facilitate the discovery of novel drugs.

The project is a research collaboration between the University of Birmingham (UoB) and GlaxoSmithKline plc, through their Diseases of the Developing World (DDW) Open Lab in Tres Cantos, Madrid initiative.

A2.7.3 Pathways to participation

The University of Birmingham had well-established links with GSK through other FP7 projects. The Coopera TB project provided an opportunity to strengthen these links further and develop early stage researchers who would gain significant exposure to an academic and industrial setting.

The EID scheme was the only funding mechanism that would have allowed the placement of fellows in applied industrial research for significant length of time. Most funding channels through research councils do not provide for multiple researchers and at most facilitate only up to three months at industrial sites. This was an important driver behind the university's decision to apply to the scheme. Neither partner had been involved in prior ITNs or other Marie Curie projects.

The significant industrial component and the opportunity to work with a company leader in the sector were amongst the reasons why fellows chose to apply to the scheme. The level of funding provided was also considered to be very attractive and better than other programmes.

No significant administrative, financial or other barriers to participation were noted. The project coordinator felt that the scheme provided adequate financial resources. Some minor challenges were noted in relation to recruitment. Challenges related to the need to meet stringent mobility criteria requiring that candidates had not lived or worked in the UK for a certain period. This also restricted the pool of applicants to choose from.

A2.7.4 Arrangements as regards supervision and training

The programme was split equally, with the first 18 months spent in an academic setting and the following 18 months in industry.

During the academic period, fellows typically updated supervisors on a daily basis about their work. There are weekly structured meetings between fellows and industry

supervisor (and with academic supervisors during the academic phase) and monthly teleconference with all partners to discuss progress and results. Fellows considered the quality and arrangements for supervision to be excellent on both sides.

Training was provided at different levels. EID fellows undertook standardised courses which were mandatory for all doctoral candidates. A few technical training modules were also developed specifically for the project and offered by both the university and GSK. The training provided by industry was unique insofar as fellows received access to resources and facilities not found in academic setting. Fellows were particularly satisfied with the level of industry training received, and felt it would not have been possible to obtain this in other programmes. The training equipped fellows with both technical and transferable skills. The scope of research and training plans was mutually decided and adapted by both partners.

A2.7.5 Results

Consultations indicated that the project has thus far achieved its intended research objectives.

As the project is far from completion it is not possible to assess final outputs. Nonetheless, the coordinator indicated that the project is on track to develop researchers who are highly trained and familiar with drug discovery in the fight against TB.

Consultations suggested that it was too early to assess opportunities for the development of intellectual property. The main expected output is the production and dissemination of high quality research through publications and conferences. It is expected that this will further enhance scope for future collaborations and the reputation of both partners in this field.

It was felt that the project helped significantly improve the skills, employability and career development prospects of fellows. Plans to recruit or retain fellows were not clear at this stage. One fellow cited that the funding provided by the programme offered the opportunity to attend conferences and meetings every year. The programme also provided access to a network of leading researchers, enabling fellows to remain up to date with latest developments on the field and in touch with experts in the research area.

One fellow indicated that the scheme had helped solidify his aspirations to work in industry after his studies.

A2.7.6 Good practice

Consultations suggest that the nature of collaboration between the partners was very effective, particularly in relation to regularity and structure of supervision arrangements. There was close cooperation between partners in identifying training needs, gaps and developing training plans which helped ensure a coherent and well integrated package to support the development of researchers.



A2.8 CRANE

A2.8.1 CRANE: Community and Ramp Aircraft Noise

Total project costs	€ 1,051,409
EU funding	€ 1,051,409
Project coordinator	Siemens (Belgium)
Number of partners involved	4
Project start date	November 2013
Project end date	October 2017

A2.8.2 Project description

The CRANE project facilitates a multidisciplinary doctoral training programme enabling early career researchers to address current and future challenges in community and ramp aircraft noise reduction. The project supports long term industry-oriented research and industrial uptake of innovative research findings. Reducing aircraft noise emissions is among the key priorities for the European aviation sector given the significant environmental impact of noise pollution and constraints it poses on airport activities, as well as the close links between low-noise technologies, fuel efficiency and air pollution.

CRANE supports the development of improved computational tools for acoustic design of aircrafts. These tools are better able to perform large scale acoustic simulations and account for real life complexity, through novel numerical methods, better integration with other engineering design tools, and stronger alignment with the needs of private sector end-users. The research program is supported by a range of courses bringing together the complementary expertise of the project partners in the field of aero-acoustics, computational methods, CAD methods and aircraft noise. This unique combination of multi-disciplinary training activities is needed to develop researchers with the appropriate blend of expertise to support the future evolutions of aircraft noise predictions.

A2.8.3 Pathways to participation

A2.8.3.1 Organisational level

The CRANE consortium is made of two chief partners leading the training and research programme (Siemens and the Institute of Sound and Vibration Research (ISVR) at the University of Southampton) and two associated partners (KU Leuven and Rolls-Royce).

The collaboration between the lead partners was supported by the strength of the expertise of both organisations in the field of aircraft acoustics. Siemens considered ISVR to be among the leading global experts in sound research and was keen to work closely with the Institute to draw and build on its expertise.

Both ISVR and Siemens enjoyed good relations in the past, through some (though limited) prior collaboration via Innovative Training Networks (ITN). The CRANE project provided an opportunity to strengthen this collaboration. Associated partners were also involved areas of research that were in very similar to those of lead partners. Associated partners also provided important complementary support to the research program. Of the four partners involved in the consortium, Rolls-Royce was the only new collaborator.

Siemens indicated that a major strength of the EID compared to other similar programmes was the flexibility offered by the scheme to help define, modify and adapt the scope of the research. This flexibility supports industry innovation.

Industry partners believed that traditional collaborative projects are less flexible and iterative in nature. For this reason, these partners found that EID offered greater scope to influence the methodologies for investigation. The EID was also deemed appealing as it provided a boost to research capacity with four full time fellows allocated to the project.

Siemens noted that it would be more difficult to increase research capacity through traditional forms of collaboration involving permanent staff, given their workloads. More conventional doctoral programmes, including those with an industry element, do not enable researchers to spend significant lengths of time in industry.

Stakeholders also felt that the scheme's focus on the development of early stage researchers was a relatively unique and appealing feature which greatly supported high-level upstream industrial research. Other schemes typically funded older, more experienced researchers with less emphasis on the critical early stages of research.

A2.8.3.2 Researcher level

Research fellows consulted for this study cited the split between industry and academia and the alignment of the project with their research interests as key reasons for their application and interest in the scheme.

Fellows had become aware of the scheme through different channels, including through universities and companies which had kept their details from previous expressions of interest for internships.

Fellows had also applied to other doctoral programmes. In most cases, these were programmes with very little industry exposure.

A2.8.4 Arrangements as regards supervision and training

Lead partners agreed to split fellows' time equally between academic and non-academic sectors (18 months in industry and 18 months in academia). This equal split was aimed to ensure maximum collaboration between both partners and to guarantee a rounded learning experience for fellows.

Fellows had significant interaction with their supervisors. Weekly calls were organised between fellows and their industrial and academic supervisors. Siemens deemed the exchange between academic and industry partner to be very beneficial, with core involvement of both parties in the supervision process.

Fellows received:

- Standard training provided by the university to all doctoral candidates on areas such as research methods and scientific writing;
- More specialised training on key research topics relevant to EID fellows;
- Industry training provided by Siemens and Rolls-Royce; and
- Other external training provided at European level.

The training plan was agreed in collaboration between partners. Siemens also highlighted that sub-partners were actively involved in this process. Rolls-Royce provided important aspects of the training and exposure to their facilities and advice on the direction of the research. Training gaps were addressed where possible through the provision of external training.

A2.8.5 Results

A2.8.5.1 Organisational level

An important benefit noted by industry was the notable boost to research and innovation capacity delivered by the scheme. Siemens indicated that it would be difficult to obtain through other channels the possibility to have four dedicated researchers working for extended periods on a specific research area.

The scheme offered the capacity and freedom to do what otherwise would not have been possible, or achievable internally without funded capacity. Nonetheless, Siemens also suggested these benefits could have been increased further if the length of the scheme was extended to allow for more time with industry, without compromising the degree of academic engagement.

Consultees lauded the strength of the collaboration between academia and industry fostered through the scheme. It was felt that this was definitely enhanced through the mutual decision to split the programme equally between time at industry and academia. Siemens felt that a smaller allocation of time to academia may have resulted in less engagement and ownership from their academic partners. In this way, all partners felt involved and followed the research. This set-up was different from other schemes such as ETNs, which are characterised by greater involvement with industry at the expense of academia. Whilst the number of partners involved in these schemes was larger and allowed more scope for networking, the strength of the collaborations was significantly greater in the case of the EID.

The EID scheme also opened up channels for recruitment and retention of researchers. Although no researchers had specifically been recruited thus far through the programme, Siemens has hired Marie Curie fellows in the past. Importantly, Siemens noted that the significant period of time spent between supervisors and fellows over the three year period provides an extremely valuable screening mechanism to fully gauge the potential of fellows and how well they will fit into the company.

Industry partners felt that whilst more research was needed, the scheme had helped them make significant headway in terms of their intended research objectives. Given the more theoretical nature of the research in this context, there were no tangible outputs such as patents, product development or entrepreneurial spin-offs.

A2.8.5.2 Researcher level

Fellows considered the scheme to have significantly improved their employability and prospects for career progression.

The quality and scope of the training provided, on the whole met the expectations of fellows. Given that both Siemens and ISVR were leading players in the field of study, fellows largely felt that it would not have been possible to receive this training through other means.

Training entailed both hard technical skills and transferable skills such as commercial management and communication, which would not have been readily acquirable through conventional doctoral programmes. Other benefits cited by consultees were the opportunities to develop interdisciplinary and application-based research skills.

Fellows also felt that it would be beneficial to increase the length of the programme. In particular where subject matter is new, the learning process in the initial phase of the programme is likely to be slower. Additionally, it could take a significant amount of time to acquire the technical skills to make significant headway in the research. Extending the length of the programme could create greater scope for core industrial research.

A2.8.6 Good practice

Both coordinators and fellows found the scheme to be well managed. In particular, the consensual decision between partners to split the programme equally between academic and industry time yielded important benefits by:

- Enabling stronger partnerships to be formed;
- Enhancing cooperation; and
- Avoid any conflicts or confusion that could otherwise have arisen among both partners and fellows over the direction and technicalities of the research.

The CRANE consortium benefitted from the active involvement of lead partners and sub-partners in the development and provision of training and setting the research direction. The degree of involvement of all partners helped to improve the effectiveness of the programme.

A2.9 JMAP – Joint Max Born Institute – Amplitude PhD programme

Total project costs	€ 0.9 million
EU funding	€ 0.9 million
Project coordinator	Max Born Institute, Germany
Number of partners involved	2
Project start date	September 2012
Project end date	August 2016

A2.9.1 Project description

The project aimed at training four Early Stage Researchers (ESR) in the framework of the development and application of state-of-the-art laser equipment. In particular, the project aimed to advance research in attosecond science, by improving the carrier envelope phase (CEP) stability of available optical parametric chirped pulse amplification (OPCPA) laser systems and by contributing to the development of novel laser systems that allow performing experiments at unprecedented repetition rates. Secondly, the project aimed to contribute to research on mid-infrared strong-field ionization, which is of relevance to studies of molecular dynamics and of laser filamentation and charged particle acceleration in relativistic laser fields.

The project was coordinated by the Max Born Institute (MBI) in Berlin, with the participation of Amplitude, a leading manufacturer of compact ultrafast lasers based in France. Through the project, Amplitude gained access to knowledge relevant for the development and delivery of CEP stable laser amplifiers, high repetition rate laser systems, intense mid-infrared laser pulses and 100 TW lasers with unsurpassed pre-pulse contrast ratios.

Besides the provision of training and career opportunities for the ESRs, the project was also expected to strengthen and expand the already existing collaboration between MBI and Amplitude.

A2.9.2 Pathways to participation

The initial motivation to apply for EID funding was twofold. First, the coordinator had very long and very positive experiences with the Marie Curie programme. He was the coordinator of one ITN project and one IAPP project under FP7, as well as a Research Training Network in FP6. In addition, he was awarded a Research Training Fellowship under Marie Curie in 1993. At the outset, there was therefore strong conviction of the relevance and added value of Marie Curie. The coordinator even suggested that in the field of attosecond laser research, Europe was able to take an early lead in large part due to the existence of some Marie Curie networks.⁵⁰ The possibility to have PhD candidates trained at different institutions, but working on one experiment or research project was particularly commendable and convinced the coordinator of the scheme's added value.

Secondly, the coordinator could build on a longstanding personal cooperation with Amplitude, and there was a lot of ongoing cooperation between MBI and Amplitude already. MBI and Amplitude previously collaborated in FP7 IAPP project FLUX, and have

⁵⁰ For instance the Marie Curie Research Training Network 'XTRA' in FP6 and the Marie Curie Industry-Academia Partnership Program 'FLUX' in FP7.

worked on other collaborative EU projects such as FLAME, a project funded under FP7's Research for the Benefit of SMEs pillar.⁵¹

The EID scheme thus combined the opportunity to further strengthen existing collaboration in attosecond research. Alternatives that were considered at the time of application included the Marie Curie FP7 IAPP scheme.

The application process itself was fairly straightforward, with MBI leading the proposal and bringing in their rich experience in EU projects.

A2.9.3 Recruitment and hosting arrangements

There were a number of issues and complications during recruitment of ESR. First, at the time the contract started, recruitment had already commenced but had not led to the identification of qualified candidates. A second call for application therefore was published, which led to the identification of suitable candidates in spring 2013, after the initial delay. However, a number of complications meant that candidates did not start their EU funded fellowship until October 2013.

The second call for applicants attracted a high number of good applications. When identifying suitable candidates, it was clear that applicants were specifically interested in the industrial element of the PhD.

Initially, the consortium had agreed that MBI would recruit all PhDs into the project, however this arrangement caused a number of problems. Two candidates did not meet the mobility rules set out by the scheme, and could therefore not be recruited by MBI. They instead had to be employed by Amplitude in France. Employing the candidates in France caused further delay as by French labour regulation, the company had to prove that the positions could not be filled by French PhD candidates. In addition, because of the country coefficients for France and Germany, salaries offered to the candidates differed substantially. MBI and Amplitude agreed to stock up funding from own resources and used part of the EU funding provided for management to level out salaries.

In addition, a third candidate who was not a EU citizen went through considerable difficulty in having a visa approved.

Between the call for applications and the start of EID fellowships (after the above issues were solved), two of the candidates received short-term MBI positions in order to start their work.

Another complication of the recruitment and hosting arrangements turned out to be the very ambitious plans with regards to mobility. Whilst all four students were working on similar research projects, they were expected to move between the institutions multiple times. The coordinator felt this was a substantial burden on the candidates, and highlighted the need for specific cost category or alternative payment arrangements to cover the substantial overheads of mobility. This holds particularly true for ESR with family and ESR who are not EU citizens. Again, the consortium agreed to provide additional funding through lump sum support for the costs incurred during each move and agreed to guarantee a net salary for all ESRs that was higher than the net salary that the ESRs would receive according to the Marie Curie rules (which in the view of the consortium had not adequately taken the added costs associated with the required mobility into account).

Fellows interviewed stated that they were primarily interested in working at the highly reputed organisations participating in the project. One fellow interviewed explained that a

⁵¹ <http://www.flame-smereasearch.eu/> [accessed 26th October 2016].

general application was submitted, and he was then given the choice between a regular PhD opportunity and the EID.

The choice fell on the EID as it is a very renowned scheme, and the prospect of spending some time in a world-leading company in the area of ultrafast lasers sounded very appealing. The fellow was particularly impressed by the combination of MBI, a very strong place for fundamental research, and Amplitude, a manufacturer of ultrafast lasers considered leading in the field.

Furthermore the PhD topics proposed were corresponding with the research interests of the fellows interviewed. Last, the salary offered was deemed to be very attractive.

Fellows stated in interviews that they perceived the differences in living allowance paid out to fellows to be unfair – an issue resulting from the project not being able to recruit all fellows at MBI in Germany.

Fellows also corroborated views of the coordinator on issues surrounding visa approval and mobility requirements. Visa regulations in both France and Germany mandated that fellow who were non-EU citizens had to re-apply for visa once they had left either country for more than six months. Secondly, mobility requirements were thought to be cumbersome, as a lot of time was invested in securing housing and arranging individual moves. Fellows were supposed to move six times initially, but this was negotiated down to four moves each for fellows with family.

A2.9.4 Arrangements as regards supervision and training [maximum half a page]

A2.9.4.1 Supervision

Arrangements with regards to supervision were set up in accordance with the recommendations from the principles of innovative doctoral training. A career and personal development plan (PDCP) was set up for each fellow, and research plans as well as joint supervision arrangements were agreed between the fellow and two supervisors each. In addition to regular bilateral catch ups, the project held so called 'network meetings' to discuss and review individual progress in detail.

For two fellows, these arrangements were not working out as planned. In their view, they did not receive necessary access to equipment and laboratories, voiced concerns about limited supervision and were not guided to conduct research activities of value to their PhD project. As these issues could not be resolved, the coordinator requested the project officer at the Research Executive Agency (REA) to allow these two fellows to move location, staying under joint supervision but moving location. The request was refused with reference to the legal requirements of the scheme which mandate that fellows should spend at least 50% of their time at the non-academic partner.

As a consequence of these complications, two fellows left the EID project and continued their PhDs as 'regular' PhD candidates at MBI, paid for from MBI and Amplitude's own resources.

A2.9.4.2 Training

The training programme set out for the project included a combination of technical training, entrepreneurial training and training in transferable skills.⁵² Technical training was offered by all partners and covered in particular training of technical capabilities related to the research areas of the project, and use of specific equipment and tools. Entrepreneurial skills training was offered by Amplitude and included e.g.:

⁵² Details in JMAP mid-term project report, made available to case study researcher.

- training in basic general management skills
- training on intellectual property rights and patents
- training on the development of negotiating skills
- training on the do's and don'ts of start-up companies

Training in transferable skills was offered by MBI and included

- training in educational skills (teaching opportunities / supervision of junior students)
- project management training
- training in language skills
- training in general job skills (curriculum vitae, interviewing)
- career prospects and planning after the network employment

Training needs and interests of individual fellows were discussed and set out at start of each fellowship, and monitored through PDCP.

Much of the technical training offered was not available to 'regular' PhD candidates at MBI.

A2.9.5 Results

In terms of research results the project was a success, resulting in a considerable body of peer-reviewed publications and potential for the company to use research results in their business activities.⁵³ However, the project carried a substantial management overhead given the issues discussed further above. Initially, the project helped in recruiting a strong cohort of high quality PhD candidates. However in the view of interviewees this might have been possible without EID support.

In addition, the project incurred substantial additional costs.

- MBI and Amplitude compensated the ESRs for extra mobility costs making use of their research, training and network budget, by guaranteeing that ESRs without family received a €2250 net salary, and ESRs with family received a €2500 net salary;
- MBI and Amplitude provided a payment of 1500 Euro to ESRs each time that they changed their primary host location for a minimum of 3 months;
- In addition, MBI and Amplitude incurred further costs since two fellows needed to be transferred to employment as 'regular' PhD candidates (at the salary rates agreed upon in their contract) before the planned end of their EID fellowship.

At the researcher level, fellows were of the opinion that the combination of MBI and Amplitude definitely helped in developing their technical and transferable skills. At the same time, fellows were satisfied with the scientific achievements during the project overall, however noting difficulties with joint supervision and mobility in some cases as outlined above.

Fellows felt that the project results and scientific achievements are particularly helpful for PhD candidates who are planning to work in applied research. However, for PhD candidates who plan a career in academia the project did not allow for enough linkage between work in the company and work at MBI and this reduced time available for completing a PhD with strong focus on basic research and fundamental science. It was also felt that the strong focus of the project on industrial application prevented some

⁵³ See project final report, made available to case study researcher.

fellows from developing a more specific expertise, which would have helped in continuing a career in academia.

In terms of job and career prospects, one fellow advised that he has received a job offer from industry.

In summary, the JMAP project delivered results despite challenges during implementation. In the view of interviewees, many of these results would have been possible in a simpler setup and bilateral cooperation between the JMAP partners outside of the EID scheme.

A2.9.6 Lessons learnt

In terms of lessons learnt from this project, interviewees advised on the following points:

- Costs associated with mobility requirements can be considerable, in particular for ESR with family and non-EU citizens. Further consideration should be given whether these costs can be offset by additional reimbursement in the scheme design, or whether mobility requirements can be loosened;
- Mobility requirements, in particular the 50/50 split of researcher time, were deemed very strict for a project including partners from two countries – there should be more flexibility in implementing the mobility requirements, particularly when issues with joint supervision or the individual PhD research programmes are encountered, to ensure that PhD candidates can complete their work within time, and at the highest standard with best supervision possible – the focus of the scheme should be on benefits to candidates/PhD candidates, and not on enforcing scheme rules
- Integration in research groups and company can be challenging – therefore individual supervisors should be urged to take more responsibility during fellowships.

A2.10 ZeoMorph: A new concept in zeolite catalysis: Morphology induced shape selectivity

Total project costs	€ 1.5 million
EU funding	€ 1.5 million
Project coordinator	Oslo University, Norway
Number of partners involved	2
Project start date	September 2013
Project end date	August 2017

A2.10.1 Project description

The project is built on the prospect of developing a new concept with shape selective zeolite catalysis – morphology induced shape selectivity. The project aims to demonstrate this new concept by a number of catalysts which will be examined in industrially relevant hydrocarbon conversion processes.

The project aimed to achieve this overall research objective by bringing together leading European groups within physical and inorganic chemistry. The catalysis research group at the University of Oslo (UiO) in Norway and Danish industrial partner Haldor Topsøe (HTAS), a world leader in catalysis and process plants based on the catalytic process, based in Lyngby near Copenhagen are full network participants. Research groups at the University of Torino (UniTo, Italy) and Aarhus (AU, Denmark) with unique competence within spectroscopy and computational chemistry will be associated partners in the project.

The ZeoMorph trains five early stage researchers during their PhD. These early stage researchers will spend 50 per cent of their time in the industrial sector at HTAS and the remaining time will be divided between extended stays at the partner academic host UiO and 3 month stays at the associated partners.

The project aims to ultimately develop improved and new zeolite based industrial processes.

A2.10.2 Pathways to participation

The project consortium included two main beneficiaries at Oslo university, Haldor Topsøe. The project proposal was built on a previous cooperation. It was previously funded by the Norwegian Research Council and from own funds directly. The project also included a number of associated partners from previous collaborations, Aarhus University and Torino University.

In terms of selecting the EID scheme over other funding options, one of the contacts in the company management knew about the scheme and advised that it required specific industry academia partnerships and would be a good fit. On the other hand, the cooperation between Oslo University and Haldor Topsøe was always built on PhDs as work force, hence the focus on training was also a natural element of the project idea.

The consortium had to submit two proposals, and only the second proposal was successful. The biggest barrier to participation was to understand the proposal template. Help in the form of the university's EU funding team ensured the success on second attempt.

The consortium chose EID funding over an alternative scheme at the Norwegian Research Council, which would have not allowed cross-national training of PhD and would have not offered funding for Haldor Topsøe, as they are based outside of Norway.

A2.10.3 Arrangements as regards supervision and training

The recruitment process was coordinated by Oslo University, resulting in a high number of applications. Whilst it was challenging, the project managed to recruit five candidates in short order.

However, interviewees noted that the requirement of spending at least 50 per cent of their fellowship in industry is a stressful requirement of the EID scheme. As each move needs a renewed phase of settling in, the number of moves to ensure 50 per cent of the fellowship is spent in industry can mean that the time left for progressing the scientific research needed for the PhD project is reduced.

Overall, interviewees felt that the joint supervision arrangements worked well. Apart from weekly catch ups with candidates, there were bimonthly project meetings which included individual progress reviews. Interviewees felt that a main prerequisite for the arrangement working well was the established working relationship between the academic partners and the industrial partner.

There were some institutional rules at Oslo University which meant that fellows had to spend more time at the university than was foreseen by the EID project. Occasionally, this caused extra travel but in general there were no major conflicts between EID rules and institutional requirements for PhD candidates.

In terms of training provided to EID fellows in the context of the project, the mandatory PhD curriculum at Oslo University has been amended for the researchers supported through Zeomorph. In addition, the EID fellows have been able to follow technical courses at Oslo University as well as the associated partner Aarhus University. This helped in ensuring progress in technical and scientific work both in Oslo and at the location of the industry placements.

In addition the project's training programme included a number of international summer schools and seminars. All of the candidates have been to two 1-2 week summer schools held over the world, as part of the individual training plans. During their on the job training in the company, EID fellows are involved in business-related work which is prioritised very differently and more short term.

Overall, fellows interviewed felt that the training offered was very relevant and of high value to their individual PhD projects. Interviewees also felt that the training offered substantial added value when compared to PhD candidates not supported through the Zeomorph project.

A2.10.4 Results

At the organisational level, the project did not have a major impact on the capacity to win further funding. The coordinator noted that he was specifically discouraged by the low (and decreasing) success rate of ITN and EID calls for proposals.

However interviewees felt that the project had a strong reputational effect. In addition, the coordinator's research team benefited from additional performance based funding that was made available by Oslo University after having won the EID project.

At the individual level, fellows have produced a number of articles in peer-reviewed journals so far.⁵⁴ No interview was able to judge whether the project will have improved

⁵⁴ An overview can be found on the project website:
<http://www.mn.uio.no/kjemi/english/research/projects/zeomorph/dissemination/>

their career prospects, or whether they would be offered employment in the non-academic sector.

In terms of commercial results, at the time of case study research one of the fellows had submitted a patent application. Furthermore, fellows have developed specialist equipment that will directly benefit the industry participant, however interviewees were unsure as to whether these improvements would translate into the actual products and services that Haldor Topsøe are offering.

A2.10.5 Good practice

In terms of good practice and recommendations for future EID projects, the coordinator advised that it would be useful to reduce the minimum time required of fellows to be spent in the non-academic sector. A reduction to spending 12 out of 36 months in the non-academic sector would give fellows more flexibility to complete their academic research project within time, whilst still ensuring that substantial ex

Annex 3 Comparator programmes

This annex provides the results of the in-depth comparator programme analysis, which covered four programmes:

- The Industrial PhD programme, Denmark;
- The Industrial Agreement of Training through Research (CIFRE), France;
- Industrial graduate programme, Sweden and
- Industrial CASE studentships, United Kingdom.

A3.1 The Industrial Researcher Programme, Denmark

In Denmark, the Innovation Fund (innovationsfonden.dk/en) has implemented an industrial researcher programme, which encompasses industrial PhDs and industrial postdocs⁵⁵. The industrial PhD programme was established in 1971 but reformed in 1988 to comply with Danish PhD regulations⁵⁶.

The programme's purpose is to educate and develop research talents into industrial researchers specialised in creating growth and employment in Denmark's business sector through research, development and innovation (Guidelines for The industrial PhD programme, 2015)⁵⁷. To join the programme and support a PhD project, a company and a university send a common application to the Innovation Fund⁵⁸. Applications are evaluated based on their commercial relevance and scientific quality.

The company, the university, supervisors and the candidate must meet a number of requirements when jointly applying for an Industrial PhD⁵⁹. For example, the company must have a division which is geographically located in Denmark, be able to provide facilities and financial support for the entire project duration, and assign a company supervisor and co-supervisor for the project. Through the PhD programme, the candidate is employed by a Danish division of a company and at the same time enrolled at a university. The candidate has a supervisor at the university as well as at the company.

The company pays the candidate's salary and receives a salary subsidy from the Innovation Fund equivalent of €2,300 per month for three years (the stipend is limited to 50% of gross salary expenses). The university also receives a subsidy for supervision, equipment and additional expenses for the candidate's education (€33,800 for projects within the fields of social science and the humanities and €48,300 for projects within the

⁵⁵ <http://innovationsfonden.dk/en/application/erhvervsphd> [accessed 16th September 2016].

⁵⁶ http://innovationsfonden.dk/sites/default/files/the_effect_of_the_industrial_phd_programme_on_employment_and_income_v4_1.pdf [accessed 16th September 2016].

⁵⁷ http://innovationsfonden.dk/sites/default/files/guidelines_for_industrial_phd_09.03.2015.pdf, p.1 [accessed 16th September 2016].

⁵⁸ To be valid, an application needs to have both a company and a university which means that an Industrial PhD candidate can not apply without having found a company yet (<http://innovationsfonden.dk/en/faq-potentielle-ansogere>).

⁵⁹ The full list to requirements and eligibility conditions for funding are provided in the Guidelines for Industrial PhD at http://innovationsfonden.dk/sites/default/files/guidelines_for_industrial_phd_09.03.2015.pdf [accessed 16th September 2016].

fields of natural, technical, agricultural, veterinary and health sciences)⁶⁰. It is possible for several companies to collaborate on a single industrial PhD project.

A3.1.1 Overall statistics

A3.1.1.1 Budget

According to the programme manager, the yearly budget of the industrial PhD has been stable over the last five years, and represents approximately €16 million per annum (120 million Danish crowns). Each stipend that the Innovation Fund gives is about €134,000 (1 million Danish crowns). Since 2010, there is a special application for industrial PhD projects in the public sector⁶¹. For 2016, €1,34 million (10 million Danish crowns) are allocated for projects of this specific scheme.

A3.1.1.2 Number of participants

The number of participants underwent a steady increase between 2002 and 2007 (from 50 to 110), and has since remained relatively stable. Since 2007, the programme provides support to an average of just over 100 PhD candidates on a yearly basis. Concerning the public sector scheme, there are 10 stipends per year.

A3.1.1.3 Success rate

The programme funding rate has not undergone any significant evolution over recent years (i.e. since 2007). This has generally stood at c.a. 60%. It is worth mentioning however that the programme funds all eligible projects. As such, it is more appropriate to speak of a 'funding rate' rather than a selection rate. The decision on behalf of the government to fund all eligible projects was taken in light of the relatively low share of industrial PhDs in the overall number of PhDs in the country (c.a. 4%).

A3.1.2 Distribution by scientific disciplines

The industrial PhD programme is open to all scientific fields. Therefore, all kinds of projects are funded: 75 to 80% are within the natural sciences, and 20 to 25% within the fields of humanities and social sciences.

Within the natural sciences, the technical sciences and the biotechnological sciences are dominant. The amount of social sciences and humanities applications has increased since 2007 and also since the turn of the millennium (in 2000 there were almost none). In 2007 they were about 10 to 15%, and then 20 to 25% as a baseline for the last five years⁶². At first sight, it seems surprising to observe this trend for the humanities and social sciences since most of the companies involved in the programme are industrial. This can be explained by the fact that the projects often seen in social sciences and humanities are related to learning, organisation and management, organisational psychology. These research fields are highly appreciated by companies, and particularly industrial or multinational companies which have many different departments and branches that work together on reaching common goals.

⁶⁰ 85 % of the university subsidy is paid out at the project's commencement. The remaining 15 % is paid out when the Fund has received documentation for the candidate's obtainment of the PhD degree. If the candidate does not obtain the PhD degree, the final 15 % are annulled – see the Guidelines for Industrial PhD (p.10).

⁶¹ The target of the public sector scheme are public sector organisations without significant industrial experience such as municipalities, public schools, vocational institutions, nursing schools, hospitals and other research organisations as long as they don't educate PhDs themselves.

⁶² However, there are some fluctuations. For example, in 2016 there was an unusually low number of applications within the humanities and social sciences.

A3.1.3 Type of participants and partner organisations

A3.1.3.1 Participation by type of organisations

As mentioned above, the purpose of the Industrial PhD programme is to foster closer collaboration between enterprises and universities, by educating and developing researchers with an insight into business aspects of research and innovation. Unsurprisingly, the participants and partner organisations involved are mostly Higher and secondary education institutions (HEIs) and private commercial organisations (PRC). With the creation of the public sector PhD programme however, certain public sector organisations such as municipalities, vocational institutions and nursing schools have become eligible to participate. It's also possible for foreign universities to participate, and receive higher subsidies than local ones⁶³.

A3.1.3.2 Funding awarded by organisation type

Table A3.1 Industrial PhDs and Regular PhDs

Types of organisation	Covered expenses	Subsidies
Private/Commercial organisations	Wage expenses	2,300 euros/month
Danish HEIs	Academic supervision; other expenses	48,300 euros/project Social sciences and humanities: 33,800 euros/project
Non-Danish HEIs	Academic supervision; other expenses	60,400 euros/project Social sciences and humanities: 42,300 euros/project

Source: *Guidelines for Industrial PhD (version of 09/03/2015)*

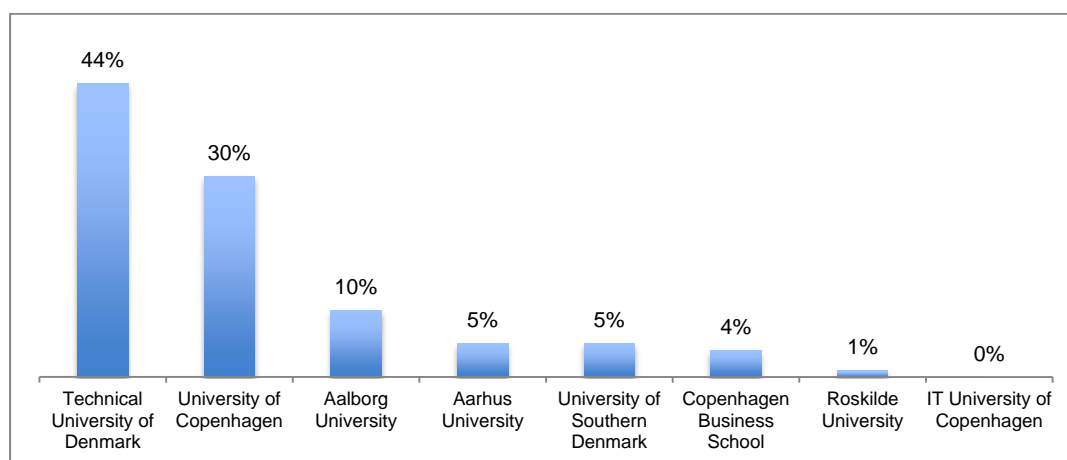
A3.1.3.3 Academic partners

As indicated above, most Industrial PhDs focus on technical and biotechnological sciences. The majority of the candidates are therefore attached to the Technical University of Denmark (44%). The second largest source of Industrial PhDs is the University of Copenhagen (30%), followed by Aalborg University (5%). Very few Industrial PhD candidates graduate from Roskilde University and the IT University of Copenhagen⁶⁴. Finally, it's worth noticing that there is a low rate of non-Danish universities in the programme (c.a. 98% of host universities are Danish).

⁶³ €42,300 for projects within the fields of social science and the humanities and €60,400 for projects within the fields of natural, technical, agricultural, veterinary and health sciences – see the Guidelines for Industrial PhD (p.10).

⁶⁴ The data refers to all universities the Industrial PhDs have been attached to in 2010 or earlier – see Danish Agency for Science Technology and Innovation (2013).

Figure A3.1 Main academic partners involved in the industrial researcher programme (2010)



Source: Danish Agency for Science Technology and Innovation (2013)

A3.1.3.4 Type and size of the non-academic participants involved

The great majority of non-academic partners participating in the scheme are enterprises. In 2013, approximately 60% of the partner companies were companies with more than 249 employees. The pharmaceutical industry, which is highly research-based, has a significant number of Industrial PhDs. Production companies (i.e. wind industry) also have a high share of industrial PhDs. The remaining companies are small and medium-sized enterprises – 20% are small and 20% are medium-sized. It is worth noticing that in 2013 the share of participating firms with less than 50 employees (30% of all firms) was higher than that of firms with between 50- to 249 employees (just over 20%).

Most of the non-academic participants are research-driven firms, regardless of their size⁶⁵. However, the public sector PhD programme was specifically intended to target non-research intensive public institutions. Interestingly, among the small companies, there are often spin offs from universities. Spin offs are eligible to participate as long as they meet the criteria for being a private sector company⁶⁶.

A3.1.3.5 Industrial PhD candidates

There are two main groups of industrial PhD candidates. The first which is the largest are those who have received a master's degree and want to continue on with a PhD. They have been on the labour market for a couple of years also and want to work with industry. The other group (about 10% of the industrial PhD candidates) are people who have a significant work experience. Most of the time, these are people in their 40s or 50s who have PhD ambitions but have not pursued them before. The latter generally conduct their research work in their host firm.

A3.1.4 The role of interdisciplinary, cross-sectoral research in the programme

The programme has adopted a 'bottom-up' approach to project identification and selection, and does not have any particular thematic restrictions. As such, the programme does not set any particular focus on interdisciplinary research.

⁶⁵ According to the programme manager, there are about 15 to 20% of partner companies which are not research-driven.

⁶⁶ The Innovation Fund requires the company to have made the majority of its revenue on the market. If more than half of the company's revenue comes from public subsidy, it's categorised as part of the public sector.

The programme manager states that there are some examples of multi-party collaborations through cross-sectoral research projects. Interdisciplinary research projects are usually quite carefully planned and are very often successful.

A3.1.5 Implementation of the programme

Industrial PhD candidates typically spend 50 percent of their time in a company and 50 percent of their time at a university while taking the degree⁶⁷. The share of time spent in the non-academic sector however varies strongly on a project by project basis, as well as throughout the PhD research project. The traditional approach is to spend the first half of the project gathering data in the company and then to spend the last half compiling it and writing the thesis, so the first half will be mainly at the company and then the second at the university.

According to the new guidelines of the programme (2015, p.2), there is no requirement for candidates to spend a set minimum amount of time at the university and company. In practice, the candidates will spend a higher share of time with the party that initiated the project collaboration.

A3.1.6 Results of the programme

A3.1.6.1 Skills acquisition

There is limited information regarding the specific types of skills acquired by Industrial PhD candidates during their training. One company partner interviewed as part of this case study indicated that Industrial PhD candidates “have a deeper insight into industrial R&D. They are better prepared to understand what it means to pursue an industrial career rather than an academic career. They learn to work on the most recent machines”. In addition, from the company point of view, the advantage of hiring a former industrial PhD candidate is that they know them, they have seen them operate, hiring is not only done on the basis of a one-day interview. The same interviewee went on to indicate that this is a strength and also a weakness in terms of supporting diverse recruitments.

Partner companies and universities were surveyed in 2007 regarding their satisfaction towards the PhD candidates’ progresses in terms of theoretical skills and practical experimental skills. 73% of the enterprises agreed with the following affirmation: “*An industrial PhD candidate is business minded and thus a good candidate for the business world after completing the education*”; the rest of them somewhat agreed. Less than 1% (0,6%) disagreed completely with the affirmation. It comes as no surprise that a significant share of Industrial PhD holders go on to work in the private sector (80% compared to c.a. 30% of non-industrial PhD holders). This is a particularly welcome trend given the fact that in Denmark, the number of PhDs being trained has more than doubled since 2000 while the number of positions at universities has remained stable.

The study on the effect of the Industrial PhD Programme on employment and income (2013) did show that industrial PhDs do tend to have higher salaries because they are in the private sector. Nevertheless, industrial and conventional PhDs working in the same sector tend to have similar salary levels (public/private). This means that there is no difference in income between Industrial and conventional PhDs when comparing salaries within the public and private sector, respectively⁶⁸. The percentage of PhDs experiencing

⁶⁷ http://innovationsfonden.dk/sites/default/files/analysis_of_the_industrial_phd_programme.pdf [accessed 16th September 2016].

⁶⁸ http://innovationsfonden.dk/sites/default/files/the_effect_of_the_industrial_phd_programme_on_employment_and_income_v4_1.pdf [accessed 16th September 2016].

unemployment during the year 2004-2009 was slightly higher for conventional PhDs than for Industrial PhDs.

Table A3.2 Expected outputs and impacts

Stakeholder type	Expected outputs and impacts of participation in the Danish Industrial PhD programme
HEIs	<p>Knowledge creation</p> <p>Knowledge exchange</p> <p>Stronger ties with the business community</p> <p>Ease of student recruiting</p>
PhD candidates	<p>Higher possibilities of finding an employment upon graduation</p> <p>Higher incomes</p> <p>Resilience to economic crisis</p> <p>Opportunity to work across fields</p>
Business partners	<p>Identifying and recruiting talent</p> <p>It is a very cost-effective way for a company to engage in research</p> <p>Access to academic research knowledge</p> <p>Higher growth rates: Companies hosting Industrial PhD projects would have considerably less positive gross profit and employment developments if they did not participate in the programme</p> <p>Hosting Industrial PhD projects increases patenting activity: Number of patent applications are higher among companies hosting industrial PhD projects</p> <p>Positive employment development: Companies hosting industrial PhD projects sustain an annual employment growth of approximately 1.58 employees per year in the first five years after first initiating an Industrial PhD project, while companies without decrease their number of employees by approximately 0.5 employees per year</p>
Society as a whole	<p>Helping young emerging scientists conduct a reflection into career options, and understand the true meaning of what it is work on industrial research. It enriches the information flow in the community.</p> <p>Economic growth and innovation</p>

A3.1.7 Recommendations of good practice

Interview partners highlighted the following attributes of the Danish Industrial PhD scheme:

- Traditional PhD are generally employed at the university, whereas industrial PhD candidates in Denmark must to be employed by the company. In this vein, the candidates has to balance the interest of the university and the company and he/she has to satisfy both stakeholders. As all collaboration projects, the scheme does require a great deal of communication, companies and universities need to communicate about what they would like draw from this collaboration.

- There are classic problem areas like publishing results and confidentiality; the company sometimes wants to withhold results, while the university wants to publish them. One way to deal with this is to talk about it in advance and figure it out before it becomes a problem – what knowledge is to be published, what areas of the project are applicable for a publication in a scientific journal, what the university would like to see in a project. The Danish Industrial PhD program encourages all parties to set up effective communication channels, and sponsors a 'kick-off' meeting with all parties with the intention to explain the rules of the game and share expectations.
- The innovation fund plays a very pro-active role in brokering relationships, reviewing proposals and encouraging the development of communication between parties.

A3.1.8 List of references

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A3.2 CIFRE (France)

The Industrial Agreement of Training through Research (CIFRE)⁶⁹ is a programme supporting PhDs conducted in collaboration between French industry or other relevant employment sector players (non-academic), a higher education institution and a doctoral candidate. By supporting joint PhDs, the programme aims to strengthen partnerships between business and public research through joint supervision of doctoral training. Since its creation in 1981, the programme has been funded by the French central government through the Ministry of Higher Education and Research. However, management of the programme has been delegated to the French National Research Association (ANRT) – a non-governmental organisation.

During their three year contract with their host organisation, doctoral candidates benefit from a joint supervision from the host organisation and the university, helping them develop and defend a PhD dissertation while contributing to the host organizations' research activities and knowledge development.

Proposals are evaluated on the basis of i) the scientific quality of the research project, ii) the degree of involvement of the host organisation as well as the relevance of the research project for its development, iii) the consistency between the research areas of the research organisation and those of the research project and iv) the academic background of the PhD candidate. CIFRE is open to students of any nationality⁷⁰ but partner organisations and universities have to be established in France. It's worth highlighting that two complementary geographically-targeted schemes (CIFRE India⁷¹ and CIFRE Morocco⁷²) have been implemented in order to increase the number of Indian and Moroccan PhD candidates enrolled in the CIFRE doctoral training programme. Another scheme called CIFRE-Defence⁷³ is also implemented by the ANRT on behalf of the French Ministry of Defence to support CIFRE projects related in this particular field.

A3.2.1 Overall statistics

A3.2.1.1 Budget

The yearly budget of the CIFRE has been stable over the last five years, and represents approximately €53 million per annum. The exact programme budget and its evolution over time are not publicly disclosed⁷⁴.

A3.2.1.2 Number of participants

Between 1981 and 2015, the CIFRE programme provided support to 25,400 PhD candidates, bringing together about 8,500 firms and more than 4,000 research

⁶⁹ http://www.anrt.asso.fr/fr/espace_cifre/accueil.jsp?r=3&p=1 [accessed 27th September 2016].

⁷⁰ Each year, the programme 25% of researchers supported are foreign (http://www.anrt.asso.fr/fr/espace_cifre/pdf/plaquette-cifre-inde.pdf - [accessed 27th September 2016].

⁷¹ http://www.anrt.asso.fr/fr/espace_cifre/pdf/plaquette-cifre-inde.pdf [accessed 27th September 2016].

⁷² http://www.anrt.asso.fr/fr/espace_cifre/cifre-maroc.jsp?p=52&p2=54#.V-4elfCLTDc [accessed 27th September 2016].

⁷³ http://www.anrt.asso.fr/fr/espace_cifre_defense/accueil.jsp?r=7&p=1#.V-44bfCLTDc [accessed 27th September 2016].

⁷⁴ Interview with programme manager.

organisations⁷⁵. Since 2007, the programme has provided support to an average of 1,300 PhD candidates on a yearly basis.

A3.2.1.3 Success rate

Over recent years (i.e. since 2007), the programme funding rate has generally stood at 85%. However, it has undergone a slight drop in 2010-2013. This could be explained by the large amount of project proposals (more than 1,600 per year) registered during this period.

A3.2.2 Distribution by scientific disciplines

A3.2.2.1 Which scientific disciplines and topics are the most and least covered?

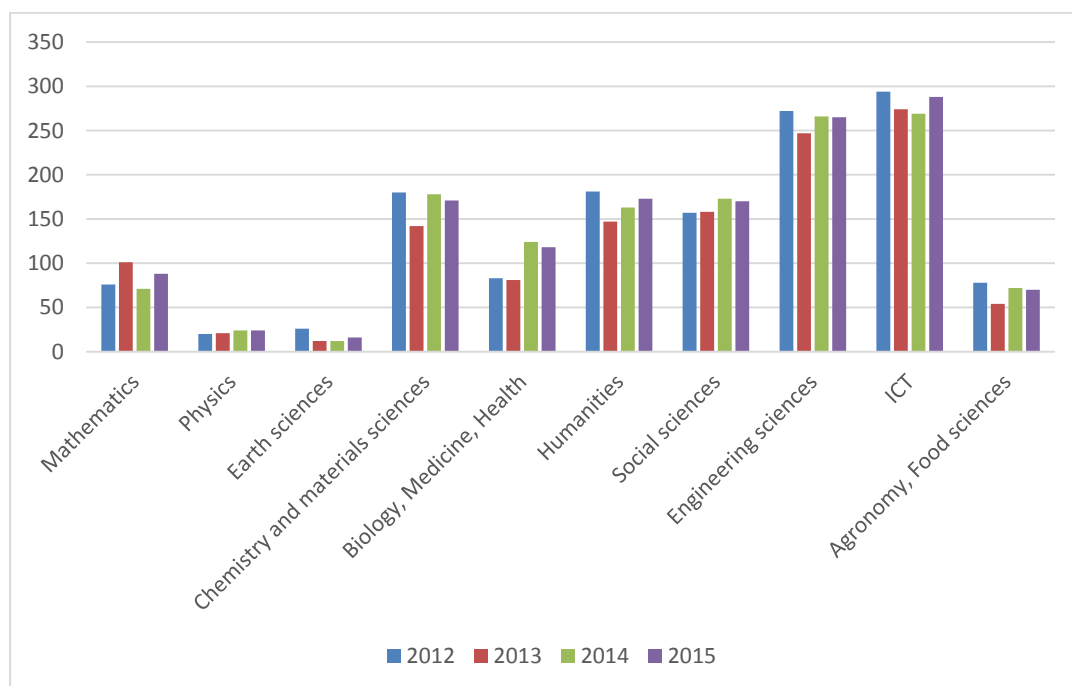
The programme is open to any scientific discipline. As a result, there is a fairly strong diversity of topics/disciplines supported. The following figure illustrates the evolution of PhDs supported by the programme by scientific discipline between 2012 and 2015. The figure includes ten main disciplines:

- Information and communication technology sciences;
- Engineering sciences;
- Social sciences;
- Humanities;
- Chemistry and materials sciences;
- Biology, Medicine, Health;
- Mathematics;
- Agronomy, Food sciences.
- Physics; and
- Earth sciences.

As illustrated by Figure A3.2, the share of PhDs by trade division between 2012 and 2015 has remained globally stable. However, the number of health-related PhDs has however undergone a significant increase.

⁷⁵ http://cache.media.enseignementsup-recherche.gouv.fr/file/Fiches_pratiques_Innovation/06/0/CIFRE_206060.pdf [accessed 27th September 2016].

Figure A3.2 Number of CIFRE projects by discipline (2012-2015)



Source: ANRT (2016)

A3.2.3 Type of participants and partner organisations

A3.2.3.1 Participation by type of organisations

As mentioned above, the purpose of the CIFRE programme is to foster partnerships between academic organisations (universities, research centres) and non-academic organisations. The vast majority of participants and partner organisations involved are Higher and secondary education institutions (HEIs) and private commercial organisations (PRC). However, practically any type of organisation may be eligible to host a PhD candidate in collaboration with an academic institution. As such, CIFRE partner institutions also include public sector organisations such as local governments or non-profit organisations

A3.2.3.2 Funding awarded by organisation type

The contract established between the PhD candidate and host organisations (academic and non-academic) offers a minimum gross annual salary of € 23,484 (paid by the non-academic host organisation). The employer (i.e. the non-academic host organisation) benefits from a € 14,000 a year public grant provided by the French Ministry of Higher Education and Research to cover part of the PhD candidate's salary costs⁷⁶.

However, the remaining salary costs might be fiscally deducted by the employer by means of the Research Tax Credit (or *Crédit Impôt Recherche* - €10,595 minimum)⁷⁷. One of the main features of CIFRE is that only the non-academic host organisations

⁷⁶ This sum is provided regardless of the salary awarded to the PhD candidate by the host organization (non-academic). http://www.anrt.asso.fr/fr/espace_cifre/pdf/presentation-Dispositif-CIFRE.pdf [accessed 27th September 2016].

⁷⁷ http://www.anrt.asso.fr/fr/espace_cifre/pdf/presentation-Dispositif-CIFRE.pdf [accessed 27th September 2016].

receive the grants, which means that HEIs don't benefit from any type of financial support.

Figure A3.3 provides an overview of the number of partner organisations (per type) between 2012-2015. This figure also provides an understanding of the distribution of CIFRE grant-funding between partner organisations.

A3.2.3.3 Academic partners

No statistics on the academic partners involved in the programme was available.

A3.2.3.4 Type and size of the non-academic participants involved

As the topics covered by the CIFRE programme are quite varied, PhD candidates are distributed among a **relatively large amount of trade divisions**. Two divisions stand out: electronics, communication and IT on the one hand (19%); R&D services and engineering on the other hand (17%). The rest of the projects are divided into a dozen categories including tertiary services, legal and finance, equipment, aeronautics and space, chemistry.

Regarding the profile of non-academic participants, there are three types of partners: enterprises (PRC) as well as French local authorities (PUB) and other structures (OTH), including local authorities and non-profit organisations.

There is a strong and growing participation of SMEs in the programme: in 2015, they represent 65% of the 784 distinct PhD employers and program partners. 42% of these SMEs employ less than 10 people, and 78% of them employ less than 50 people. Intermediate-sized enterprises and large companies are less numerous, as each account for 14% of the non-academic participants. Other structures (i.e. local authorities and non-profit organisations) account for 7% of the non-academic partners.

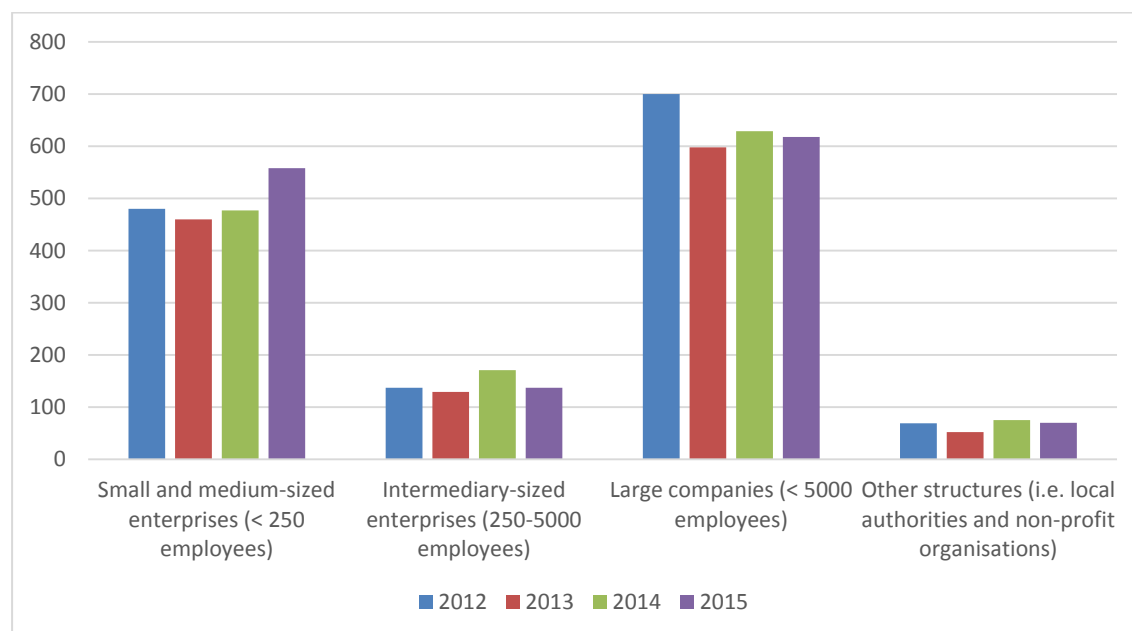
However, as illustrated by Figure A3.3, despite the strong and growing involvement of SMEs, large companies account for nearly half of the projects funded in the framework of the programme (45%). Large companies account for a low share of overall partners, but they represent highest share of projects due to the fact that a significant part of them are involved in several PhD projects at the same time. Large enterprises are followed closely by SMEs which host 40% of the projects. Intermediate-Sized Enterprises (ISEs), associations and local authorities are respectively account for 10% and 5% of the CIFRE projects. This distribution of CIFRE PhD projects is representative of the structure of employment in France.

Table A3.3 Table 1 PhD candidates' distribution within trade divisions (for accepted projects in 2015)

Trade division	Distribution of PhD candidates
Electronic, communication and IT	19%
R&D services, engineering	17%
Services (tertiary sector)	11%
Legal, finance	8%
Equipment and products	7%
Aeronautics and space	7%
Chemistry and materials	7%
Energy production and distribution	6%
Transportation	6%
Medical and pharmaceutical industry	4%
Publishing	4%
Agronomy and agri-food industry	3%

Source: ANRT (2016) - <http://www.enseignementsup-recherche.gouv.fr/cid22130/les-cifre.html> [accessed 15th October 2016]

Figure A3.3 Number of projects funded by organization type (2012-2015)



Source: ANRT (2016)

A3.2.4 The role of interdisciplinary, cross-sectoral research in the programme

The programme has adopted a 'bottom-up' approach to project selection, and does not have any particular thematic restrictions. The programme manager states that the implementation of the CIFRE is intended to support partners' needs and thus, the programme does not set any particular focus on interdisciplinary research. As such, the programme does not keep any registry of the role of importance of interdisciplinary research among the PhDs it supports. There are example of interdisciplinary and cross-sectorial PhDs. However, it is worth mentioning that in a survey conducted among the PhD candidates⁷⁸, 82% of them say they acquired skills in terms of interdisciplinary work during their PhD training.

A3.2.5 Implementation of the programme

The share of time spent in the non-academic sector is completely open i.e. there is no requirement for candidates to spend a set minimum amount of time at the host organisation (non-academic). As such, the programme does not monitor the share of time spent by PhD candidates within each of the partner organisations (academic vs. non-academic).

A survey conducted in 2012 among the PhD candidates by Technopolis on behalf of the ANRT shows that the proportion of time spent in the company varies according to respondents, especially in accordance with their doctoral discipline.

For example, more than a third of PhD candidates in agronomy indicate that they do not spend time in the non-academic sector at all, while almost half of them report spending a quarter of their time there. Only 16% of the PhD candidates in agronomy spend more than 25% of their time in the enterprise, against 60% for all students. Conversely, PhD candidates in mathematics spend little time in the laboratory and a lot in the non-academic partner organisation: 77% of them spend at least 50% outside of university, and 67% of them spend 75% or more of their time in the non-academic sector.

⁷⁸ http://www.technopolis-group.com/wp-content/uploads/2014/04/1580_FINAL_REPORT_Etude_CIFRE_2012_Rapport_final_120313.pdf [accessed 27th September 2016].

Table A3.4 Table 2 : Proportion of time spent by the PhD candidates in the enterprise, per discipline

Discipline	0%	25%	50%	75%	100%	Total (%)
Mathematics	7%	18%	10%	41%	26%	100%
Physics	17%	25%	13%	18%	28%	100%
Life sciences	9%	39%	9%	24%	19%	100%
Chemistry & materials	27%	36%	10%	10%	18%	100%
Biology & medicine	23%	39%	12%	12%	15%	100%
Human & social sciences	2%	11%	26%	42%	19%	100%
Sociology	0%	19%	20%	46%	15%	100%
Engineering science	11%	27%	15%	23%	24%	100%
ICT	8%	11%	19%	33%	30%	100%
Agronomy	35%	49%	4%	6%	6%	100%
Total	14%	26%	15%	23%	22%	100%

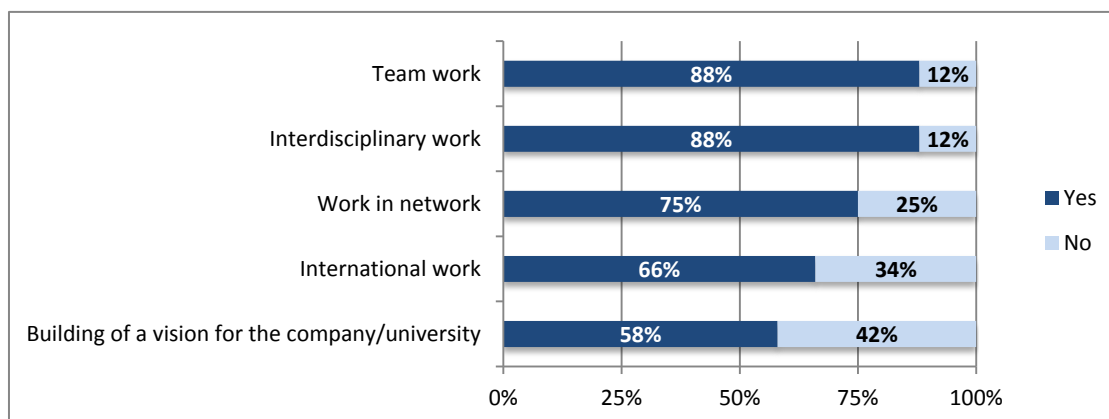
Source: Survey conducted by Technopolis on behalf of the ANRT (2012)

A3.2.6 Results of the programme

A3.2.6.1 Skills acquisition

The survey conducted by Technopolis among the PhD candidates and on behalf of the ANRT highlights the transferable skills acquired by the PhD candidates during their training. Most of them say they acquired skills in terms of teamwork (61%), interdisciplinary work (82%), the ability to work within a network (64%) and to work internationally (55%). There is limited indication on where these skills emanate from but one university partner interviewed as part of this case study indicated that CIFRE PhD candidates have a good understanding of the business world because of their long standing presence in companies. This indicates that the improvement of skills, especially those related to business management and administration (patent rights management, contracts and projects management, business networking, etc.) should be correlated with the amount of time spent by PhD candidates at the non-academic organisation.

Figure A3.4 Transferable skills acquired by the PhD candidates during their training



Source: Survey conducted by Technopolis of behalf of the ANRT (2012).

A3.2.6.2 Expected outputs and impacts

According to the programme manager, about 90% of CIFRE fellows complete their PhD. 60% of CIFRE PhD holders go on to work in the private sector; 25% on the public one and 15% on other sectors. Based on the survey among the CIFRE fellows, we are not able to claim that this distribution is a direct effect of CIFRE since the programme seems to have a weak influence on the career perspectives of CIFRE fellows. Indeed, even though 60% of CIFRE PhD holders go on to work in the private sector, Table A3.5 indicates that around 60% of them expressed having already planned to work in industry one year before starting their PhD. This trend also holds true with CIFRE fellows who have planned to work in academic organisations before joining the programme. As illustrated by the following figure, CIFRE only appears to have a very limited impact on career pathways of grant beneficiaries.

Table A3.5 Career perspectives of CIFRE fellows (in terms of employer)

	One year before starting the CIFRE		During the CIFRE		After thesis defence		Three year after thesis defence	
	Nb.	%	Nb.	%	Nb.	%	Nb.	%
Higher and secondary education institutions (HEIs)	493	30%	451	25%	417	24 %	320	24%
Large companies	732	44%	840	47%	796	45 %	607	46%
Small and medium-sized enterprises	247	15%	314	17%	346	20 %	233	18%

Source: Survey conducted by Technopolis of behalf of the ANRT (2012).

90% of the PhD candidates find a job within 6 months (70% within 3 months), which is considerably higher than the employment average of the general PhD population. A third of the PhD candidates are retained in the host organisation (non-academic) upon completion of their PhDs⁷⁹.

The following table illustrates the expected outputs and outcomes of the CIFRE programme for each of the involved partners.

Table A3.6 CIFRE outputs / outcomes for involved parties

Stakeholder type	Expected outputs and outcomes of participation in the French Industrial Agreement of Training through Research programme
HEIs	Train doctoral students as per industrial needs Reinforce ties with businesses
PhD candidates	Acquire valuable academic and industrial research ability Higher possibilities of finding an employment in the private sector
Non-academic partners	Train future employees Improvement of R&D capabilities through the reduction of research costs

A3.2.7 Recommendations of good practice

Interview partners highlighted the following attributes of the French Industrial Agreement of Training through Research programme:

- A classic problem in CIFRE relates to the sharing of intellectual property (IP) between the non-academic (especially private sector) and academic partners. Sometimes companies do not want to share the rights of IP with universities and thus, the negotiations between partners become difficult. In order to facilitate negotiations, agreements about sharing of IP must be effectively communicated to partners.
- The programme aims to create a bicultural identity for PhD candidates. Therefore, even if there is no requirement for them to spend a set minimum amount of time at the partner organisations, the share of time spent in academic vs. non-academic sector should be consistent with this overall objective, as well as with the objectives of the individual PhD research project.
- The programme is open to all disciplines, a wide array of partner types, and has no pre-defined requisites in terms of the research topics to be covered by PhDs. As such, it is highly adaptable to demand. This has allowed it to exist, evolve and adapt over time.
- The delegation of day to day management of the programme to the ANRT could be considered as a contributing factor to programme flexibility and efficiency.

⁷⁹ http://www.anrt.asso.fr/fr/espace_cifre/pdf/presentation-Dispositif-CIFRE.pdf [accessed 27th September 2016].

A3.3 Sweden – Industrial Graduate Schools

The Industrial Graduate School programme aims to provide new universities with the opportunity to establish doctoral/graduate training programmes that help strengthen the university's profile and develop the research and education environment at the university. At the same time the programme is aimed at training qualified researchers who meet the skills needs of the industry. Therefore, the Swedish Knowledge Foundation (KKS) launched the Industrial Graduate School programme, to foster collaborative PhD training, thereby strengthen the research and educational links between academia and industry and improve the long-term competitiveness of the business sector as well as the research and education environment of the new Swedish universities and university colleges.

A3.3.1 Overall statistics

The scheme is dedicated, therefore available only to the new universities and university colleges in Sweden, who are entitled to award PhD degrees. There are four universities and 18 university colleges in Sweden, who can apply for the scheme. They are: Blekinge Institute of Technology, Swedish Defence University, The Swedish School of Sport and Health Sciences GIH, Dalarna University, University of Borås, University of Gävle, University of Halmstad, Jönköping University, Kristianstad University, University of Skövde, University West, Karlstad University, Konstfack University College of Arts, Crafts and Design, Linnaeus University, Malmö University, Mid Sweden University, Mälardalen University, Royal Institute of Art, Royal College of Music, Stockholm University of the Arts, Södertörn University and Örebro University.⁸⁰

Since the launch of the programme in 1995, the Knowledge Foundation has granted more than 30 PhD graduate schools.⁸¹ The schools act like a collective of projects that provide the opportunity to enrol 'classes' of PhD candidates during a longer time period. The Foundation contributes towards the financing of the Industrial Graduate School by covering part of the costs of each doctoral student, who is awarded a degree from the graduate school.

The scale and scope of the different Graduate Schools vary. Usually, there are between 6-15 research students (funding between 10-27 million SEK for stage one) allocated to a Graduate School in the first instance, which can be increased to a maximum of 20 graduate students in total (up to SEK30million). In addition, licentiates might also be included (1 licentiate equals with half a PhD, thereby 2 licentiate places = 1 PhD place). The maximum funding is SEK1.8 million for a PhD and SEK900k for a licentiate, or a maximum of SEK450k per year for full-time studies (4 years or 2 years respectively). KKS funding provides 50% of the scheme, while the other 50% is provided either in cash or as in-kind contribution by the implementing industrial partners. The industrial partners often provide top-up for the salaries of the students i.e. pay higher amount that could be covered from the KKS funding. Overall, industrial partners make a significant contribution to these schools.

⁸⁰ Source: 2016 call for proposal documentation. Call for proposals in English can be found here: <https://www.miun.se/siteassets/forskning/storre-forskningssatsningar/kk-miljo/call-for-proposals-industrial-graduate-programme-15-2pdf> [accessed 25th October 2016].

⁸¹ A description of the programme in Swedish can be found at: <http://www.kks.se/verksamhet/Forskarutbilda/Startsida.aspx> [accessed 25th October 2016].

Figure A3.5 Example of an Industrial Graduate School - ITS -EASY⁸²

ITS-EASY – The Industrial Graduate School in Embedded Software and Systems at the School of Innovation, Design and Engineering at Mälardalen University.

The main focal areas of the research activities include embedded systems including software-intensive systems, dependable (reliable and safe) systems, and sensor systems.

Since the launch of the School in October 2011, there have been 24 PhD candidates enrolled and funded through the Graduate School so far. The School will continue until 2020. It is led by a Board, which is a six strong body, led by a representative of ABB. In addition, the industrial partners are represented in an advisory committee engaging all 10 business partners of the ITS-EAS Graduate School.

The students enrolled in the Graduate School are employed by the industrial partners, and complete their studies mainly part-time.

A3.3.2 Motivations to apply

The new Swedish higher education institutions play an important role in the regional development. Therefore, they have a strong focus on educating students who have the skills and competencies required by the regional economies. With a primary focus on education, research, although at multiple institutions it is of very high quality, still represents a somewhat less dominant activity for them. Building capacities through industrial PhD student training is an important motivation for these universities to be engaged in the programme.

In addition, the pressure on the HEIs to get more funding plays an important incentive for the universities to be open minded, get involved in the more flexible schemes and research programmes, such as the Industrial Graduate Schools. There are a multitude of funding schemes available for more senior researchers, however funding for PhD candidates is often difficult to get. Combined with the relatively limited experiences of some of these new institutions with regards PhD training, some of the institutions established PhD schools through this programme for the first time, the scheme plays an important role and fills this funding gap, while provides the opportunity to strengthen their relations with regional industrial partners as well.

Industry's main motivation for participation is to develop – most of the students involved in the PhD scheme are employed by the companies - and recruit personnel for the future. Access to human resources and their development has been and remains industrial partners' primary motivation. To further increase the benefits of participation, industrial partners are urged to formulate research projects that are intertwined with their daily work. Thereby, the students' contribution can be also paid off for the company through undertaking a relevant project that benefits from input and knowledge gained through the academic relations. A recent paper⁸³ exploring the impacts of university-business relations through examining three Industrial Graduate Schools found, that having a well-defined problem that needed solving is a common characteristics among the companies who are engaged in the programme.

Industrial partners gain access to a pre-competitive network both within academia and industry. The latter through the class of the students who meet regularly, and have background with different companies operating often in the same sector. In addition,

⁸² http://www.es.mdh.se/projects/268-ITS_EASY_Post_Graduate_School_for_Embedded_Software_and_Systems [accessed 27th October 2016].

⁸³ Linda Gustavsson, Cali Nuur and Johan Söderlind: An impact analysis of regional industry–university interactions, The case of industrial PhD schools, *Industry & Higher Education* Vol 30, No 1, February 2016, pp 41–51

benefits to the company include use of research results, which often have potential for commercial application.

A3.3.3 Distribution by scientific disciplines

Around 30 Industrial Graduate School have been founded within the Industrial Graduate Programme, which cover a wide field of scientific disciplines and topics.⁸⁴ The sectors covered by the programme include:⁸⁵

- Applied IT Software Engineering
- Biotechnology
- Construction
- Management
- Medical bioinformatics
- Food
- Surface Chemistry
- Robotics and
- Rock Engineering

Currently there are 10 ongoing Industrial Schools. The sectors and scientific disciplines play an important role only with regards their fit to the regional economies. There are no set quota per scientific discipline in terms of the number of students to be funded.

A3.3.4 Type of participants and partner organisations

The Schools are implemented in partnership with industrial partners who are usually the employer of the students. The Knowledge Foundation considers as partners mainly private companies, but it can also include some organisations under a public ownership, if some conditions are fulfilled. The partners have to operate in Sweden, produce services or goods and well as they cannot be exclusively an administrative enterprise.⁸⁶

There are no requirements in terms of the type and size of companies, however they have to be able to provide the necessary environment and research infrastructure for the students to undertake their research. The partners involved are mainly larger companies, however SMEs are also engaged in the PhD scheme. The types of companies engaged with the activities of the different Industrial Graduate Schools usually reflect the structure of the regional economies of the HEIs.

A3.3.5 The role of interdisciplinary, cross-sectoral research in the programme

The programme's objectives include strengthened knowledge exchange and an increased rate of innovation through academia-industry collaboration and long-term relationship building. Interdisciplinary per se is not a stated objective of the scheme, however the mode of implementation supports the development of interdisciplinary research projects. The students work on real industrial problems, and due to the cohort approach applied throughout the implementation, interdisciplinarity approaches are a common feature of the PhD projects undertaken.

⁸⁴ Ibid

⁸⁵ Industrial Graduate Schools – University-Industry Interaction for Development of Absorptive Capacity

⁸⁶ Industrial Graduate Schools - call for proposal, 2016

A3.3.6 Implementation of the programme

The scheme is implemented jointly by the academic and industrial partners. It is possible for the student to be employed by the industrial partners or by academia, but it is the experience of the Knowledge Foundation that it is to be recommended that the students are employed by industry. The programme gives the institutions rather large freedom and *modus operandi* to participate in these programmes. The universities set the requirements regarding the curricula, the courses students should take and the papers to publish. The curriculum followed corresponds to the studies carried out by the 'normal' PhD candidates. Integrating the Industrial PhDs in the academic environment is a highly important aspect of the programme.

A business partner might have one or more students involved in a Graduate School programme. All participating industrial partners are expected to participate actively and be well integrated into the Graduate School's implementation. The individual doctoral candidates always have, besides a formal tutor at the university, a mentor in the company, who often has a PhD. The call for proposals of the Industrial Graduate Programme states that each student must be connected with a company and that the student has to spend a minimum of 20% of the total time at both the company and at the university.

A recent study⁸⁷ conducted on the students, their project and engagement of the industrial and academic partners in the ITS-EASY Graduate School highlighted the some key influencing factors that affect the successful implementation of an industrial PhD.

Students, employed by the industrial partners are often very loyal to the company, which in return causes some tension to get time devoted to their studies. Especially, because companies do not always understand the requirements and time needed for students to undertake their study programme. The students usually spend 80% of their time on study-related tasks and the remaining 20% on work-related tasks. This shared time is reflected in the fact that industrial PhD have five years to complete their studies while 'normal' PhD candidates should fulfil the same expectations during four years. Students reported that they find balancing these tasks rather demanding. This problem might cause delays in completing their studies on time.

To compensate for the heavy workload of the students, the Schools can have built in flexibility. For example, the students can have leave of absence, which is however not encouraged due to the risk of losing students from the programme. At ITS-EASY, the dropout rate is roughly 25%. The School has so far recruited 24 people and 3 students had already dropped out without a degree. Out of these three started from scratch and two from licentiate, but they did not finish. Another two dropped out after successful licentiate, but never finished the PhD. There might be another student leaving the programme, which would result in a 25% dropout rate out of the 24 enrolled. The Schools have the possibility to fill dropout places, either in collaboration with the company who was already engaged in the School or with a new one.

The study mentioned also found, that there is a difference in terms of how students feel when employed at research departments of a company or elsewhere. Those students, who are integrated into the research departments of the companies are more comfortable being at the company, because the colleagues understand better what they do, and what does it mean to undertake research. Company buy-in and support as well as strategic engagement of the partners are among the key success factors identified by

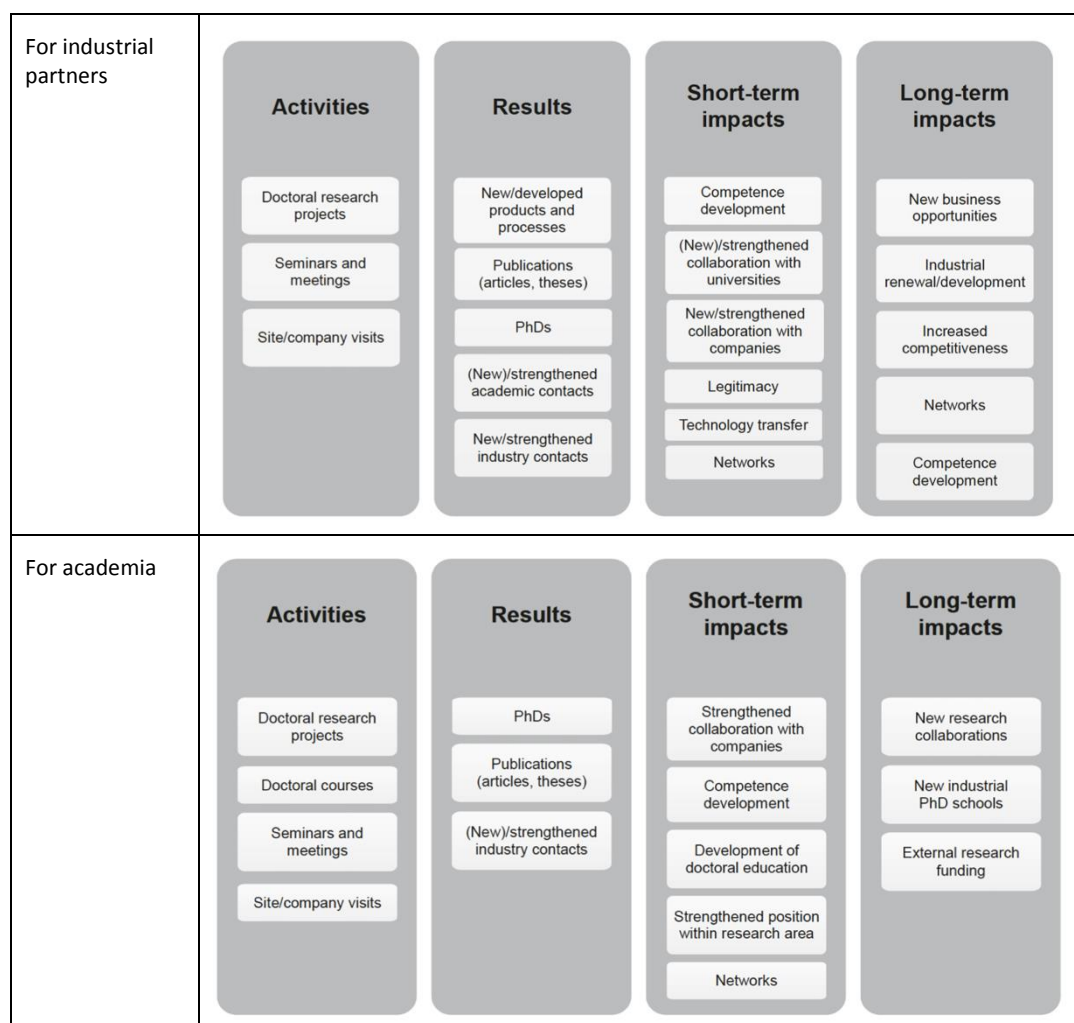
⁸⁷ Sundström, Widforss, Rosqvist and Hallin: Industrial PhD students and their projects, 2016 / Procedia Computer Science 00 (2016) 000–000

the impact paper⁸⁸ as well as the stakeholders involved in the implementation of the scheme.

A3.3.7 Results of the programme

There are numerous benefits and results delivered by the programme to all parties involved. The above mentioned impact paper⁸⁹ examined the activities, key results and short and long-term impact delivered through the scheme to academic as well as industrial partners. The key findings of the paper are summarised below.

Figure A3.6 Results and impacts from the short and long-term perspectives



Source: Gustavsson et al: *An impact analysis of regional industry–university interactions, The case of industrial PhD schools*

For the students, benefits include that they become very well acquainted with industry, gain a lot of knowledge about the they know a lot about the industrial operations, motivations, understand what are the key interest areas for research. They learn and experience technology transfer throughout their PhD studies, and therefore they are a major asset in bridging industry and academia. Furthermore, the students learn a lot

⁸⁸ Linda Gustavsson, Cali Nuur and Johan Söderlind: *An impact analysis of regional industry–university interactions, The case of industrial PhD schools*, Industry & Higher Education Vol 30, No 1, February 2016, pp 41–51

⁸⁹ Ibid

about project management and can benefit from a significant network of researchers active in other companies due to the cohort based approach in the education.

The research results generated are of good quality and often result in products and services that are further developed by the companies. Quality assurance is ensured through the supervision and the outputs generated by the PhD candidates. Most PhD candidates for example in computer sciences either write a monography or put together journals and conference papers. These papers have to go through a peer review process, which has built in quality assurance. In addition, due to having multiple supervisors, each student can engage both their academic as well as their industrial supervisor in their work at any time.

The students after graduation are also highly employable. They might change their place of employment upon finishing their studies for various reasons, e.g. company cannot find the most suitable position for them, but for example from among the graduates of the ITS-EASY School, no one is unemployed. The impact study found through the three Graduate Schools examined, that about 50% of the PhD remain with the same company after graduation, and overall 80% of the graduate remain working in industry. The fact that the students remain within the industry is evidence that this funding scheme is one measure for developing competencies that are relevant and needed by industry.

Table A3.7 Figure 1 PhD candidates' employment after graduation

	Mekmassa	CAPE	RAP	Total	%
Same company	10	8	11	29	51
Same industry	5	8	1	14	25
Another industry	2	0	0	2	3
To academia	0	4	1	5	9
NA/non-completed studies	1	2	2	7	12
Total number of doctoral studies	18	24	15	57	100

Source: Gustavsson et al: An impact analysis of regional industry–university interactions, The case of industrial PhD schools

A3.3.8 Recommendations of good practice

Interview partners highlighted the following comments and recommendations regarding the further development of the EID scheme, based on the Swedish experience:

- The Industrial Graduate Schools are an important instrument that help bridging the skills and competencies gap between the academic offer and industrial demand on the job market. The EID programme is a welcome addition to the national activities
- Flexibility built in the scheme is a crucial aspect – for example in the Swedish programme, students can finish their studies after completing a licentiate degree in the Industrial Graduate Programme, because industrial partners often find that two-three years spent with the programme is enough to ensure transfer of skills and knowledge. The EID programme could thus consider allowing fellows to complete their PhD after they have completed their fellowship.

- The implementation of the EID requirements, that state that half of the time has to be spent by the PhD students in each participating country should be reconsidered. The proportion could be decided in a more flexible way and agreed on by the partners in a way that works best for them. Linked to this point, the frequency of changing host institutions could be an issue. Although there is a generous EU family allowance, it can be costly and time intensive to move families.

A3.4 Industrial CASE studentships, United Kingdom

The UK has a broad range of tools and programmes available for PhD candidates to gain experience with industry. CASE awards (Collaborative Awards in Science and Engineering) are doctoral studentships that can be undertaken around collaborative research activities between academia and their industrial partners. Placement and training at a non-academic partner is a key aspect of the programme.

The BBSRC (Biotechnology and Biological Sciences Research Council) Industrial CASE studentships specifically fund PhD in the field of bioscience. The BBSRC has been providing funding for the Industrial CASE studentships since 1994. Six other Research Councils exist in the UK which fund studentships in other fields. The Councils expressed their commitment towards promoting collaborative PhD training through sharing a joint vision for collaborative training.⁹⁰ There are many similarities in the mechanisms used for collaborative training funding, as set out in the cross-Council terms and conditions for training grants,⁹¹ but the different Councils apply some varieties as well. The table below summaries how Research Councils deliver collaborative training.

Table A3.8 Research Council approaches to doctoral training – funding routes

Arts and Humanities RC	Two mechanisms: 1) Collaborative Doctoral Awards (CDA) awarded by annual competition for single collaborative projects; 2) block awards to non-academic organisations through Collaborative Doctoral Partnerships (CDP) run every 2-3 years
Biotechnology and Biological Sciences RC	Two mechanisms: 1) Block awards of CASE studentships allocated to academic consortia through BBSRC Doctoral Training Partnerships (DTP); 2) block awards of CASE allocated to industrial partners through Industrial CASE Partnerships (ICP) – to be succeeded in 2017 by a new Collaborative Training Partnership (CTP) programme
Engineering and Physical Science RC	One mechanism: EPSRC allocates CASE awards directly to businesses, primarily using an algorithm based on financial contributions on EPSRC-funded research
Economic and Social RC	One mechanism used: ESRC DTPs are given a target of making 20% of their studentships collaborative. ESRC DTPs (formerly called Doctoral Training Centres - have competitions every 5 years)
Medical RC	One mechanism: annual CASE competition for single collaborative projects
Natural Environment RC	Two mechanisms: 1) annual CASE competition for single collaborative projects; 2) NERC DTPs are given a target of making 30% of their studentships collaborative. NERC DTPs have competitions every 3 years.
Science and Technology Facilities Council	One mechanism: annual CASE competition for single collaborative projects

Source: BBSRC

BBSRC delivers CASE studentships through two instruments: its Doctoral Training Partnerships (DTP) and its Industrial CASE Partnerships (ICP) (Figure 1). DTPs are consortia of academic institutions that – as part of their award – receive a block allocation of CASE studentships to identify to partner with non-academic research organisations (typically from industry). ICPs are industrial research organisations that

⁹⁰ Research Councils UK website - <http://www.rcuk.ac.uk/documents/skills/rcdvision-pdf/> [accessed 16th September 2016].

⁹¹ Research Councils UK website - <http://www.rcuk.ac.uk/funding/grantstcs/> [accessed 16th September 2016].

receive a block allocation of CASE studentships to identify and partner with academic institutions.

The block award of CASE studentships to DTPs is a recent development. Prior to 2015, BBSRC ran an annual competition to award individual CASE studentships to single projects between an academic and non-academic collaborator. This competition was resource intensive for BBSRC, so in 2015 a decision was made to move these studentships onto the DTPs for them to manage at the local level. Another recent development is the re-branding of the ICP scheme into a successor Collaborative Training Partnership (CTP) programme, launched in 2016. CTP retains the core features of ICP but with added flexibility for applicants to forge industrial consortia.

These block grants build on a model that has quality assurance at its heart. The competitions for selecting the academic consortia and industrial partners are based on expert review and thorough assessment of the partners' ability to successfully deliver collaborative PhD training activities. When the assessment is concluded positively, the partners are trusted with studentships.

A3.4.2 Overall statistics

The last call for proposals for the ICP scheme was in 2013. The call covered three consecutive student intakes in the academic years 2014/15, 2015/16 and 2016/17. Each studentship is funded for four years, meaning the final doctoral students will graduate from this scheme in 2019/20. The call resulted in the selection of ten industrial partners⁹² who were awarded multi-annual CASE studentships. For each of the industrial partners a defined number of CASE studentships were allocated annually.

For the 2015/16 academic year 71 CASE studentships were allocated across the ten companies. This figure corresponds to the figure presented in the evaluation report of the scheme,⁹³ that accounted for 70 ICP studentships awarded annually. The number of CASE studentships per industrial partner varies significantly. In 2015/16 the most, 22 studentships were allocated to GSK, while the least 2 studentships each were allocated to Nestle and Oxitec.

The last round of iCASE annual competition was in 2014, with studentships started in 2015/16. The success rates of the former annual CASE studentship call for proposals - i.e. the annual call for individual CASE studentship proposals up until 2015, which were assessed by peer review each year. - have been very high, shifting between 60-85% during the years.

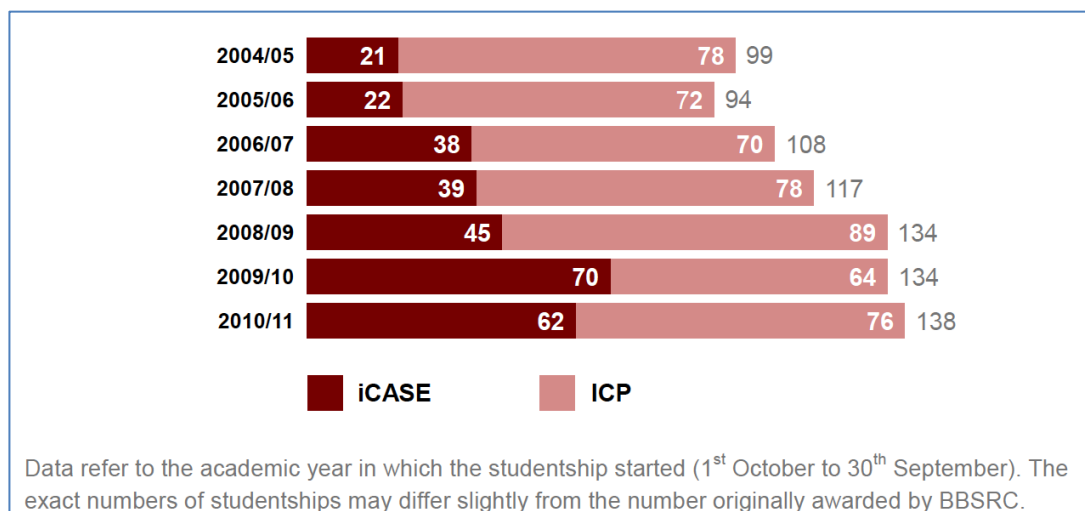
Through the iCASE competitions up to 90 studentships were funded annually, and these will now be made available through the DTPs. The annual calls were discontinued and from the academic year 2016/17 onwards, the funding will be made available through the DTP programme. There have been two rounds of DTP calls launched (2012-2014 and 2015-2019). DTP provides four-year PhD studentships.

As part of the 2016 CTP call, there will be up to 15 CTPs awarded, where each of the industrial partners is expected to have at least 4 studentships annually for the upcoming three academic years, starting in 2017/18.

⁹² For the full list of beneficiaries, please see: <http://www.bbsrc.ac.uk/skills/investing-doctoral-training/case-partnerships/> [accessed 16th September 2016].

⁹³ Evaluation of BBSRC's Industrial CASE scheme, June 2013.

Figure A3.7 Overview of the funded CASE studentships between 2004-2010s



Source: *Evaluation of BBSRC's Industrial CASE scheme, June 2013*

The available funding for a studentship covers the students' stipend based on their location (differs for London and outside London locations), fees, and additional expenses and training support. On average the iCASE studentships were granted between £85-130k for the full duration of the studentship, the exact amount and annual adjustments are defined and made available by the Research Councils UK.

In terms of the attractiveness of the scheme, there are differences between the industry led and academia-led initiatives. Universities are more prone to take a higher number of students, therefore there is an element of strong competition involved in awarding the grants. Industry-led studentships are more limited in terms of volume, because the industrial partners have more limited capacities to absorb the students, especially when small companies apply.

A3.4.3 Distribution by scientific disciplines

The Biotechnology and Biological Sciences Research Council, provides funding in the scientific areas of its remit. Subject fields covered include, among others, agriculture, energy, environment, health as well as industrial production. Similarly, the other Research Councils – as listed in Table A3.8 – provide CASE studentships in the subject fields of their own individual remits. The seven RCs in total provide a comprehensive coverage of the various disciplines.

A3.4.4 Type of participants and partner organisations

Grant holders i.e. those who receive financial support - can be academic research organisations and other public institutions such as NHS Trust. The non-academic partners are usually companies that 'have an established UK-based research and/or commercial production capability.'⁹⁴

Most of the industrial partners are mainly large multinational companies, in this scientific field involving many large pharmaceuticals, as the list of the awarded ICP studentships show for the 2015/16 academic year:

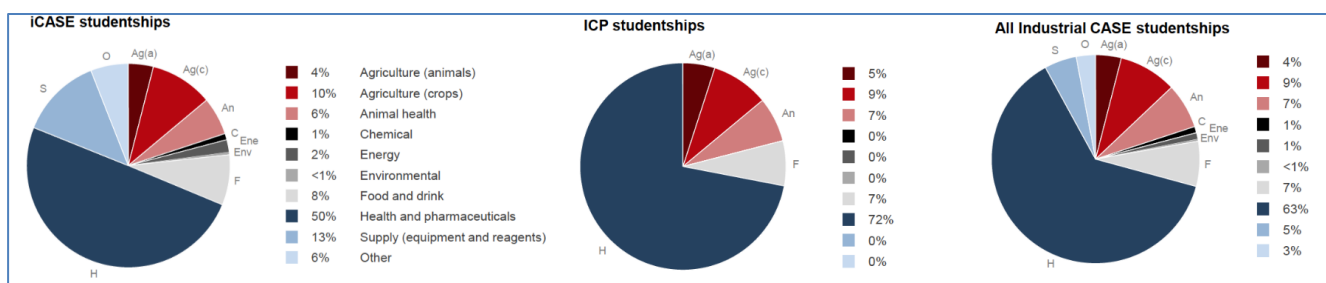
- AstraZeneca - Partnership Awards 2015/16: 7
- Bayer - Partnership Awards 2015/16: 3

⁹⁴ *ibid*

- GSK - Partnership Awards 2015/16: 22
- Knowledge Transfer Network - Partnership Awards 2015/16: 10
- MedImmune - Partnership Awards 2015/16: 6
- Nestle - Partnership Awards 2015/16: 2
- Oxitec - Partnership Awards 2015/16: 2
- Syngenta - Partnership Awards 2015/16: 10
- UCB - Partnership Awards 2015/16: 3
- Unilever - Partnership Awards 2015/16: 6

The evaluation of 2013 found the same results. It reported, that the majority of the companies involved in the studentships represent the 'health and pharmaceutical' sector.

Figure A3.8 Industrial CASE studentships by sector of the industrial partner



Source: *Evaluation of BBSRC's Industrial CASE scheme, June 2013*⁹⁵

The call for CASE studentships as part of the 2016 Collaborative Training Partnerships (CTP) set the expectation of a minimum of four student's intake by the industrial partners annually. This implies a minimum size for the companies that can take part in the scheme, and continues the previous batch award system of the ICP scheme.

To encourage the involvement of smaller companies in the scheme as well, the BBSRC make a distinction between the payment obligations towards the academic partner (contribution of £1,400 per annum) for companies below – contribution is not compulsory – and above 50 employees – contribution is compulsory – for the academic-led DTP-based CASE studentships only. The previous stipend top-up mandatory requirement was discontinued for both DTP and CTP based CASE studentships.

A3.4.5 The role of interdisciplinary, cross-sectoral research in the programme

BBSRC DTPs provide interdisciplinary research training, and so it is expected that the DTP-led CASE studentships will have a similar focus.

In addition, there has been a strong emphasis put on cohort training as part of the DTPs since the launch of the scheme. It is an important aspect if the industrial doctoral education, that students must feel at home both at the university and at the company, where they spend their placement. Therefore, the promotion of networking among the students, applying a cohort-based approach, has a high level of importance. Based on the positive experiences gained, BBSRC intends to move towards the cohort based approach for the CASE studentships implemented through the CTP mechanism as well. Previously, fostering networking between students with CASE studentships happened less

⁹⁵ Note from the evaluation report: Based on information for 518 studentships between 2006 and 2010 with information on the industrial partners.

strongly, mainly at their annual meetings, where students gave presentations on their progress.

A3.4.6 Implementation of the programme

Out of the usual length of a PhD programme with four years, there is a requirement for the CASE studentships for the student to spend between three months and 18 months at an industrial placement. The minimum requirement of three months to be spent on the industrial placement was reduced from an originally set half a year to increase the flexibility of the scheme. Spending time at the companies is a highly important aspect of the scheme, and enabling to have a shorter time period increased the flexibility of the scheme.

The research undertaken at the industrial partner has to be more basic by nature, fitting the academic research carried out while generating value for the company as well. The exact topic of research and the relevance to the industrial partner depends on the type of studentships as well. Industry-led studentships are closer to the needs of the industrial partner. The industrial partners are however advised by the funders not to put students on commercially sensitive project at the early stages of the studentships.

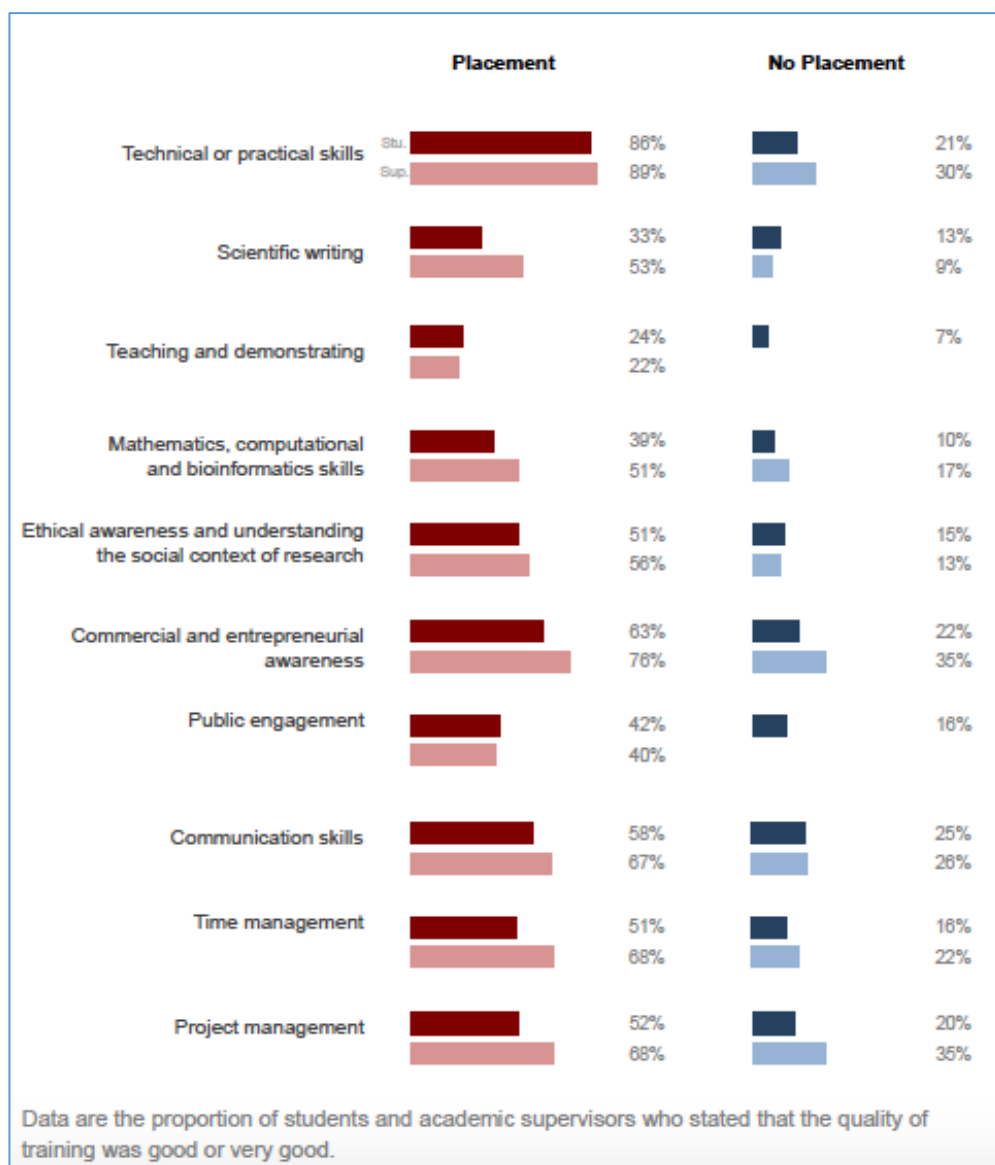
The cooperation between the academic and industrial partners can be highly intense especially at the beginning of the CASE studentship. Reportedly, frequent meetings, weekly telephone conferences and then face-to-face meetings are often needed to ensure the smooth and efficient implementation of the CASE studentships. It is crucial for all parties to be involved to understand the requirements, the objectives set as well as the implementation of the studentship.

The scheme incorporates many flexible elements, out of which the possibility to extend the placement at the industrial partner is one. An initial 3 months long placement can be over the years extended as the project of the student evolves, up to 18 months in total, which is the upper limit of the placement.

CASE students participate in the general PhD education, however their participation has to be treated with more flexibility. Sometimes due to the placement periods, they cannot participate in a given course, therefore they have to retake it the next year. Still, the time spent with the industrial partner produces a long list of additional skills and knowledge obtained through the placements.

In terms of the quality of the industrial training provided, the chart overleaf from the 'Evaluation of BBSRC's Industrial CASE Scheme' demonstrates the assessment of students and academic supervisors.

Figure A3.9 Students' and academic supervisors' assessment of the quality of industry training provision



Source: Evaluation of BBSRC's Industrial CASE scheme, June 2013

A3.4.7 Results of the programme

BBSRC have begun running CASE placement reports for students on completion of their placement to understand the results and skills obtained through the placements. In those reports, students identify 'Self-management' (e.g. Preparation and prioritisation, Time management) and 'working with others' as their most important skills gained while on placement.

In addition, among the results of the scheme, the evaluation of the scheme highlighted, that many students had published an original research article from their studentship, including some in prestigious, high-impact journals.

Similar results were reported by an academic participant, with a decade long experience with the CASE studentships. Students, who undertake placement at industry, learn the ways how industry works. They also gain exposure to the thinking behind research-related decisions and how industry sets research priorities and manages different

processes. They obtain transferable skills and learn how research results are put in practice at the industrial partners, as well as the viewpoint of how industrial partners look on the academic problems. In addition, students might have the opportunity to work with materials to which the universities have no access.

The scheme also worked well, in providing students with an attractive career choice in the form of experience with industrial partners. It is regarded as a scheme that has the potential to develop future industrial leaders in niche research areas.

BBSRC's recent student survey explored to what extent does the scheme influence students to work in HEI after the PhD and at an industrial partner. Based on the responses, those with a CASE studentship are much more likely to want to have a career in industry. 41% of the respondents stated this that they wish to work at a company in biosciences more than before the placement. The students are influenced by the placements, in terms of how they see industry, therefore in their career choices.

A3.4.8 Recommendations

Interviewees provided the following recommendations that can benefit the EID programme, based on the experiences with the CASE studentship scheme:

- The 'Joint Vision for Collaborative Training' describes the three main criteria used to identify high-quality collaborative training projects. These are the basis of all assessments before the award of funding
- Use of expert review to assess applications i.e. first select partners that can be trusted to deliver successful high quality PhD training
- Monitoring of placements due to the recommendations of the 2013 evaluation to have a closer monitoring of the placements, BBSRC introduced a system, when a colleague goes out and checks the students, whether they have undertaken the placement as yet, if not when is it planned. BBSRC devised a form which has to be completed on the placement. The number of students who have been or planning to go on placements. This is also checked with the industrial and HEI supervisors.
- The industrial partners should make a financial contribution to a project (combination of cash and in-kind elements), which can be made different based on the size of the company
- Frequent communication at the beginning of the implementation of the studentship is highly important. This does not only help reassure the student that both partners involved are highly interested in his/her work, but also lays the foundation of the future work and ensures long-term efficient project implementation.

Annex 4 Programme demand and participation – further analysis

This Annex presents some further analysis of demand for EID funding and participation in EID projects in FP7 and Horizon 2020 up to March 2016.

A4.1 Demand and participation by country

A summary of the number of EID applicants as well as the EU funding requested by EID applicants in Horizon 2020 by countries is provided in the tables below. A summary of the number of EID participants as well as the EU funding awarded to EID projects by countries is provided below as well.

Table A4.1 Number of EID applicants and amount of EU funding requested by EID applicants by countries (top ten EU Member States and other countries; since introduction of EID programme)

Country	Number of EID applicants, FP7 and Horizon 2020	Amount of EU funding requested by EID applicants (€m – Horizon 2020 only) ⁹⁶
All countries	2,013 (100%)	336 (100%)
EU Member States	1,789 (89%)	326 (97%)
Associated countries	89 (4%)	9 (3%)
Third countries	133 (7%)	<1m (<1%)
No information	2 (<1%)	0 (0%)
UK	280 (14%)	79 (23%)
DE	248 (12%)	33 (10%)
ES	201 (10%)	49 (15%)
IT	197 (10%)	36 (11%)
NL	184 (9%)	32 (9%)
FR	182 (9%)	19 (6%)
BE	111 (6%)	17 (5%)
DK	80 (4%)	17 (5%)
IE	56 (3%)	6 (2%)
CH	53 (3%)	3 (1%)

⁹⁶ No information was available on EU funding requested by applicants to FP7.

SE	56 (3%)	7 (2%)
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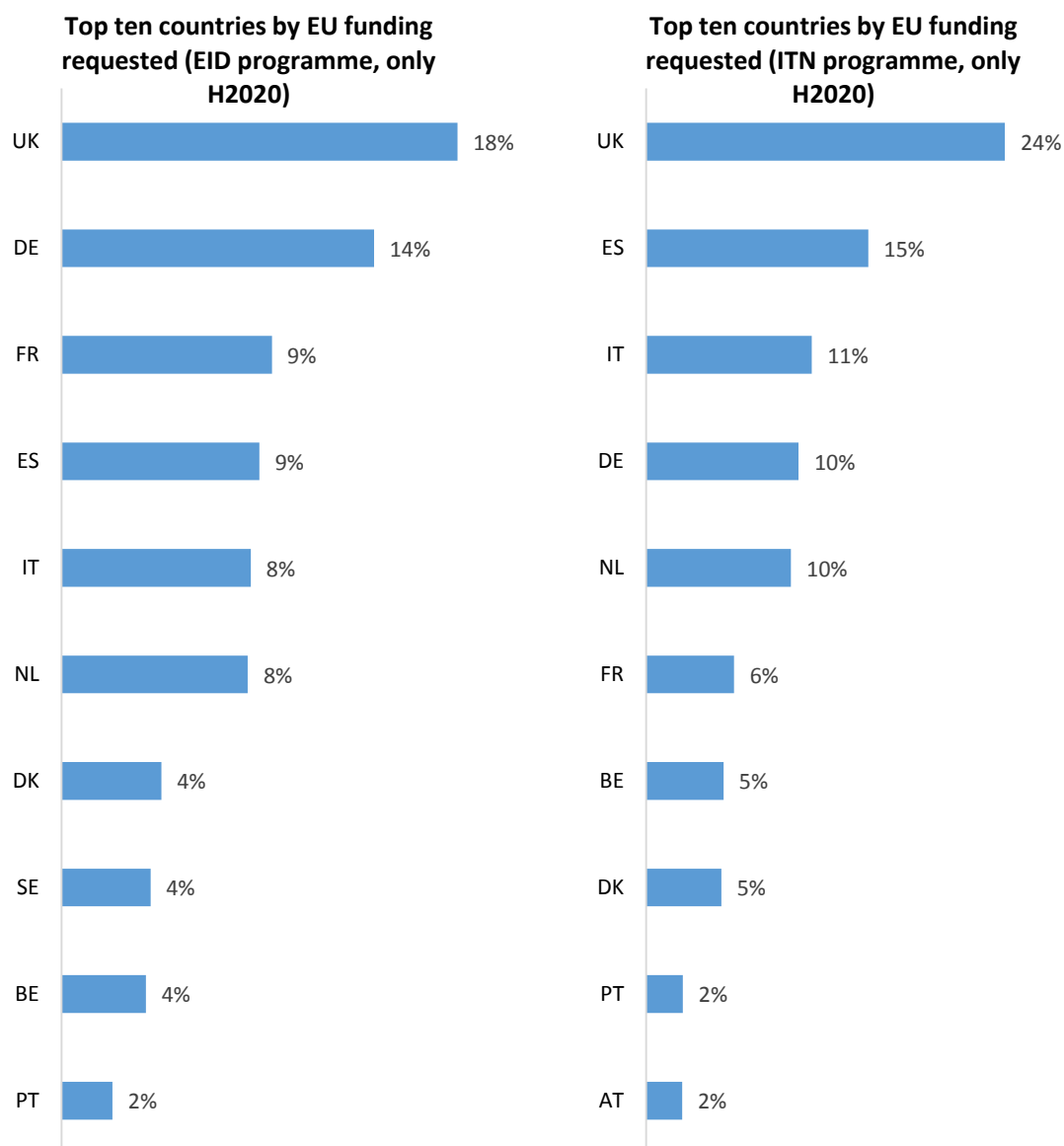
Source: ICF CORDA analysis

Table A4.2 Number of EID participants and amount of EU funding awarded to EID projects by countries

Country	Number of EID participants	Amount of EU funding awarded to EID projects (€m)
All countries	281 (100%)	114 (100%)
EU Member States	263 (94%)	106 (93%)
Associated countries	18 (6%)	8 (7%)
Third countries	0 (0%)	0 (0%)
Country	Number of ITN participants	Amount of EU funding awarded to ITN projects (€m)
All countries	4,517 (100%)	1,832 (100%)
EU Member States	4,209 (93%)	1,714 (94%)
Associated countries	287 (6%)	113 (6%)
Third countries	21 (<1%)	5 (<1%)

Source: ICF CORDA analysis

Figure A4.1 Top countries by EU funding requested, EID and ITN since introduction of EID programme



When analysing EU funding awarded, the United Kingdom and the Netherlands are amongst the countries which were awarded particularly high proportions of EU funding under the EID programme, compared to the ITN programme overall.

Germany and France were awarded a lower share of EU funding under EID as compared to the overall figure for ITN projects (respectively, Germany received 15 per cent of ITN funding and 11 per cent of EID funding, and France was awarded 8 per cent of ITN budget but only 3 per cent of the EID funding). This might be linked to the fact that a lot of applied research in the French and German academic sector is conducted by organisations which cannot award PhDs – France and Germany might be more successful in winning EID funding in the future, as research organisations who cannot award PhD degrees are since 2015 taking a more prominent role in EID projects.

A4.2 Demand and participation by scientific panel

The tables below present the number of EID applicants as well as the amount of EU funding requested by scientific panels in Horizon 2020 for the two main organisations (PRC and HES). There were no significant variations in the distributions of PRC and HES organisations among scientific panels compared to the distribution of all organisation taken together.

Table A4.3 Number of EID applicants by scientific panels and by organisation types (FP7 and Horizon 2020)⁹⁷

	PRC	HES
ENG	576 (47%)	280 (45%)
LIF	242 (20%)	129 (21%)
CHE	176 (14%)	107 (17%)
ENV	114 (9%)	55 (9%)
PHY	23 (2%)	11 (2%)
ECO	22 (2%)	8 (1%)
MAT	25 (2%)	11 (2%)
SOC	47 (4%)	15 (2%)

Table A4.4 Amount of EU funding requested by EID applicants by scientific panels and by organisation types (€m – Horizon 2020 only)

	PRC	HES
ENG	43 (46%)	100 (49%)
LIF	21 (22%)	40 (20%)
CHE	16 (17%)	25 (12%)
ENV	9 (10%)	18 (9%)
PHY	1 (1%)	4 (2%)
ECO	0 (0%)	5 (2%)
MAT	1 (1%)	4 (2%)
SOC	2 (2%)	9 (4%)

⁹⁷ Information on panels was not available for 3 PRC proposals and 3 HES proposals.

The tables below present the number of EID participants as well as the amount of EU funding requested by scientific panels for the two main organisations (PRC and HES). PRC organisations were under-represented in terms of participations in the CHE panel (26 per cent of participations compared to 46 per cent for all EID projects).

Table A4.5 Number of EID participants by scientific panels and by organisation types (FP7 and Horizon 2020 only)

	PRC	HES
ENG	47 (36%)	50 (39%)
LIF	32 (25%)	24 (19%)
CHE	26 (20%)	30 (24%)
ENV	12 (9%)	16 (13%)
PHY	3 (2%)	1 (1%)
ECO	1 (1%)	1 (1%)
MAT	7 (5%)	4 (3%)
SOC	1 (1%)	1 (1%)

Table A4.6 Amount of EU funding awarded to EID projects by scientific panels and by organisation types (€m - Horizon 2020 only)

	PRC	HES
ENG	8 (43%)	15 (41%)
LIF	5 (26%)	6 (16%)
CHE	3 (18%)	8 (22%)
ENV	2 (12%)	4 (13%)
PHY	<1 (1%)	1 (2%)
ECO	0 (0%)	1 (4%)
MAT	0 (0%)	1 (3%)
SOC	0 (0%)	0 (0%)

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