European Commission

Marie Skłodowska-Curie Actions

Lessons Learnt from the implementation of European Industrial Doctorates in Horizon 2020

Report from the Cluster Event with European Industrial Doctorates (10 November 2022)

Marie Skłodowska Curie Actions

European Research Executive Agency
June – 2023

EUROPEAN COMMISSION

European Research Executive Agency (REA)
Unit A.1 — Marie Skłodowska-Curie Actions Doctoral Networks

E-mail: REA-INFO@ec.europa.eu

European Commission B-1049 Brussels

European Commission
B-1049 Brussels

Marie Skłodowska-Curie Actions

Lessons Learnt from the implementation of European Industrial Doctorates in Horizon 2020

Report from the Cluster Event with European Industrial Doctorates (10 November 2022)

European Research Executive Agency (REA)
Marie Skłodowska-Curie Actions

2023

Manuscript completed in June 2023

1st edition

LEGAL NOTICE

PDF	ISBN 978-92-95234-15-4	doi: 10.2848/48902	JW-07-23-347-EN-N

Luxembourg: Publications Office of the European Union, 2023

Table of Contents

Acknowledgement

This report is based on the notes taken by six experts invited to attend the cluster event and appointed to draft specific parts of the meeting report: the main rapporteur Prof. Haydn Thompson (THHINK BV) and the other five workshop rapporteurs: Tobias Bauer (Head IT Security Consulting, INFODAS), Prof. Kenneth Camilleri (Professor, Systems and Control Engineering, University of Malta), Hilary Hanahoe (Secretary General of the Research Data Alliance (RDA)), Dr. Gohar Sargsyan (Director for Partnership, Innovation and Sustainability, CGI) and Prof. Donatella Verbanac (Professor, Medical Biochemistry and Hematology, University of Zagreb). The experts' contribution is mainly presented in Chapters 5 of the report.

The whole report was coordinated by Thomas Vyzikas, for the cluster event organizing team, from the MSCA Doctoral Networks unit, that also includes Dana Weintraub, Sofia Hardouin Monroy and under the supervision of Frank Marx and Klaus Haupt. The full report was finalised cooperatively by the REA organising team and DG EAC co-organising team, Sohail Luka and Claire Morel.

The description of the EID Cluster event together with the presentations of the speakers can be accessed via the link: https://rea.ec.europa.eu/events/msca-industrial-doctorates-lessons-learned-horizon-2020-2022-11-10_en.

Acronyms

- DG EAC - Directorate General for Education, Youth, Sport and Culture
- DG RTD - Directorate General for Research and Innovation
- DN-ID - Doctoral Networks - Industrial Doctorates
- EACEA - European Education and Culture Executive Agency
- EC - European Commission
- EC - European Commission
- EHEA - European Higher Education Area
- EID - European Industrial Doctorates
- EIT - European Institute of Innovation and Technology
- EJD - European Joint Doctorates
- ERA - European Research Area
- ERASMUS+ - EU's programme to support education, training, youth and sport in Europe
- ESR - Early Stage Researcher
- ETN - European Training Networks
- EU - European Union
- EU - European Union
- H2020 - Horizon 2020 Programme (2014-2020)
- HE - Horizon Europe Programme (2021-2027)
- HES - Higher and Secondary Education Establishments
- IPR - Intellectual property rights
- ITN - Innovative Training Networks
- JU - Joint Undertaking
- KICs - Knowledge and Innovation Communities
- MCAA - Marie Curie Alumni Association
- MSCA - Marie Skłodowska-Curie Actions
- NCP - National Contact Point
- PM - Project Manager
- PO - Project Officer
- PPP - Public-Private Partnership
- REA - European Research Executive Agency
- RTO - Research and Technology Organisations
- SME - Small and medium-sized enterprises

Foreword

The cluster event on European Industrial Doctorates (EID) took place on 10 November 2022 with over 160 participants involved in Marie Skłodowska Curie Actions (MSCA) EID projects, companies, associations and funding organisations. The event was organised by the European Research Executive Agency in close cooperation with the European Commission's Directorate-General for Education, Youth, Sport and Culture. The EID event followed a series of networking meetings organised since 2021, gathering coordinators of MSCA European Joint Doctorates or focusing on specific topics such as cancer research, ocean research and the European Green Deal. These events are part of a wider strategy that strives to provide feedback to policy by collecting best practices from MSCA projects and by offering opportunities for networking to projects working in similar areas or facing similar challenges.

The MSCA European Industrial Doctorates have a special position in the MSCA funding of doctoral programmes – they are forging partnerships of universities and research institutions with the non-academic sector notably with industry and businesses. Thus, the EID projects are key vehicles in advancing innovation at doctoral level and in bridging the skills gap between research and the market. This has a two-fold outcome: improving the employability of the fellows and boosting an innovation-based European economy and sustainable growth. However, the intersectoral mobility, joint procedures and the strong involvement of the non-academic sector pose challenges in the implementation of the EID projects.

We are pleased to share this report, which takes stock of the experience and the knowledge collected from the implementation of MSCA EID in Horizon 2020. The concrete recommendations will help better orient the new MSCA Industrial Doctorates in Horizon Europe and serve as a guide to applicants and project participants for better designing and implementing their projects. Following the identified best practices and the lessons learnt to avoid pitfalls, we hope that future Industrial Doctorates will continue to maximise their outcomes and benefits for doctoral candidates and institutions.

Begoña ARANO

Head of MSCA & Support to Experts Department, European Research Executive Agency

Claire MOREL

Head of MSCA Unit, Directorate-General for Education, Youth, Sport and Culture

Executive Summary

Funded under the Marie Skłodowska-Curie Actions (MSCA), the European Industrial Doctorate (EID) is a specific implementation mode of the MSCA Innovative Training Networks (ITN), which were the predecessor of MSCA Doctoral Networks (DN) implemented during the EU European Research and Innovation Framework Programme Horizon 2020 (2014-2020). The MSCA ITN and DN programmes were developed to provide a highly integrated type of international, intersectoral and interdisciplinary collaboration in doctoral training. Key aspects of these programmes are mobility of the fellows between project participants and their joint supervision. The Industrial Doctorates are highly prized training programmes performed in conjunction with industry. The fellows are jointly supervised by academic and non-academic supervisors providing fellows with an industrially-relevant PhD which has a clear foundation in industry and business skills. This results in multiple benefits for doctoral fellows such as enriching their experience, increasing their exposure to the non-academic sector and improving their employability.

On 10 November 2022, the European Research Executive Agency (REA) organised a cluster event gathering over 160 relevant actors from 75 EID projects funded under Horizon 2020. The participants represented both the academic and non-academic sectors, which is essential for this mode of MSCA - ITN projects. The participants included project beneficiaries and coordinators, industry representatives, Early-Stage Researchers (ESRs), National Contact Points (NCPs), representatives from the REA and the European Commission (EC) as well as the Marie Curie Alumni Association (MCAA). The meeting was pertinent in terms of timing and focus as highlighted by a survey conducted by the REA in April 2022[1]. During this cluster event, an overview of the funded projects was given, as well as the key outcomes highlighted by the survey. The experiences of participants in the implementation of EID projects were discussed in depth. A key goal of the meeting was to document successes, good practices and lessons learnt, as well as provide recommendations to help improve and enhance the efficiency and impact of the programme for fellows, industry and academia in the future, thus contributing more effectively to the corresponding EU priorities. These conclusions are also applicable to the DN-ID programme in Horizon Europe.

During the cluster event, six parallel workshops took place to share ideas and best practices covering key topics identified by the survey. These included joint procedures (governance, recruitment, supervision), mobility-secondments-training, industry and business participation, simplification of project administration, strengthening the impact of EIDs, and facilitating project implementation. Three ESRs provided testimonials and shared their experience working in EIDs and the impact it had on their careers. Two project coordinators of successful EIDs also presented their insights and shared best practices. To get a wider viewpoint, a Roundtable Policy Discussion was held with five key representative stakeholders from Academia, Industry, the Policy Directorate General (DG EAC), the MCAA, and an EU Member State ministry. They discussed the incentives for organisations to participate in EIDs, and how the outcomes of the projects can be enhanced, broadened and ultimately valorised.

Overall, the stakeholders highlighted that the MSCA EID programme is very successful. In Horizon 2020, 155 EIDs have been funded with €241M supporting over 900 ESRs. The REA survey results showed that the experience of participants was very positive with 98% of the participants considering their involvement in EID projects beneficial for their organisation. Notably, 84% of participants would be keen to join in another EID project. It is also clear that the programme is being successful in creating long-lasting collaborations, which results in a structuring effect within Europe.

[1] See ANNEX B: Preparatory survey.

There are, however, still challenges, and although progress has been made with respect to simplifying the programme's administration, it was highlighted in the cluster event that there is a need to make the scheme more attractive, particularly for industry. The needs for more flexibility and adaptation was a key aspect raised during the day. In particular, this related to the rule of spending at least 50% of the fellowship in non-academic organisations. A number of best-practice approaches were identified for recruitment, Intellectual Property Rights (IPR) agreements and for issuing visas for non-EU fellows. The monitoring of impact in terms of papers, patents and other outcomes needs to be improved to clearly demonstrate the produced innovation. Better communication is also needed as a means of raising awareness of the benefits of the industrial doctorate programmes. Here, there is an opportunity to reach out to the Joint Undertakings (JUs) and Public-Private Partnerships (PPPs) which have a strong link with industry to further engage the non-academic sector in the doctoral training. Regarding potential commercialisation of the project results, even if not a key objective of the programme, there needs to be a change in mindset and more entrepreneurship training for fellows. The latter is a core area of the transferable skills promoted by MSCA, and this feedback confirms that such emphasis should be maintained and strengthened. Finally, to fully valorise the experience and skills gained by the ESRs, as well as the benefits for non-academic organisations a set of potential Key Performance Indicators (KPIs) could be established to better measure the projects' outcomes.

The cluster event participants strongly advocated for the importance and value of the EIDs. Both industry and academia put forward a strong message of commitment to support the streamlining and enhancement of the programme to further successful implementation in the future. The main recommendation focused on the early involvement of the industry in the proposal preparation and the project in order to proactively resolve any issues, and to better incorporate their needs and build trust as foundations for long-lasting collaborations. A summary of key recommendations is provided at the end of the present report.

1. Introduction

The Innovative Training Networks are a key part of the Marie Skłodowska-Curie Actions (MSCA)[2] under the previous EU Research and Innovation Framework Programme Horizon 2020. There are three different implementation modes: European Training Networks (ETNs), European Joint Doctorates (EJDs) and the **European Industrial Doctorates (EIDs).**

The aim of EIDs is to train highly skilled researchers, and to stimulate entrepreneurship, creativity and innovation in Europe. By involving the non-academic sector in doctoral training, a better match between skills public and private sector need is attained, thereby improving the employability prospects of the doctoral candidates. Crucially, the funded MSCA ITNs are expected to have a structuring effect on research in key topics by bringing together key expertise across Europe enhancing these networks' longer-term sustainability. The main difference with EIDs is that ESRs develop their skills in industry and business by spending at least half of their fellowship duration there. The ESRs thus enjoy a joint academic and industry supervision while enrolled in a PhD programme in an academic institution.

The EIDs provide direct benefits for universities, industry, students and ultimately employers. For universities and industry the collaborations are mutually beneficial providing cross fertilisation that often goes beyond the project lifetime having a structuring effect on doctoral training. Fellows benefit from personal development, gaining both research and industrial experience. The collaborations promote excellent science and allow industry to attract better candidates with skills that match market needs while gaining more international visibility. This gives industry access to top research talent and knowledge, which acts as a catalyst for technology transfer and innovation. As the main actors of the non-academic sector, industry and businesses play a key role in advancing innovation and bridging the gap between research and market. Nevertheless, EIDs cater for collaborations with the non-academic sector as a whole and not only industries. Accordingly, a non-academic partner could for example be a Non-Governmental Organisation, a Think Tank, a charity, a hospital, a museum or a department in national administration.

EIDs have been funded since 2014 under the MSCA, a core part of Horizon 2020, the EU's flagship programme for research and innovation between 2014-2020. Since their introduction in Horizon 2020, 155 EIDs have been funded with €241M, which has supported over 900 research fellows. As all ITNs, EIDs were designed with the objective of promoting international, intersectoral and multi/interdisciplinary collaboration in doctoral-level training in Europe and beyond. Moreover, as a dedicated implementation mode of the ITNs, EIDs specifically involve the non-academic sector – in practice having a particular focus on industry and businesses - in the doctoral training, so that the skills of the trained researchers better match public and private sector needs, thereby meeting the objectives of inter-sectoral research of ITN and resulting in enhanced employability of the fellows. To achieve this, the joint supervision of the researcher is mandatory and is ensured by at least one supervisor from the academic sector and one supervisor from the non-academic one. Furthermore, the researchers must spend at least 50% of their fellowship duration in the non-academic sector. In addition, the commitment and involvement of both sectors is ensured through the joint management structures, considered essential for the project implementation.

[2] https://rea.ec.europa.eu/funding-and-grants/horizon-europe-marie-sklodowska-curie-actions_en

The set-up of such joint research supervision and project management governance at doctoral level can be challenging. These challenges are often underestimated during the preparatory phase of the EID proposals preparation. The implementation experience with EID projects shows additional challenges in comparison to the ETN mode, such as mobility arrangements for the recruited researchers, consecutive recruitments, or different culture and tasks between the academic and non-academic participants. Moreover, certain EID-specific rules were strict and have been continuously evolving in the different Work Programmes, creating additional challenges to applicants and project beneficiaries. The identification of potential difficulties or blocking issues and of possible corresponding solutions together with best practices and lessons learnt from ongoing or finished EIDs is of utmost importance in order to overcome the barriers towards the setting up of new Industrial Doctorates.

The MSCA EID Cluster Event represented a networking opportunity for a growing interdisciplinary community involved in the implementation of industrial doctoral programmes. The cluster event allowed participants to exchange views and provide feedback for policy making with regards to the improvement of DN-ID in Horizon Europe, taking stock of the experience from Horizon 2020. The event brought together participants from Horizon 2020 EID projects to share their challenges, lessons learnt and best practices from their experience in project implementation, as well as to suggest means to increase the potential for innovation advances and maximise the benefits for the career development of the fellows.

In this regard, the key objectives of the EID cluster event were to:

- collect good practices in EID project implementation;
- identify possible solutions to existing bottlenecks for generating tangible innovation;
- gather practical comments for improving cross-sectoral interactions and collaboration between academia and industry;
- provide inputs for the policy feedback related to obstacles for project implementation;
- provide outputs that can be beneficial for MSCA Industrial Doctorates in Horizon Europe.

The meeting attracted around 100 participants from EID projects (coordinators, supervisors, ESRs), approximately 15 from relevant stakeholder organisations (MSCA Alumni, employers' organisations, practitioners from other industrial doctorates programmes) and NCPs (National Contact Points), and another 45 participants from the Commission services (REA, EACEA, Commission's Directorates General). The participants shared their own project implementation experiences via 6 parallel workshops, each with around 30 participants, addressing specific topics. These topics were identified as being important in the REA survey, conducted in April 2022. The workshops addressed topics such as joint procedures, administration, mobility and secondments, training, policy, industry and business participation and project practicalities.

Plenary sessions were also organised before and after the workshops. These included presentations from two project coordinators, testimonials from ESRs and a roundtable discussion that focused on enhancing the employability of the EID ESRs. The ESRs were invited to share their experience through testimonials at the beginning of the day, and also participate in the workshops. The roundtable discussion and workshops provided inputs

on MSCA project implementation, acting as a tool for the REA to provide policy feedback to the DG EAC of the European Commission. The event closed with conclusions and recommendations drafted by dedicated rapporteurs.

The present report includes the information exchanged during the one-day EID Cluster Event and highlights important conclusions and recommendations for the improvement of the EID project implementation and the DN-ID programme design. The structure of the report mirrors the structure of the EID Cluster Event (see ANNEX A – Meeting Agenda).

2. Portfolio Analysis

A portfolio analysis[3] of EID projects funded in Horizon 2020 shows that overall, €3.42Bn has been allocated to MSCA ITNs, representing ~55% of the total MSCA budget and 5.9% of the total Horizon 2020 budget (€80Bn). The EIDs received approximately 15.3% of the MSCA ITN funding, corresponding to €241M in Horizon 2020.

An average project within MSCA ITN funds around 9 beneficiaries with an average project budget of €3.35M supporting 11.5 ESRs. There have been 7 ITN/EID calls between 2014 to 2020 attracting 1009 applications, and from these, 155 projects have been funded. Between 2014 and 2020 there has been a stable submission trend with EID success rates varying between 13% and 21% dependent on the year since the scheme began in 2014, as seen in Figure 1. This is considerably higher than the ETNs, which had a success rate of about 10 %[4].

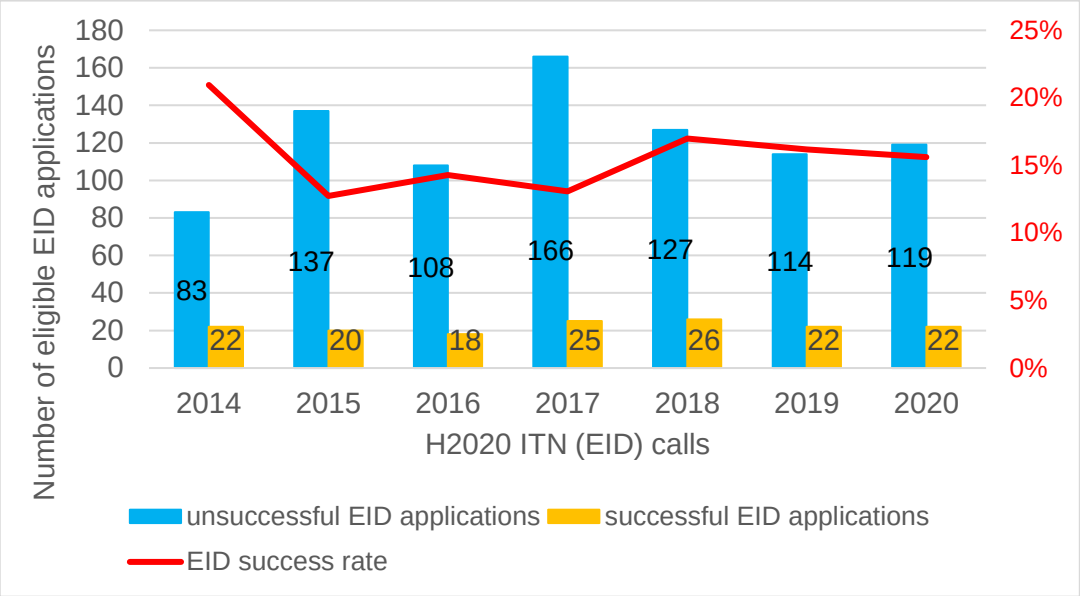

Figure 1:Applications and funded EID proposals in Horizon 2020

The EID programme has funded 727 beneficiaries, 48% of which came from the non-academic sector, with 40% of them being SMEs. Furthermore, 248 partner organisations engaged with the programme, of which 62% came from the non-academic sector and of which 28% were SMEs. Overall, around 930 Fellows with 90 nationalities have been trained in EID projects. This shows a large diversity of participants and the openness of the programme.

[3] Access the presentations via the link: https://rea.ec.europa.eu/events/msca-industrial-doctorates-lessons-learned-horizon-2020-2022-11-10_en

[4] In Horizon 2020, the different implementation modes had different allocated budget. In Horizon Europe, all implementation modes belong under the same budget split, corresponding to the scientific panel under which they had submitted an application.

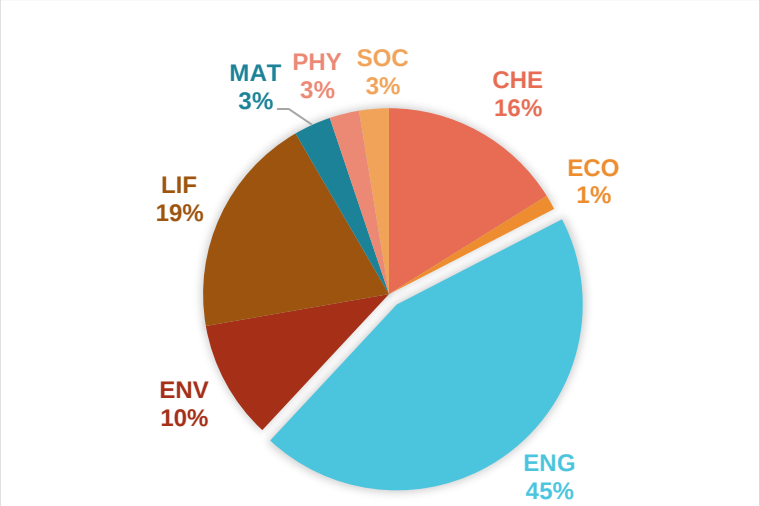

Figure 2: EID funded projects per scientific panel

In terms of scientific fields, EIDs have a particularly strong representation in the ENG panel (Information Science and Engineering), as shown in Figure 2, with 45% of projects being in this area.

In terms of implementation, the projects tend to be smaller than ETNs, and this is likely because smaller projects are easier to manage in a cross-sectoral setting. The average size for an EID is 177 person months equating to around 5 ESRs. Notably very few consortia request the maximum grant size (540 person months). The average EID consortium has 4.7 beneficiaries, but with a significant number of projects (20%) with only 2 beneficiaries, which is considerably smaller to the average number of 9 beneficiaries in ETN and EJD projects.

In terms of participants, the non-academic sector plays a key role. The top ten companies as regards participations in different EID projects are shown in Figure 3 and represent large well-known industrial companies. These are companies that participated in 2-4 EID projects each. The top 11 Universities are also shown in Figure 3 and they participated in 4 to 8 EIDs each. Therefore, considering the relatively low number of projects where each entity participates, there is high diversity in the participants and it can be said that the programme is open to a wide range of non-academic participants.

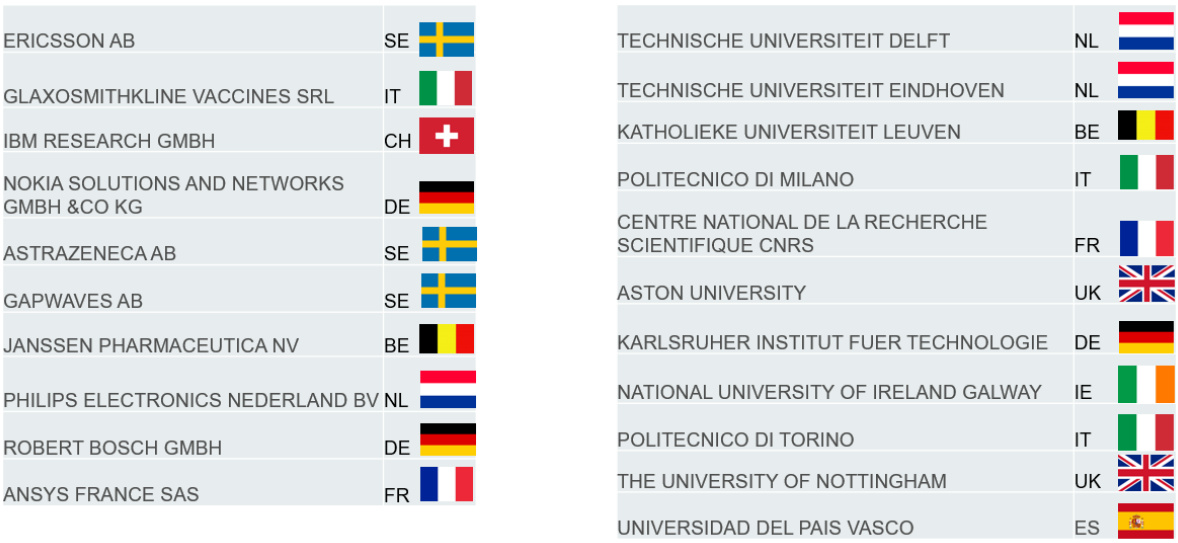

Figure 3: Top 10 Participating Companies and Universities in EIDs

Due to their strong industrial component, EIDs have the potential to produce tangible innovation. This can be more concretely measured through the reported patents that stem from the projects. Typically, EID projects report twice the number of patents than ETN/EJDs per ESR. A recent study[5] about the cluster analysis of ITN projects supports that innovation is generated mainly at industrial partners. In particular, it was found that beneficiaries that are in nature industrial, such as companies, and are identified in general as innovators, can boost the project success in terms of innovation produced.

Regarding the ESR's experience, at the end of their fellowship, the ESRs are asked to complete questionnaires, from which it appears that EIDs are viewed positively and ESRs report a very high satisfaction level with the programme (83%). It was particularly noted that there are more job opportunities for EID students in large enterprises and SMEs than from other ITN modes.

In conclusion, EIDs tend to be smaller in terms of participants and budget, attract both large industry and SMEs, produce on average more innovations and result in better job prospects for ESRs compared to other ITN modes.

3. Survey Results

As a preparatory step for the organisation of the EID Cluster Event, a survey was launched in April 2022 to identify the key aspects in Horizon 2020 EID Projects[6]. All beneficiaries' registered contact points from Calls 2014-2020 were invited to report on their role in the project, their incentives to participate, their challenges and their achievements. The response rate was very good with almost 90% of the EID projects (137/155) responding to the survey. There were 481 individual responses from both academic and non-academic beneficiaries and coordinators**.** Notably, 45% of the

[5] Report on R&I project cluster analysis:H2020 MSCA ITN 2014-2015-2016-2017: https://op.europa.eu/en/publication-detail/-/publication/0bece3cd-a697-11ed-b508-01aa75ed71a1/language-en

[6] Access the presentations via the link: https://rea.ec.europa.eu/events/msca-industrial-doctorates-lessons-learned-horizon-2020-2022-11-10_en

responders belong to the non-academic sector, which gives reassurance that the results of the survey represent those participants who are in the centre of the EID programme.

The survey showed that the main project bottlenecks are linked to mobility and administration. For this reason, the focus of the cluster meeting was on administrative/organisational/logistical issues rather than scientific issues. The responses from the participants from different sectors were analysed and compared in order to identify the different incentives that drive engagement with EID projects and the challenges that are experienced from both sides (academic and non-academic).

It is worth noting that a similar survey was conducted by the European Commision at the beginning of Horizon 2020[7]. The main difference with the present survey is that the previous one included input also from EID fellows, but examined only EID projects until March 2016, when none of the EID Horizon 2020 projects was reached completion. Since the rules of the EID programme have evolved, direct comparisons between the two surveys may be inconclusive. Nevertheless, both surveys highlighted similar challenges for the implementation of EID projects, such as visa issuing for international mobility and joint supervision across sectors and countries. Herein, the analysis concerns only the survey of the present study.

Overall Experience: Overall, the experience of participants was very positive with 98% of the participants considering their involvement in the EID projects beneficial for their organisation. Further, 84% would be keen to join in another EID project. Feedback from academic beneficiaries indicated that the scheme was excellent for training researchers and that the links with industry gave great experience. From an industry perspective, it was noted that via engagement in research it was possible to show that a company was innovative.

Coordinators: 75% of project coordinators came from Higher and Secondary Education Establishments (HES), which represent predominantly the academic sector. The satisfaction with the programme among them was very high. It was noted that the private for-profit organisations (industry, SMEs and businesses) prefer to participate as beneficiaries in EID projects instead of leading the project, most likely because the administrative and project management burden is reduced compared to that of the coordinators.

Incentives: There are different incentives to engage with EID projects, and participants were asked whether they were looking for new business opportunities, wanted to increase international visibility, improve quality of training, get access to research infrastructures, establish long lasting collaborations, participate in exchanges or wanted funding for PhD candidates. For HES the greatest incentive is in gaining funding for fellows. For private organisations the top reasons for participation were to establish long-lasting collaborations with institutions and to engender knowledge exchange. The long-lasting cross-sectoral collaborations and access to further opportunities through the network, e.g., via new proposals, were highlighted as being key benefits of participation by all organisations as shown in *Figure 4*. Other benefits for HES participants were the production of publications, new scientific collaborations, and increased visibility.

Main outcomes: As seen in *Figure 5*, the participants in the survey highlighted that long-lasting collaborations was the main outcome of the EID projects (80% on average), and the second main outcome was accessing further opportunities through the established network (75% on average), such as applications for funding and new scientific collaborations. The potential commercialisation of the project outcomes was the least achieved result. However, it is worth noting that the private for-profit organisations have

[7] European industrial doctorates Towards increased employability and innovation: final report (2017), published by the European Commission, DOI: 10.2766/643937, https://op.europa.eu/en/publication-detail/-/publication/c6abb4b4-3c3e-11e7-a08e-01aa75ed71a1

reported 2-3 times more such outcomes compared to the other types of participants, indicating their role in valorising the project results and exploring market uptake.

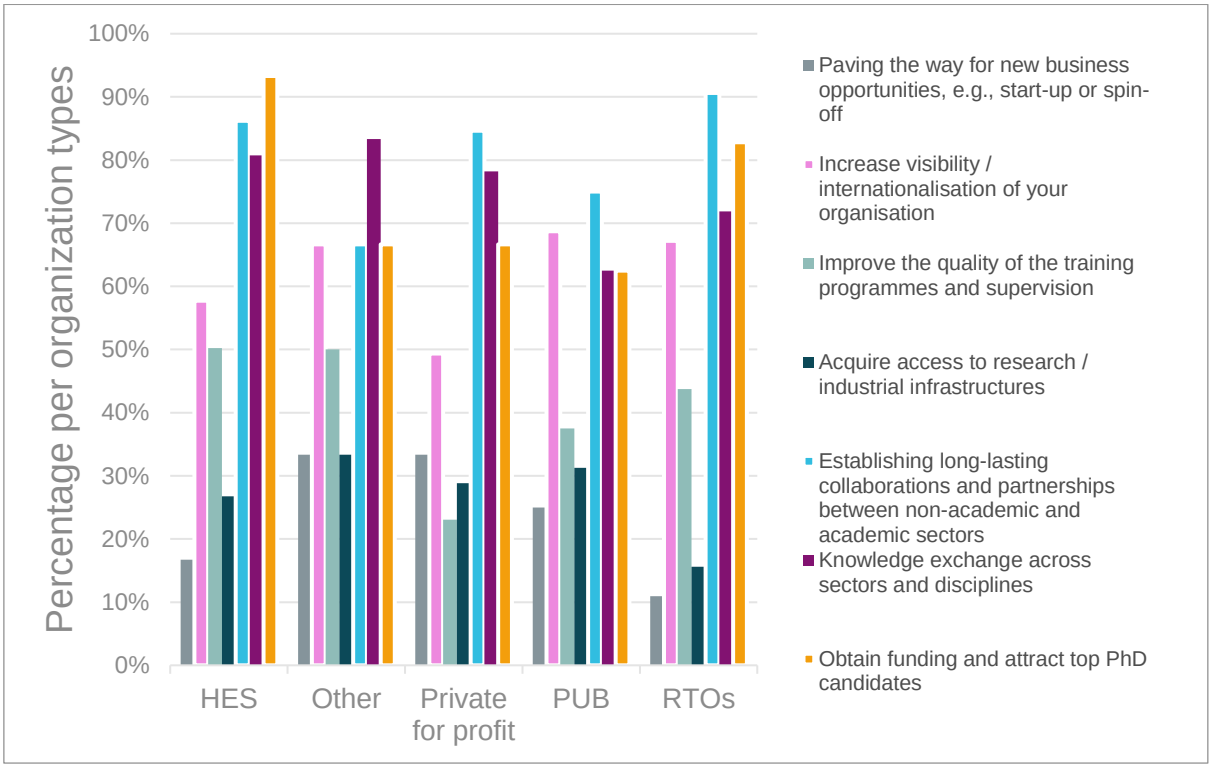

Figure 4: Incentives to join EID projects for different organisations[8]

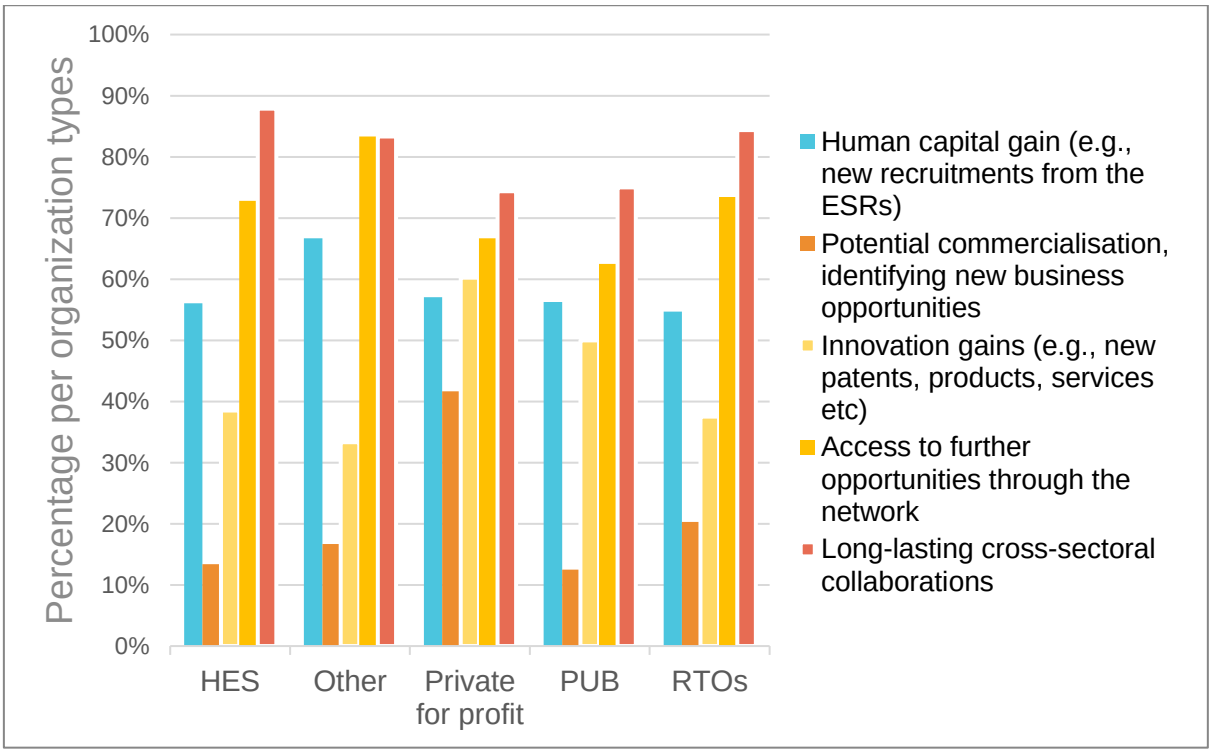

Figure 5: Outcomes from EID projects for different organisations

[8] HES: Higher and Secondary Education Establishments; PUB: Public Bodies; RTOs: Research and Technology Organisations

Identified Challenges: Overall, the survey showed that approximately 40% of the participants had not faced significant challenges. The responders indicated as main challenge in the project implementation the joint supervision across two countries and diversion of ESR effort into non-academic tasks while on secondment, which can lead to an interruption of an ESRs' focus on scientific project work if not properly designed. Moreover, anecdotal evidence indicated that the ESRs found the transition between the academic style and industrial style of supervision as being difficult in some cases.

An important conclusion from the survey was also that the private for-profit partners faced the same challenges in the project implementation as the other participants. One would expect that private entities with a commercial interest would highlight IPR as being a challenge, but overall IPR was not indicated in the survey as being a main issue during the project implementation.

A deeper analysis of the responses showed that challenges are identified at an individual project level (55% of negative comments came from 11% of projects). Specifically, many problems arose in the Call 2019 projects that started in 2020, possibly due to the COVID-19 pandemic that caused lockdowns and travel restrictions, which affects particularly EID projects that have compulsory mobility. The above highlight that the challenges are not directly related to issues stemming from the EID programme itself.

Administrative barriers and costs: Secondments and cross-sectoral and international mobility were reported as the main implementation and administrative issues for the consortia. However, such mobility is at the core of the MSCA programme[9]. It was noted that visa issues restrict ESRs' mobility, especially for non-EU nationalities. The 50% rule for presence in the non-academic sector had also presented a real challenge for students on a 3-year PhD as well as the supervisors at both academic and industrial organisations.

This issue is also reflected in the administration costs, which were higher than expected due to legal, human resource and visa overheads. The administrative effort was also highlighted as a matter of concern by some organisations, which calls for better considerations regarding the simplification of administrative procedures as well as the number and content of reporting deliverables during the proposal design.

Conclusions: In conclusion, the very encouraging outcome was that 90% of projects responded and that there was very high level of satisfaction among the participants in EID projects (98%). The main incentives to participate in EID projects and the main outcomes from the projects were long-lasting collaborations and knowledge exchange. This contributes positively to creating a sustainable structuring effect of the doctoral training. There were, however, a number of challenges similar for both the HES and private for-profit partners. The greatest challenges referred to mobility, which is a core aspect to the programme, and 43% considered the international mobility to be the most administratively cumbersome aspect of projects. Notably, 29% of the participants indicated joint supervision and monitoring as the most significant challenge. Further analysis showed that the majority of the challenges and issues identified were mainly reported by a small number of projects, indicating that the issues are caused by the project implementation and are not inherent at the EID programme.

4. Testimonials by ESRs

A series of testimonials was given by ESRs who had been engaged in MSCA EID projects highlighting the experience and benefits gained as well as the challenges encountered.

[9] The MSCA DN-ID programme in Horizon Europe introduced more simplified and flexible rules for mobility.

The testimonials aimed at obtaining directly the view of the ESRs who are in the core of the EID programme and essentially the main beneficiaries of the projects.

4.1. Elena Detta (VIRO-FLOW)

Elena was an ESR in the VIRO-FLOW project[10]. She finished her PhD in July 2021 and is now a Post-Doctoral researcher in computational and organic chemistry. Her main driver for pursuing the industrial doctorate was to achieve a life changing experience from both a scientific and personal point of view. She conducted half of the PhD in a company, which was a very good experience. The work was both multidisciplinary and multicultural as it was performed in Germany and Spain. This led Elena, who is Italian, to learn German and Spanish. The aim of doing the PhD had been to pursue research challenges, and this had been successful. In terms of improving the experience for ESRs, it was noted that the transition between countries had been quite smooth as the consortium partners provided good support to deal with accommodation, documentation, tax declarations, etc. Writing the thesis was more of a challenge as there was a lot of pressure to produce many deliverables and reports for the programme. This could be reduced as it left less time to develop scientific skills. It was noted that it would be useful to specify at the project start the number of publications that an ESR is expected to achieve in order to give a better idea of the output required from ESRs in terms of publications. From a career perspective, the chance to travel and build a network in conferences and workshops/webinars was seen as highly beneficial. It was noted that the experience had been very good and life changing.

4.2. Mariana Pereira Guimarães (SOLOCLIM)

Mariana was an ESR in the SOLOCLIM project[11], which deals with climate adaption in architecture. The project supported a cohort of 6 ESRs engineer architects at universities and consulting companies. Mariana came to the programme after finishing a double masters in the USA. She was at a career decision point whether to continue in academia or go to industry, and the MCSA Industrial Doctorate programme allowed her to evaluate both routes. There had been some hurdles to doing this caused by travel restrictions coming to Europe due to the COVID-19 lockdowns. The obstacle was circumvented by the Italian University and Dutch consultancy company partner through virtual signing of contracts which allowed her to receive her salary. Meetings and courses were conducted online as well. Other hurdles included a lack of understanding of PhD requirements, in how the available funding could be used for training, and on simple things such as submitting invoices, booking trips and getting reimbursed.

Mariana highlighted what a great experience the project had been and that she would do it again. She has met many skilled and helpful people and had opportunities to present her work internationally. The project has changed her perspectives and she would now consider a job in a consultancy company when she returns to Italy.

[10] https://cordis.europa.eu/project/id/766058

[11] https://cordis.europa.eu/project/id/861119

4.3. Marina Avena Maia (REWATERGY)

Marina is an ESR at Cambridge University working on the REWATERGY project[12] looking at wastewater treatment with industrial experience in a company in Delft (NL). She highlighted that she had chosen the industrial doctorate to enrich her experience at both the scientific level and from a professional point of view. In terms of hurdles, she experienced a key problem related to visa bureaucracy in the UK and the Netherlands as she is originally from Brazil. This is a common problem for non-EU fellows. Experience shows that it is necessary to start the paperwork in advance, because the procedures can sometimes take at least 6 months. This should be considered when setting up projects in different countries. It was noted that the strict 50% placement at university and in industry as planned in her project was difficult to comply with if there are long waiting times for visa paperwork.

Marina highlighted that the EID programme is an amazing opportunity for students. It is highly beneficial as the researcher gets a PhD while at the same time develops as a professional. Marina has received technical training to improve as a scientist and has also gained many soft skills that allows her to enter the jobs market. In particular, she has been doing a lot of training on communication skills and has received four awards for presentations at conferences and events. This has really enriched her career.

4.4. Commonalities among ESRs

In all cases the ESRs wished to expand their horizons both from a scientific and professional point of view. The opportunity to experience an industrially driven project was highly appreciated and the soft skillsets that had been gained were clearly demonstrated in their statements. Although there are some hurdles (temporary in the case of COVID-19), but also known issues such as obtaining visas and understanding the necessary paperwork requirements, these had been overcome. The experience for the ESRs was very positive and had led to enrichment of their careers.

5. Workshop Outcomes

At the EID Cluster Event six 90-minute parallel workshops were organised to perform a deeper dive into topics which had been highlighted by the survey (see ANNEX B – Preparatory survey). These were led by a Moderator, who coordinated and chaired the discussion, and a Rapporteur, who summed up the result of the discussions. Each workshop attracted around 30 or more participants with a mix of research, academic, industry and policy backgrounds. Participants were assigned to a workshop based on their preferences during the registration for the event. The workshops were designed to be interactive and encourage the active participation from all the participants, who could express their ideas and make suggestions for the improvements of the EID programme or the implementation of industrial doctorate projects.

The REA organisers together with the moderators and rapporteurs of the workshops prepared a preliminary structure of the workshops, including a list of points for discussion, as seen in **Table 1**.

[12] https://cordis.europa.eu/project/id/812574

Table 1: Six parallel workshops description

1) Joint procedures	**4) Administration**
Moderator: Jan Tobias Rapporteur: Tobias Bauer How to effectively engage both academic and non-academic partners in: • Governance structure • Recruitments • Supervision • Consortium agreement	Moderator: Tobias Nielsen Rapporteur: Donatella Verbanac How to simplify and make more efficient the project implementation • Scientific reporting • Financial management • Project Manager assisting the coordinator • Consortium internal organisation
2) Mobility – Secondments – Training	**5) Policy workshop**
Moderator: Susana Fernandez Prieto Rapporteur: Hilary Hanahoe How to better prepare the project for: • Compliance with the 50% cross-sectoral mobility rule • International mobility administration (visa, work permit etc) • Joint network events: summer school, workshops etc • Synergies with other projects / programmes	Moderator: Marco Biancolini Rapporteur: Haydn Thompson How to strengthen the impact of EID projects? • Incentives for pursuing an industrial doctorate • Contribution to EU Policies: Green Deal and Horizon Missions • Creation of start-ups and potential for market uptake • Alumni strengthening and employability of the fellows
3) Industry and business participation	**6) Project practicalities**
Moderator: Sterling Raymond Rapporteur: Gohar Sargsyan How to strengthen and further integrate the industrial and business participation: • Involvement in the proposal design to reflect their needs and expectations early in the process • Tangible impact: Advancing science and enhancing innovation • Benefit for the career development of the ESRs • Creation of long-lasting collaborations and interactions	Moderator: Sarah Hudson Rapporteur: Kenneth Camilleri Specific tips to facilitate to the project implementation • Open access / Open data - IPR issues • PhD duration • Enrolment in a PhD • Resignations of ESRs

In the following sections the key messages from the workshops are presented.

5.1. Joint Procedures - How to effectively engage both academic and non-academic partners

The Joint Procedures workshop focused on the joint academic and non-academic procedures required to implement industrial doctorates. The workshop attracted around 30 participants with a mix of backgrounds including project representatives from academia and industry, REA staff and ESRs. The joint procedures comprise the governance structure, recruitment, supervision and the preparation of the consortium agreement. During the workshop, the participants identified challenges, best practices, issues and potential solutions, which are discussed below.

Governance Structure

Both the academic and non-academic sectors are engaged in project governance. The projects are typically coordinated and organised by academic beneficiaries that lead the project activities. Academic partners mainly drive organisation and decision-making since they are much more familiar with the rules and conditions of Horizon 2020. The academic partners also have dedicated support offices that help with project management and compliance with all rules and regulations. Typically, EID are smaller projects with 5 to 6 beneficiaries and fewer ESRs than other ITNs, which requires relatively lean governance structures. Industry partners appreciate the academic partner taking the lead to ensure compliance with all Horizon 2020, national and university rules associated with implementing the project and the PhD student enrolment. It was highlighted that a higher contribution of industry to coordination can positively contribute to academic institutions since the sector can bring additional perspectives to project management. Hence, industrial coordination can also improve the allocation of internal company resources and broader engagement to make the results more useful.

Recruitment

Usually, there is a good pool of researchers interested in industrial doctorates from all over the world. Best practice is that both the academic and industrial sectors jointly select the candidates. The selection should be merit-based and aligned with the MSCA Work Programme requirements. Consortia use their websites and the EU platform EURAXESS to advertise positions. It was noted that the EID projects are popular among applicants from Asian and Middle Eastern countries. Some selected candidates can face severe issues obtaining their visas, which causes delays in the project. The actual salary to be paid after all deductions needs to be clearly stated. The recruiting institution also deducts non-wage labour costs from the total paid allowances, and this can have a significant impact on the researcher's take-home pay. Furthermore, the need to set up work contracts in different countries creates an administrative burden for students and can be time-consuming. It was noted as important to get the balance right between industrial secondment time and in achieving scientific progress. The rule to spend at least 50% of the time within industry would benefit from additional flexibility to optimise projects based on individual student needs and it should be designed well from the outset of the project in order to have an added value to the training.

Supervision

It is mandatory that both academic and industrial partners actively supervise researchers. However, having a primary supervisor that guides and facilitates decision-making is essential. This supervisor must be clearly identified from the very beginning of the project. This should be agreed upon in the proposal and, as such, evaluated and implemented.

However, in practice ESRs require partial adjustments according to their individual situations. Therefore, the supervisory board should closely monitor the frequency and efficiency of the supervising meetings and arrangements and propose adjustments if this is required. A different issue is that the industry supervisors can request additional tasks from the doctoral candidate – sometimes unrelated to the individual research project-, which can easily result in overload and endanger good scientific progress. It is important that all supervisors be aware of the requests made upon ESRs and that they regularly meet for proper expectation management. The local doctoral schools also request partly different progress measures compared to the research and training programme, which brings additional workload for the doctoral candidate. Here, it is suggested that the doctoral candidate and the PhD supervisor assess the school's expectations and requirements from the beginning so that the ESR can adequately align with these needs minimising double reporting.

Consortium Agreement

For the Consortium Agreement it is advised to start early with the preparation process, for example, during the proposal creation. In practice, this rarely occurs due to the high risk of not obtaining the funding and investing too much effort and resources without a final need. Therefore, consortia typically begin with the creation of the Consortium Agreement during the grant preparation phase. The main aspects that are negotiated are related to internal intellectual property agreements, the embargo rules for the publication of scientific findings and dissertations, and the distribution of the management costs to enable proper project management and network-wide training. Since the Consortium Agreement is concluded between the participating organisations (not among individuals), the negotiations are conducted by the legal departments and lawyers. It was noted that establishing the agreement usually takes significantly longer than expected because of the large number of people involved, the different views on the IP and financial aspects, and the high degree of freedom with which a consortium can establish this document. A possible solution to avoid delays is to provide a central pre-defined template which contains only a few options from which consortia can choose. Additionally, researchers and non-academic organisations would benefit from a better explanation of the potential terms and conditions, options available and the meaning of these for a consortium. It is essential to define all requirements so that commercialisation by consortium members is possible and cannot be delayed or blocked by other consortium members, due to not providing a required license, or disagreements on selling license rights or intellectual property rights to a third party.

Summary of the key recommendations

1. Considering Governance, industry-coordinated networks should be encouraged to increase engagement of the industry participants in project governance, supervision, management, decision-making, etc.
2. To ease recruitment, it would help if the requirement for 50% secondments/placements in the non-academic sector in a different country were relaxed.
3. For generating the Consortium Agreement, it would be beneficial to have examples and better explanations with respect to Intellectual Property management as well as suitable model clauses for industrial doctorates.

5.2. Mobility, Secondments and Training- How to better prepare the project

This workshop was attended by 26 participants from 12 different countries covering a large spectrum of expertise in terms of EID project representatives, REA staff, ESRs and NCPs. During the workshop, there was a great deal of interaction and discussion on mobility, secondments and training topics identified by the survey. These included the difficulties of compliance with the 50% cross-sectoral mobility rule and the administrative issues of international mobility (visa, work permit etc.). The workshop also explored best practice for organising joint network events such as summer schools and workshops, and how to best promote synergies with other projects and programmes.

Compliance with the 50% cross sector mobility rule and international mobility administration (visa, work permit, etc.)

There was consensus from both industrial and academic participants that cross-sector mobility is very beneficial for the ESRs and participating organisations. However, there is a need for efficient joint planning by industrial partners, the academic counterparts and PhD programme supervisors as there are some institutional and national restrictions on timing as well as different PhD programme structures. Additionally, industrial partners often need to ensure that the research continues during the industrial secondment. This may have implications on company practice and policies. The consortium should agree on an optimum start time for the recruitments and secondments. Considering mobility from other regions to Europe the main issues are visas and work permits. Thus, non-EU ESRs may face stricter rules for mobility. This creates significant overhead and bureaucratic difficulties. This is further complicated when contract changes arise, for example from academia to industry. There are implications and differences between academic and industrial contracts in terms of social welfare benefits and taxation. Mobility also creates challenges in terms of where taxes are paid and by whom.

Considering best practices for ESR contracts, one size does not fit all. For example, in some countries, e.g., Italy, academic regulations require that the ESR is contractually tied for the duration of the PhD programme meaning that an industrial contract is not possible. A proposed best practice is to create an 18-month academic contract combined with an 18-month industry one to reduce bureaucracy, however, ESRs prefer to have only one contract. It was highlighted that finding appropriate solutions is hugely time consuming for all involved (beneficiaries and ESRs). This requires financial resources, international legal experts and accountants, presenting a barrier and potential for significant delays. Academic institutes and large industrial organisations often have dedicated international coordination departments or dedicated expertise to deal with mobility and contractual challenges. However, smaller organisations, e.g., SMEs, do not necessarily have these resources available and struggle with the related expenses and time to identify appropriate solutions.

It was noted that NCPs are an excellent reference point, but for bureaucratic issues they often do not have the mandate or information necessary to support visa, contract, work permit queries. However, EURAXESS[13] provides very helpful advice and support for multinational complexities and the REA can provide visa support letters, which are powerful to accelerate visa applications. Overall, it was noted that applicants, beneficiaries and ESRs would very much welcome a centralised contact point, which could provide guidelines from the REA during both the application phase and project execution. As a

[13] https://euraxess.ec.europa.eu/

starting point a set of Frequently Asked Questions (FAQs), which is regularly updated, could be made available to beneficiaries and potential applicants[14].

Joint network events: summer school, workshops, etc.

Overall creativity is key to maintain motivation. Joint activities are hugely beneficial to both beneficiaries as well as ESRs in terms of community creation, getting to know each other, as well as expanding networks. However, there had been many challenges with respect to COVID-19 in terms of face-to-face opportunities. Stakeholders highlighted the importance of restoring face-to-face meetings and making them part of the projects. It was also noted that larger projects face networking challenges where collaboration between work packages and across the whole project is required. There are, however, a number of best practices. Project wide summer schools or similar "time together" occasions are very powerful, fruitful, and important. Involving ESRs in, or indeed giving ownership to them, to organise networking events and training plans creates many professional and personal opportunities. To address internal project networking frequent (monthly) structured meetings between ESRs and supervisors to advance progress and discuss technical challenges has proven to be successful. Additionally, ESRs should be encouraged to hold team meetings (e.g., 30 minutes per week) without their supervisors, which allows for direct and frank discussions. Overall, it was advocated that it is important to ensure that there is a diverse set of joint networking events, with a good balance of face-to-face opportunities in the Description of Action of the Grant Agreement. Empowering the ESRs to plan and execute some of these also adds to their skillset.

Synergies with other projects/programmes

It was highlighted that exploiting synergies with other projects and programmes was very positive and can lead to unexpected connections and benefits. There are, however, challenges related to the incorporation of extra external events and networking as this needs to be done without compromising any patents, IP, knowledge, etc. The activities also may not have been identified as a specific activity in the Grant Agreement and thus can represent a deviation from the project's core activities. It was noted that the REA Project Officers (PO), with an overview of funded projects, can be instrumental in highlighting connections with "sister" projects. It is also possible to leverage external/personal networks and connections to offer increased training and networking for both the consortium and the ESRs. It was emphasised that inter-departmental and institutional opportunities are very valuable for ESRs. A good example is the dissemination of the programme and activities across companies within the same (industrial) group, which can result in unexpected benefits and connections. A key recommendation is to include the development of project and/or programme synergies in the project work plan, with appropriate allocation of time and resources, from the outset, as they are very beneficial.

Summary of the key recommendations

1. Projects struggle with many bureaucratic issues (visas, tax, etc.) and rely on a mix of support contact points. The creation of a dedicated contact point would be highly beneficial to provide advice, both at the application and project execution phases, on visa and contractual aspects.

[14] The REA produces a FAQ annually after every coordinators' infoday.

2. Networking is highly beneficial, and it is important to ensure that a diverse set of joint network events are available, with a good balance of face-to-face opportunities.
3. Project and /or programme synergies should be incorporated into work plans as they are very positive and can lead to positively unexpected connections and benefits.

5.3. Industry and Business Participation - How to strengthen and further integrate the industrial and business participation

This workshop considered ways of strengthening and further integrating industrial and business participation. Several specific aspects were discussed, including earlier involvement in the proposal design to better reflect needs and expectations and how to create tangible impact through advancing science and enhancing innovation. Also, how to create long-lasting collaborations and interactions was explored. The workshop attracted 32 participants with a multi-disciplinary, multi-cultural mix representing industry, academia, government, NCPs and ESRs.

Attraction of private sector

The participants discussed successful approaches that had been adopted to attract new partners from the private sector to participate in EID proposals. The feasibility of actively involving industry/business partner during the preparation of the proposal was also considered. This covered the need for integration of the industrial organisations during the proposal preparation phase and take into account their incentives to participate. There was an agreement that careful consideration needs to be placed on alignment of the business and academic organisations' goals. This is complex as the EID programme often requires detailed research plans before engagement. As most projects are proposed and coordinated by academia, there was a general agreement that there are considerable challenges with regards to involving industry in an EID project. Despite that, all the participants highlighted that they found engaging in the EID programme positive. The industry participants in the workshop saw added value to their business. For example, one of the industry participants highlighted an excellent collaborative innovation project as a reference. This had resulted in short and mid-term business benefits for its clients. Another industry participant noted that they had a strong research organisation within the company providing a system that can support multiple EID programmes. One of the challenges raised was the difficulty in approaching new partners. This requires new methods of engagement such as talk shows, conferences, personal business connections, and reliance on prior successful project collaborations.

Tangible impact: Advancing science and enhancing innovation

Tangible innovations, such as patents and outcomes translated into products, services or even spin-offs were discussed. IPR was discussed intensively and may be a key barrier to industry engagement. It was highlighted that there needs to be a focus on this in early conversations with industry. This is important as the filing of new patents can add value in terms of revenue streams for industry and new grants and recognition for academia. In the past, universities wanted to own their research results, however, due to the expense of applying and maintaining patents, most universities have become more open to joint ownership. The handling of patents can be complex potentially consuming time and money. It is therefore important to agree beforehand who will own the patent, who will

bear the costs and who will maintain it. The workshop participants believed that patents and publications are good ways of tracking innovation, although the number produced depends on the type of innovation. For the creation of spin-offs, some companies organise workshops and exercises for ESRs. The aim of these is to stimulate innovation and change the mentality ESRs towards spin-off creation. One of the participants provided an example of "24-hour spin-off creation challenge" which ESRs had undertaken. The need for measurable KPIs for ESRs and industry engagement in the EID programme was advocated and this could also be used to monitor tangible outcomes of the collaboration. Industry participants highlighted the lack of measurable KPIs within their organisations for addressing participation in research and innovation, including EID projects. Introduction of quantitative and qualitative measurement criteria for both ESRs and industry would be beneficial. Experiences were shared on how to better integrate the ESRs into the company and balance academic research with industrial needs. The need for ESR training to help them fit within industry was raised. Some of the industrial organisations have well established induction training sessions for ESRs. In some cases, this includes education on business aspects such as creating MVP (Minimum Viable Products) and in talking to potential investors.

Benefit for the career development of the ESRs

The career progression of ESRs and how to ensure proper industrial monitoring of the ESR was discussed. All university and industry participants mentioned that they have established internal mechanisms in place to discuss and track the career progress of ESRs. Some participants have 2-3 weekly meetings with ESRs to monitor progress. One of the participants shared that from their experience only 20% of ESRs end-up in scientific careers, which means 80% choose other paths, including moving to industry. Another company highlighted that out of 6 ESRs that they supported only one was recruited by them, however, this was not a primary reason for engaging in EIDs. There was also an EID project where three of the ESRs went on to pursue industrial careers, but not in the same companies in which they did their secondment. It was highlighted that overall, 90 % of ESRs from this particular organisation ended up in an industrial career. The main challenge identified in moving to industry was the integration of ESRs into a different culture. In one case an ESR did not have the right competence, had not integrated well, and was asked to resign. To avoid such cases in the future it was proposed that during the interviews it is good practice to dedicate the first 10 min to the project, then discuss about the individual's motivation and understand why the ESR is important to him/her. Considering secondments and supervision of the ESRs, it is important to have good collaboration between two supervisors, otherwise the fellow has to choose which supervisor's instructions to follow.

Creation of long-lasting collaborations and interactions

Examples of long-lasting collaborations, not only within EID programme, but also beyond the funding were explored. In most cases collaboration had occurred due to previous collaborative experiences. Not all projects result in further collaborations and there needs to be mutual value in a collaboration. Engaging new partners requires more time to develop a trusted relationship. New collaborations can be beneficial to expand the horizon of the business, but a strategic approach is needed. To enable this, it is important to engage in platforms, networks and EU/EID related events to identify potential partners. There was also some discussion on how to extract more value from ESR secondments for future collaborations. This led to the conclusion that it is important to clearly understand the business needs of the industry and make sure to regularly align them with the ESR's research goals. In this way industry sees better value and stays engaged in future projects.

Summary of the key recommendations

1. The consortium should analyse and clearly understand the incentives of industry/business and engage them as early as possible in the EID proposal preparation phase.
2. Ownership of intellectual property is critical for industry/business. A clear position on ownership, including costs of filing and maintaining IPR needs to be agreed during proposal preparation and further clarified in the consortium agreement.
3. Good collaboration is the key guarantor for effective long-lasting relationships between academic and industrial organisations. It is important to have a balanced collaboration between both industry/business and academic supervisors to ensure mutual interests are pursued and to help the ESR to obtain holistic experience.

5.4. Administration - How to simplify and make more efficient the project implementation

The workshop addressed several topics identified by the survey with respect to administration such as scientific reporting, financial management, and internal organisation of the consortium. The idea of providing help for the coordinator in terms of providing a dedicated Project Manager (PM) was also discussed. Altogether, the workshop attracted around 25 participants with representatives from academia, large and small industry, ESRs, NCPs, and REA staff.

Scientific reporting

There was an agreement that the reporting on measurable outputs, particularly deliverables, could be very demanding from a quantitative and qualitative point of view. Already the REA shows flexibility in adjusting some deliverables during the Grant Agreement preparation process, but participants highlighted that it would be beneficial to provide more scope to change the names of deliverables as the work plans were made more than a year before the start of the project. It was noted that research can easily go in another direction as the project advances. Here a possible solution would be to identify mandatory and non-mandatory deliverables in the proposal template, and to have standard templates for the mandatory deliverables. For reporting, more flexibility was advocated regarding the time needed, e.g., for the mid-term report, or to have a different format of reviews for the EIDs. In addition, it was generally agreed that online meetings have been functioning well in the last few years (during the COVID-19 outbreak), including the Mid-term Review Meetings (organized between months 12 and 15). The online option facilitated a lot, and the ESRs do not have to travel, however, personal interaction with the PO is appreciated. Some participants found it helpful to have face-to-face review meetings when there are different levels of interaction with the external expert monitor. The one-day duration of a review meeting was considered suitable for average-size EIDs, but more days may be required for larger projects. An identified good practice is to link Mid-term Review Meetings with project related events, e.g., summer or winter schools.

Financial management

The participants highlighted that the financial resources have been used appropriately and transparently and there are no specific issues due to the strict administrative rules. It was highlighted that ESRs with a single contract with the academic partners experienced additional administrative hurdles when spending time in different countries at the private sector. For instance, in some countries it is necessary to return to the country where the

contract was issued every three months in order to retain residency status. This leads to potential issues with visas and with returning for the continuation of the project. Some stakeholders have used double (separate) contracts, one for the academic partner and one with the private sector. This creates additional administration which represents a burden. However, when the taxation laws in different entities/countries are diverse, having a double contract is financially convenient for fellows. From an industry perspective, dual contracts are considered a suitable solution. Overall, the key need is for additional help and experience sharing with respect to the different taxation regimes and on how to deal with split contracts. It was highlighted that funding the tuition fees and associated expenses per doctoral candidate during the duration of the PhD program (usually not less than four years) can represent a burden, particularly for the universities. Many EU countries have a four-year PhD program, and while the academic partner manages the tuition fees, there is no provision for the ESRs' living allowances in the final year. This requires further resources/money outside the budget received from REA. It was noted that it is possible to pay the tuition fees from the consortium budget categories B1 and B2 (if agreed upon and put in the Consortium Agreement). To overcome this issue, it was reported that some ESRs finalised all research in the project's first three years, and then performed teaching activities in the fourth year. The flexibility of offering a three or four-year PhD at the very beginning of the project is another option.

Project Manager assisting the Coordinator

There was strong agreement that a PM assisting the Coordinator/Consortium would be highly beneficial. The HES and academics face increased difficulties when handling projects without the assistance of a PM. Best practice would be for the HES to identify the PM in the plans from the beginning, and this should be the first person appointed. It was noted that a good PM can run two-to-three small EID Projects in parallel. This, however, would require allocation of additional resources to the project management tasks since the HES does not have enough resources to support a dedicated PM to assist the project. Although a portion of the projects management costs can be allocated from all the partners, this budget may not be sufficient. It was also noted that it would be useful to have some proper guidelines generated by experienced PMs on how to handle a PM position, particularly when managing a higher number of users (ESRs). Project coordinators and stakeholders have very good experience with personnel coming out from academia who could take the place of a PM. The best solution, and an excellent initiative, would be to have available PMs in the EID network willing to participate in managing projects, sharing experiences and exchanging ideas. The REA could potentially facilitate this through the ID session during the upcoming Coordinator's Information Days.

Consortium internal organisation

It was highlighted that an internal communication strategy is essential for the ESR's career development and the project's progress. Based on experience, the dedicated Supervisory Board approach with clear decision-making duties is functioning very well. There is no need for a separate ESR Board as a standard element in the Consortium's internal organisation. The consortium's internal communication strategy is, in general, the project team's responsibility. However, some best practices and recommendations were identified. The communication strategy is often organised as a discussion of scientific and strategic decisions as well as interactions with the Supervisors. This strategy is essential for the ESR's career development and the project's progress. A predefined structure and schedule of interactions/reporting provides an excellent communication strategy between the ESRs and their supervisors and mentors. Experience shows that keeping regular, broad, and open monthly interaction (organised in person, utilising online communication platforms or via phone calls) represents best practice. In addition, half-yearly meetings with all the mentors helps address the robustness of results and verify the course of the

individual research project. Having a predefined structure with mandatory reporting/meetings is recognised as a credible preventive mechanism to deal with potential difficulties. It was noted that there is a difference between the academic system requirements for reporting and the project consortia level reporting needs. Internal reporting requirements for universities cannot envisage what is happening at the project level of writing mandatory reports and it is important that production of these mandatory reports does not compete with the EIDs' necessary academic reporting requirements. Double reporting should be avoided to reduce the burden of the ESRs.

Summary of the key recommendations

1. Scientific reporting can be very demanding, particularly for small projects. Providing pre-defined formats of reports and deliverables for EIDs might provide a potential solution.
2. Additional help and experience sharing is needed when dealing with two different taxation regimes when multiple recruitment of an ESR is needed. The best option is to put in place double contracts to simplify the paperwork involved.
3. A dedicated Project Manager is a valuable member of the project team. An experienced Project Manager can serve several projects. Having the possibility to find experienced Project Managers within the EID project network to exchange ideas and support projects would be highly appreciated.

5.5. Policy workshop - How to strengthen the impact of EID projects?

The workshop was well attended attracting around 34 participants with a mix of backgrounds including, ESRs, academia, small and large industry as well as REA staff. The aim of the workshop was elaborated in terms of the key driving question on how to strengthen the impact of the EID projects. Firstly, the incentives for pursuing an EID programme were explored. Following on from this, the discussion addressed how the impact of the work could be strengthened in general, but also more specifically considering contributing to EU Policies such as the European Green Deal and the Horizon Europe Missions. Commercial impacts were also considered in terms of opportunities to create start-ups and the potential for market uptake. Finally, alumni strengthening, both of the ESRs and internal academic staff, as well as the employability of fellows were considered.

Incentives for pursuing an industrial doctorate

The incentives are strong for both academia and Industry to engage with the EID programme. A key incentive, as identified by the survey, was the establishment of long-lasting collaborations. This was confirmed by the workshop participants, and the opportunity for networking was also highlighted. There are various different perspectives with respect to the incentives. For large Industry engaging with an EID is seen as a way of exploring a new idea and as a networking opportunity. Another driver, more for smaller companies, is to try out new ideas. For many companies it is possible to network at a national level, but at an international level this is more difficult, so the MSCA provides a route to this. Experience shows that many projects are driven by academia. This is due to awareness of the programme within the academic sector. Anecdotal evidence was given on how a project started from a chance meeting at an event between an academic and a large company that had a problem that they wanted to solve. This had led to a project being set up with 3 ESRs. The financial interest in participating differs depending on the

size of companies. Smaller companies find the funding attractive to pursue research, however, for larger companies the administration overheads are greater. The funding levels of MSCA programmes are thus less attractive for them and it is more difficult to engage in projects. In terms of content, it was highlighted that it is important to identify real industrial problems that companies are interested to engage with, and balance expectations due to the different academic and industry needs to publish and protect Intellectual Property. Considering the incentives for students to pursue EIDs, although there is great interest in ESR positions among potential candidates, there are also several challenges. These include difficulties in employing students outside of the EU Member States and a mismatch between funding which only lasts for three years and the four-year PhD requirements in some countries.

In terms of best practice, it was highlighted that projects tend to start from pre-existing interactions, and long-term collaborations are key to building trust. From an industry perspective, recruitment of good staff is a driver and running an EID programme allows a company to perform an extended assessment of an ESR as well as train them with an appropriate skill set.

How to strengthen the impact of EID projects?

Many impacts are identified by the survey prior to the EID Cluster Event, and these are at the ESR level, at the project level and at the consortium level. Some of these are related to creating synergies, some are with respect to innovation and there is also some evidence of commercialisation. It was highlighted during the workshop that it takes time for impact to be generated, particularly commercialisation which tends to be beyond the lifetime of the project. Following up and monitoring this impact is difficult as although reporting platforms remain open, there is no formal follow up requirement. If long-lasting collaborations are formed beyond the project duration, then there should be an opportunity to gather more information in the longer term. The importance of having a long-term monitoring system was emphasised.

There is also insufficient communication of impact. There is a strong emphasis on producing academic papers as the consortia tend to be academic driven. It would be beneficial if the industry partners also produced outputs such as White Papers. Overall, it is important to better communicate the impact of EID projects. The survey that had been performed was seen as a good start and it was advocated that this should be periodically repeated to gather information on impact. Additionally, long-term monitoring of long-lasting collaborations would be valuable.

Contribution to EU Policies, European Green Deal, and Horizon Missions

It was highlighted that the various EU policies are well communicated by the EC to the public. These policies are in general not reflected in current projects strongly as they mostly address bottom-up science. However, there are examples of projects that can strongly contribute to the European Green Deal and Horizon Mission priorities. A balance is needed as if projects are directed to strongly focus on EU policies/missions then there are likely to be fewer proposals and fewer good or very focused ideas.

Overall, it was noted that there is a need for better and more targeted communication of EU policies to academia and industry, and this will naturally lead to more proposals and research that is in synergy with them. At the same time, there are already other targeted programmes and Calls for proposals that address topics such as the European Green Deal and the Horizon Missions. To incentivise the contribution to the EU policies and the reporting from the EID projects, an approach that may be effective is for the EC to provide appropriate credit if these topics are addressed in EID projects and also promote these projects across the community.

Creation of start-ups and potential for market uptake

It was highlighted that there are very few instances of start-ups being created. This was further discussed, and underlying issues were found to be the lack of an entrepreneurship culture in Europe, a lack of funding for start-ups and a lack of innovation training. The engineering projects are far more likely to produce patents and such EID projects produce more patents than other areas, e.g., social science projects, but even here patenting is very project dependent. If a new start-up is to be created, then this tends to be done by the academic partners. It was commented, however, that many academic supervisors wish to concentrate on their academic careers and do not have an interest in creating a start-up. Even if students are keen, there may not be support for this. Also due to the nature of the work being performed in terms of early-stage research, the idea of commercialisation is seen as happening much later, even several years after the project end. More fundamentally, the EID programme is not designed to encourage the creation of start-ups, instead it focuses on inter-sectoral doctoral training.

The need for more entrepreneurship training and creation of an innovation mentality was highlighted. Already some projects provide this in as part of the soft-skills training, but in many cases this is not a requirement. Moreover, to avoid any IPR ownership difficulties that could prevent future commercialisation, there is a need to appoint an IP manager from industry and put in place good IP protection from the very beginning of the project. In practice the main market uptake of new ideas into industry was via knowledge transfer through employing the ESR.

Alumni strengthening and employability of fellows

It was acknowledged that the EID projects are clearly skilling the next generation. The employability of ESRs depends on acquiring a broader skillset than just technical skills and the key challenge is to find appropriate high-quality training. It is not just the ESRs who require training. Internally academia also has to invest heavily in its own internal staff to educate them on the MSCA programme management and reporting needs. Considering employability of ESRs industry is very happy as they get very good, trained candidates for employment, and have the opportunity to “try” them in advance. However, a challenge is in lining up open job positions at the appropriate time for good ESR candidates. It is not possible for a company to keep positions open, for instance for 6 months while an ESR completes their PhD course.

It was highlighted that the programme is creating highly skilled ESRs with relevant industrial experience. The model is very good, but it would be possible to enhance the skillset of ESRs with more entrepreneurial training. In addition to enhancing the ESRs, the programme is also increasing the quality of academic staff members, particularly giving them interdisciplinary experience, which boosts their careers.

Summary of Key Recommendations

1. There are clear incentives for ESRs and academia to participate in EID projects. While, to encourage industry to participate there is a need to have trust, there is a need to address real industry problems and balance publication and IPR expectations. Recruitment of good skilled staff is a driver for industry and more flexibility to allow easier employment of ESRs would be beneficial.
2. Impact takes time and for the predominantly academic-led projects, there is a need to better communicate the industry impact. The impact of projects towards European Commission policies, such as the European Green Deal and Horizon Europe Missions, should be collected and highlighted.

3. There is need for entrepreneurship training to create an innovation mentality and encourage creation of start-ups. Researchers with strong technical and with high entrepreneurial skills help boost the European Economy.

5.6. Practicalities of Projects - Specific tips to facilitate to the project implementation

This workshop considered practical aspects that have an impact on the efficient and effective running of an EID project. The practical aspects identified from the preliminary survey were issues related to open access and open data, IPR, the duration of PhD, the enrolment process for PhD programmes and the resignation of ESRs during the course of a project. This list was further extended to include a number of additional aspects related to PhD recruitment, such as salary differences, different polices at different institutions, secondment challenges with respect to finding accommodation and obtaining visas as well as the impact of changes within the industrial partners. The workshop was well attended with 34 participants with a good mix of universities, research agencies and industry.

ESRs and their PhD programmes

Several challenges were discussed considering the mismatch between PhD durations and the EID duration, the added challenge due to delayed recruitment, different conditions applied to ESRs recruited in different institutions/countries and the impact of resignation of ESRs. However, it is worth noting that these are not EID-specific challenges. They can be augmented though due to the mandatory inter-sectoral mobility. For institutions that have four-year PhD programmes it was noted that the coordinator must find alternative funding for the fourth year. Even for institutions with three-year PhD programmes, it was remarked that spending significant time in industry was not looked upon favourably as it constrained the research and stifled creativity as there is not much time for research exploration. Delays in recruitment or in obtaining visas exacerbated these duration constraints. Considering different conditions for ESRs, the most obvious difference is salaries, which may cause some disgruntlement among the ESRs. While it was acknowledged that the cost-of-living variations from country to country justifies different salaries, it was highlighted that the cost of living may also vary from city to city within the same country, even to the point of being higher than that of a higher-cost country. This results in financial pressure on the ESRs, which is especially manifested in the cost of accommodation in certain cities. The final issue discussed was the impact of an ESR resigning. Although there is no way of always preventing this, it can be an issue if the ESR resigns at such a time that it is not sensible to recruit a new replacement ESR due to little remaining funding.

In terms of best practice, it was recommended to enrol the ESRs on the PhD programme as early as possible. It would be beneficial if the EID rules allowed funding for four-year PhDs and to also mitigate recruitment and visa delays, it would be desirable if EID projects' duration was extended to five years. More flexibility in the time spent in industry would also help. A highly praised best practice that helps mitigate the challenge of disgruntled ESRs in the light of different employment conditions is to have an ESR orientation session organised by the beneficiary to make the ESRs aware of the local conditions and to ensure full transparency of the EID financial rules. Once all the ESRs are recruited, a kick-off ESR meeting should be organised to present the whole project covering the scientific and financial issues. It was emphasised that the ESR career development is paramount, so the beneficiary needs to be flexible to ensure that the ESRs get the most benefit from their participation in the programme, even if this requires

changes to some project deliverables. The decision on whether to recruit a new ESR when one resigns needs to factor in the new ESR's career development. It was highlighted that REA POs have been very supportive in such cases, which was greatly appreciated.

Secondments, industrial change and differing policies

The key challenges identified were with respect to accommodation and visas during the secondment. Securing visas, especially for non-EU ESRs and for EU countries outside the Schengen Area, emerged as a major hurdle. Delays in securing visas made it difficult for ESRs to spend the required time in secondment, jeopardising the secondment plan. Another challenge highlighted was the difficulty in retaining an ESRs' accommodation while they work in the industrial partner which often leaves them looking for new accommodation on their return.

There are several risks to industrial secondments related to the content and purpose of the secondment. One risk is the potential for company's priorities to change resulting in a lack of interest in the project. Other associated risks are changes to availability of equipment or from the industrial contact point moving on. These risks can also result in changes to the project, which may also place additional pressures on the ESR, who requires stability throughout the PhD.

Disbursement of funds can be complicated as beneficiaries may have different policies. It may be more difficult for the ESR to claim reimbursement for expenses when the funds are managed by an industrial organisation than it would be if they were managed by an academic institution. This could potentially be solved if the academic beneficiary hired all the ESRs.

Considering best practice to mitigate visa problems, it was suggested to liaise with the beneficiary's human resources (HR) department at the earliest possible time. Here the support of the REA and the POs was acknowledged in terms of understanding the visa challenge and in issuing support letters. To address accommodation difficulties, participants have been known to ask ESRs to swap their accommodation when an ESR moves out so that the accommodation is not lost. In the case of changes within the industrial organisation, there needs to be the flexibility to redesign the project appropriately.

Open access and open data, and intellectual property rights

The challenges due to open access and IPR were discussed, and this mainly revolved around the cost of open access publishing, which is a general challenge not specific to EIDs though. It was pointed out that while some universities have Open Access subscriptions, this limited the choice of venues for publication and, in those periods of the year when the subscriptions run out, delays are incurred in submitting for publication. It was also highlighted that conflicts can arise due to patents being claimed by the industrial partner on the topic of the ESR's PhD. This makes it difficult for the ESR to publish and complete their academic requirements. With respect to Open Access, it was pointed out that there is leeway to negotiate with Open Access publishers which may result in discounts on the Open Access fees. It was also highlighted that the EC follows the policy of 'as open as possible, as closed as necessary'[15] with regard to open access publications, indicating that there is a degree of flexibility. Considering IP issues, best practices indicate that the IP agreements should be kept as simple as possible (e.g., in the Consortium Agreement) with a main contract agreed between the main beneficiaries

[15] Horizon Europe Programme Guide

and add-on agreements signed by the secondment organisations. It was recommended that background IP is identified from the project start.

Summary and Key recommendations:

1. It is recommended that five-year EID projects are funded to cover funding for four-year PhDs with some flexibility on the time required to be spent in the industry.
2. ESRs should be made fully aware of the EID financial rules, the conditions faced by the different ESRs and their respective employment conditions. The ESRs should be employed, where possible, by the academic beneficiaries to avoid complications from different reimbursement policies within industrial organisations.
3. To avoid IPR issues it is important to distinguish from the start the ESR's PhD research objectives from those research objectives that may be of direct interest to the industrial partners.

6. Lessons Learnt from Projects

Two projects were invited to present lessons learnt. One was VIRO-FLOW[16] from the H2020-MSCA-ITN-2017 Call and the second one was ASIMIA[17] from the H2020-MSCA-ITN-2018 call. These addressed drug discovery and aerospace simulation, and their coordinators shared lessons learnt that can be applicable to other projects.

6.1. VIRO-FLOW Anna Banet (Coordinator ICIQ Spain)

Consortium Composition: The VIRO-FLOW project had two main beneficiaries, an academic and a non-academic one both with a background in biology and chemistry. A further two associated partners were added during project implementation. The project funded three ESRs with chemical and biology backgrounds.

Selection Process for ESRs: For recruitment, at least four years' experience and or a master's degree was required. The positions were advertised widely on the partners websites, social media and jobs portals. Indicatively, it was noted that there were 81 applicants, and so it is necessary to have good selection criteria. The process involved prescreening, phone interviews and then face-to-face interviews for the seven final candidates. On-site interviews were organised, and it was necessary to cover the costs of the invited candidates, but the advantage was that the students got to see the institutions and vice versa. This is easier to do for smaller projects. A strict calendar for the selection was used to speed up the process. Notably, each university has its own process, admissions calendars and national rules. It was strongly advised to have a reserve list of good applicants, as candidates apply for multiple positions and may therefore not be available to employ. Other candidates may start but leave early on. Having a reserve list provides a quick solution to addressing these eventualities. In the case of VIRO-FLOW the three ESRs were recruited by the academic partner as this was thought to be easier. In practice this was not the case due to the long 18-month secondments in the industry. This led to tax declaration and health insurance issues for the ESRs and institutions. A challenge was noted for this matter.

[16] https://cordis.europa.eu/project/rcn/212130/

[17] https://cordis.europa.eu/project/id/813605

Secondments: With respect to the 50% secondments in the industry, it was noted that it is important to plan well. These are challenging for the ESRs in terms of change, and a good working plan was vital as the ESRs needed to finish everything at each institution as they cannot go back. The scope for additional secondments within the rules is limited and in one case an ESR needed less time at the academic institution and more in industry.

Management: The project's management had employed standard communication channels; monthly meetings had been held and in addition, the ESRs had had their own meetings. Each ESR had two supervisors, one from each beneficiary. Most important was to keep each supervisor informed, and monthly network-wide meetings were held where the ESRs presented their progress. It was noted that previous experience of managing this type of project is highly recommended. There is also a need to engage with different departments of the organisation internally, and it is good if these have prior experience with similar programmes. On the non-academic side there are time pressures on scientific staff performing management and with less experience of working with such programmes.

For the Consortium Agreement, it is important that all IPR is discussed at the proposal stage so that people are clear on background IPR, exploitation and the dissemination needs. In terms of budget 100% of living and mobility allowance was administered by the academic partner, however, management costs between partners were shared.

Training: A number of network-wide activities had been performed including a 4-5 day training course for the ESRs to gain experience of scientific talks and transferable skills. Soft skills training was shared between projects to amortise effort, but this also has the added advantage that the ESRs can meet with other ITNs and projects. This had proved very beneficial leading to new collaborations.

Outcomes: Very positive long-lasting collaboration had been achieved as the company has now established a permanent laboratory in the academic partner institution. The ESRs had become highly employable in the drug discovery field due to their multidisciplinary experience. The ESRs were, in particular, very positive about their experience and the value to their careers.

6.2. ASIMIA Charles Hirsch (Coordinator CADENCE Design Systems Belgium)

Consortium Composition: The ASIMIA project is addressing computational fluid dynamics with partners from Airbus, McLaren and Dyson. The project was original created by a Brussels-based start-up in computational algorithms, but this has been acquired by CADENCE[18] during the course of the project. The academic partner is the Universidad Politécnica de Madrid in Spain and the project supports five ESRs addressing a range of synergistic algorithmic or application issues.

Selection Process for ESRs: It was noted that recruitment was challenging and not optimal. Two students came from India, one from China, one from Greece and another

[18] https://www.numeca.com/home

one from Spain. There had been problems with obtaining a visa for the Chinese student and several issues with social security, etc. One student left after six months, and so a replacement had to be found. The recruitment was a lengthy process, and it was noted that many students just send in a standard CV not adapted to the position on offer. 150 CVs were screened, and joint interviews were set up between partners.

Secondments: COVID-19 had proved a challenge, and secondments had to be virtual due to travel restrictions. The ESRs worked on two research codes, one from CADENCE and one from Universidad Politécnica de Madrid, and this led to a fruitful exchange of knowledge. Some academic ideas were tested on industrial codes, and some industrial methodologies were implemented in university codes.

Management: Bi-weekly supervision meetings were put in place. There were no issues with IPR as only research codes were addressed. The experience was that the scheme is highly successful, but the administration load for both industry and academia is high. The biggest problem encountered was that in some cases the ESR is considered to be a foreign immigrant by governments as they do not understand the MSCA EID status.

Training: The provided training covered scientific needs and also soft skills, such as communication, presentation, etc. For IPR management, a commercial approach had been adopted as there are opportunities for industrial exploitation.

Outcomes - The main benefit of engagement in the programme had been the transfer of knowledge and the creation of highly trained engineers ready to be employed. Two of the ESRs have been hired and so their IPR belongs to the employing company.

7. Keynote by Marja Makarow

Marja Makarow is the President of Academia Europaea[19], after having ended her term as Director of Biocenter Finland[20]. She is former Vice-President of the Finnish Research Council - Academy of Finland, Chief Executive of the European Science Foundation, and Vice-President for Research and Innovation and Professor of Applied Biochemistry and Molecular Biology at the University of Helsinki.

In her presentation she highlighted the pressing need to invest in the renewal of industry by creating skilled staff. An example of how this had worked in Finland 30 years ago was given. The country had experienced severe economic problems with the fall of the Soviet Union. There had been a strong relationship with Russia, and overnight agreements were cancelled which led to many companies going bankrupt. In turn, banks started to wobble and unemployment in Finland went to 30%. To address this, the government decided to invest in education for high technology industries. These industries employ a high number of PhDs. To support this, public-private doctoral programmes were put in place with universities. This led to spectacular results and the resource-based economy became knowledge based. Notably the country is now one of the best performers in terms of innovation in the EU scoreboard. Todays' challenges were highlighted as being the green and digital transition, the energy crisis and technological sovereignty.

[19] https://www.ae-info.org/

[20] https://www.biocenter.fi/

There is a need for entrepreneurship. This is linked to economic growth, which in turn leads to more re-investment in the future. Although Universities provide a set of skills, these are not enough. There is a need for a real-world understanding of the business ecosystem. This requires recognition of the merit and provision of careers for entrepreneurial students that acknowledges their impact on society. It was highlighted that PhDs are needed in both the academic and the non-academic sectors. There are not enough positions in academia for new PhDs to follow a tenure track, so inevitably some need to go to industry. In this respect, the importance of activities such as the European Institute of Innovation and Technology Knowledge and Innovation Communities (EIT KICs[21]) was highlighted. These provide thousands of graduates annually with an EIT labeled certificate. There are nine thematic KICs across Europe and also a range of regional innovation hubs that engage with large companies, start-ups, regional bodies and universities. The creation of Aalto University was given as an example of how formation of a new University can bring together research and innovation in a multidisciplinary setting. Most PhD candidates at the university do research with companies. Students are provided with a cutting-edge course on entrepreneurship. There is also a dedicated programme in Aalto Ventures which provides start-up experience to think like an entrepreneur. Other courses address business leadership and consider the impact of the student's own research to enhance their career progression. This has led to students being far more entrepreneurial and they have set up events like Slush[22] to gather like-minded people.

Programmes are being put in place to fund postdocs or PhD candidates to work on highly specialised 3-6 month projects with the expectation that 600 researchers will participate. It was also highlighted that other EU programmes and funds are useful to support new companies. These include Pathfinder grants[23] for early stage and breakthrough in academia, Breakthrough funds[24], Accelerator Programme[25] grants for startups as well as a range of coaching and mentoring services.

Finally, it was highlighted that a key lesson learnt is that a detailed plan is needed for the candidate and industry from the outset to make sure that both sides benefit. As a best practice, at the end of the placement both the PhD candidate and the company involved have to write their own assessment of success. The text provided by the company can be used in the CV of the PhD candidate as a reference for future employers. This had clearly shown that internships were hugely beneficial.

8. Roundtable Discussion

The roundtable discussion addressed policy aspects, in particular, the benefits and challenges of connecting academia and industry together via PhD programmes. This highlighted many benefits, but also cultural differences between academia and industry, differing needs in terms of publishing and protection of Intellectual Property, as well as pragmatic issues of mobility and administration burdens. The Roundtable Discussion was moderated by Claire Morel (DG EAC) with participation from Benjamin Martinez Sanchis (Coimbra Group[26]), Murat Gunes (MCAA[27]), Rob Smeets (Director PPPs - Philips), and

[21] https://eit.europa.eu/tags/kics

[22] Slush 2023 – The World's Leading Startup Event

[23] https://eic.ec.europa.eu/eic-funding-opportunities/eic-pathfinder_en

[24] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7437

[25] https://eic.ec.europa.eu/eic-funding-opportunities/eic-accelerator-0_en

[26] https://www.coimbra-group.eu/

[27] https://www.mariecuriealumni.eu/

Kristine Henriksen (Innovation Fund Denmark[28]). Each participant made a brief statement before the open discussion.

Kristine Henriksen highlighted that Denmark has been running a programme equivalent to the European Commission's Marie Skłodowska-Curie programme for two years. The aim of the Innovation Fund in Denmark is to educate and produce research talents while at the same time connecting academia and industry. This opens the eyes of students to the work field by performing projects with Industry. This also contributes to business-oriented research as well as business in SMEs and large enterprises. Projects can also be implemented with public institutions. The main purpose of the programme is to strengthen collaboration between industry and academia.

Rob Smeets of Philips highlighted that their key driver is to get outside knowledge into the company. A key benefit is that the company gets access to a pool of researchers. This is particularly important for Philips as they are in a transition from a hardware company to a software company. Many internal people that used to do chemistry and physics are now working on computer science. Via collaboration with young researchers, the company gets insights that help it go digital. It was highlighted that there were opportunities for MSCA to engage more with European PPPs and associations who have experience in Industry and EU programmes.

Benjamin Martinez Sanchis from the Coimbra Group highlighted that the association brings together 40 Universities from 22 countries in one of oldest European networks. This started in 1985 even before the ERASMUS programme[29]. 50% of activities of the group are to try and influence European policies. The Industrial Doctorate is seen as key and it was highlighted that their value really depends on the researchers themselves. The added value for universities is clear. There is a need to strengthen and energise relations, encourage entrepreneurial initiatives, and reinforce competencies and lifelong learning mentality and practices in companies.

Murat Gunes from the MCAA echoed the added value of Industrial Doctorates. The alumni association bridges industry and academia, which is important as industry and academia speak different languages. This gives both sides a wider perspective so that industry understands better the research perspective and academia learns the business language. The ESRs benefit by gaining more confidence and competitiveness through exposure to industrial experience.

In the open discussion, it was noted that understanding academic and industrial needs is key. If the joint supervision really works, then the result is a good project with high impact. This requires regular meetings and often in such cases the collaboration continues after the project. However, the style of supervision in academia is different to supervision in business, which offers normally mentoring. It was highlighted that outcomes are not always research related. For example, via a MSCA programme, Philips had gained knowledge on the use of data and legal constructs as well as security and privacy for home monitoring, etc. This has major benefits for the company as it allows them to understand how to appropriately deal with health data and access new markets, e.g., China. The multidisciplinary aspects are also highly important. It was noted that it is not just industry that can host PhD candidates, it is also possible for a range of non-academic institutions to host PhDs such as hospitals, policy institutes and NGOs. The term "Industrial Doctorates" is thus wider than just industry.

It was commented that organising a training-oriented network is easier because universities with similar cultures get together with the same aim. Working with industry is more challenging. The concept of bilateral industry doctorates had been tried in the past,

[28] https://innovationsfonden.dk/en

[29] https://erasmus-plus.ec.europa.eu/

but those programmes did not give a broad European scope. It was advocated that after COVID-19 there is a need for a new definition of mobility. The key question is “How much mobility do we need?”. Post COVID-19, there is less mobility and the requirement to spend 50% of time abroad has become a greater barrier. It was noted that in Denmark there had been a significant decrease in EID PhD applications due to COVID-19 and other instabilities. Another factor in this was a large increase in other funds available which were more attractive. At a national level, there is a push to increase the number of applications and increase the number of grants. Outreach is being used to contact companies and universities that do not know about the EID programme and to highlight the benefits. It was noted that it is beneficial to leave things more open in an industrial doctorate programme so that a PhD student can try both industry and academia without solely committing to either.

In terms of attracting industry, a main issue is the requirement to publish results. Not all companies are open to publicising the research and this makes universities more reluctant to engage. More flexibility and less prescription are needed. The prescriptive format of the scheme, e.g., 50% of time within industry is a barrier and it would be better if mobility is driven by scientific requirements. It was noted that it is not easy to find a candidate who wants to change countries after 18 months. Likewise, pursuing a PhD in some countries may take longer than the grant, i.e., four years.

More fundamentally, PhD preparation has largely stayed unchanged within academia. In general candidates concentrate on a study topic which is maybe less attractive to industry. There is a lack of subject-related skills and the accelerated pace of technology makes the skills provided less relevant to industry.

It was noted that the administrative overhead is always an issue. Although the role of stakeholders is defined well, there is a need to be clear on the objectives of a project and intellectual property. One way of making EIDs more attractive is to increase funding. To attract new participants, seminars should be organised to share the positive results of previous projects.

9. Key Messages from The Cluster Event

The meeting was closed by Begoña Arano (Head of Department A, REA). Overall, the meeting showed that there was widespread consensus that the EID programme offers an opportunity to researchers to interact in a structured way, while stimulating entrepreneurship, creativity and innovation in Europe. The key needs emphasized during the day had been the needs for flexibility and adaptation with respect to secondments and reporting needs. The REA is ready to see if adaptations are feasible and they are already trying to simplify implementation. The aim is to make the whole scheme as attractive as possible. It was noted that synergies and cooperation between projects should be encouraged. More exchanges would be beneficial and projects could be proactive in this. There are many opportunities and there is a need to raise the visibility of the EID scheme, e.g., by reaching out to the JUs and PPPs which have a strong link with Industry. It is clear that the ESRs find the Industrial Doctorate stimulating, which is good for both industry and academia. A key outcome of EIDs is the creation of long-lasting collaborations and these can lead to a structuring effect within Europe. This demonstrates the crucial role that MSCA can play in getting the academic sector together with industry and business. It is crucial to show how important the programme is for innovation in companies. Finally, it was noted that the networking during the day had proved very positive and participants were encouraged to continue this. A key aim is to create an EID community to valorise and promote the scheme.

Areas for Improvement

During the cluster meeting several practical issues that need addressing were highlighted. Many can be solved through exchange of experience and via advanced planning, e.g., recruitment delays and agreements on patent ownership, however, there are some more fundamental issues such as the mismatch between PhD durations and the EID duration that require further investigation. Experience shows that start-ups and spin-offs – although not an objective of the EID programme – do not happen frequently and the support to generate innovation needs to be further explored. Here, it is clear that the approach from the academic side needs to change and there is a need to change the mindset to nurture entrepreneurship training for students. This change needs to come both from the bottom up and top down in PhD programmes. There is a need for better measurement of the outcomes with KPIs for ESRs both on the academic and industry side. This is important so that the experience and skills gained by the ESRs are measurable and valued in the future. Measurement of impact is an issue and there needs to be much better communication of outcomes. This is not just academic papers, but also patents and other outcomes.

The conclusions from the six parallel workshops (see Table 1: Six parallel workshops description), are compiled below:

Joint Procedures

1. Considering Governance, industry-coordinated networks should be encouraged to increase engagement of the industry participants in project governance, supervision, management, decision-making, etc.
2. To ease recruitment, it would help if the requirement for 50% secondments/placements in the non-academic sector in a different country were relaxed.
3. For generating the Consortium Agreement, it would be beneficial to have examples and better explanations with respect to Intellectual Property management as well as suitable model clauses for industrial doctorates.

Mobility Secondments and Training

1. Projects struggle with many bureaucratic issues (visas, tax, etc.) and rely on a mix of support contact points. The creation of a dedicated contact point would be highly beneficial to provide advice, both at the application and project execution phases, on visa and contractual aspects.
2. Networking is highly beneficial, and it is important to ensure that a diverse set of joint network events are available, with a good balance of face-to-face opportunities.
3. Project and /or programme synergies should be incorporated into work plans as they are very positive and can lead to positive unexpected connections and benefits.

Industry and Business Participation

1. The consortium should analyse and clearly understand the incentives of industry/business and engage them as early as possible in the EID proposal preparation phase.
2. Ownership of intellectual property is critical for industry/business. A clear position on ownership, including costs of filing and maintaining IPR needs to be agreed during proposal preparation and further clarified in the consortium agreement.
3. Good collaboration is the key guarantor for effective long-lasting relationships between academic and industrial organisations. It is important to have a balanced collaboration between both industry/business and academic supervisors to ensure mutual interests are pursued and to help the ESR to obtain holistic experience.

Administration

1. Scientific reporting can be very demanding, particularly for small projects. Providing pre-defined formats of reports and deliverables for EIDs might provide a potential solution.
2. Additional help and experience sharing is needed when dealing with two different taxation regimes when multiple recruitment of an ESR is needed. The best option is to put in place double contracts to simplify

the paperwork involved.

3. A dedicated Project Manager is a valuable member of the project team. An experienced Project Manager can serve several projects. Having the possibility to find experienced Project Managers within the EID project network to exchange ideas and support projects would be highly appreciated.

Policy

1. There are clear incentives for ESRs and academia to participate in EID projects. While, to encourage industry to participate there is a need to have trust, there is a need to address real industry problems and balance publication and IPR expectations. Recruitment of good skilled staff is a driver for industry and more flexibility to allow easier employment of ESRs would be beneficial.
2. Impact takes time and for the predominantly academic-led projects there is a need to better communicate the industry impact. The impact of projects towards European Commission policies, such as the European Green Deal and Horizon Europe Missions, should be collected and highlighted.
3. There is need for entrepreneurship training to create an innovation mentality and encourage creation of start-ups. Researchers with strong technical and with high entrepreneurial skills help boost the European Economy.

Practicalities of Projects

1. It is recommended that five-year EID projects are funded to cover funding for four-year PhDs with some flexibility on the time required to be spent in the industry.
2. ESRs should be made fully aware of the EID financial rules, the conditions faced by the different ESRs and their respective employment conditions. The ESRs should be employed, where possible, by the academic beneficiaries to avoid complications from different reimbursement policies within industrial organisations.
3. To avoid IPR issues it is important to distinguish from the start the ESR's PhD research objectives from those research objectives that may be of direct interest to the industrial partners.

ANNEX A: Meeting Agenda

Time	Topic	Presenters
9.30 – 9.45	Opening remarks and welcome address	Klaus Haupt (Head of Unit, MSCA Doctoral Networks, REA) Claire Morel (Head of Unit, MSCA, DG EAC)
9.45 – 10.00	MSCA EID projects – brief portfolio analysis	Audrey Arfi (Head of Sector, MSCA Doctoral Networks, REA)
10.00 – 10.15	Overview of MSCA EID survey results	Thomas Vyzikas (Project Manager, MSCA Doctoral Networks, REA)
10.15 – 10.30	3 testimonials by Early-Stage Researchers from MSCA EIDs	Elena Detta (VIRO-FLOW) Mariana Pereira Guimarães (SOLOCLIM) Marina Avena Maia (REWATERGY)
10.30 - 10.45	**Coffee break**	
10.45 – 12.15	6 parallel workshops	Selected moderators and rapporteurs; all participants
12.15 – 13.15	**Lunch break**	
13.15 – 13.35	Lessons learnt and best practices - MSCA-ITN-2017 Project VIRO-FLOW Followed by Q&A	Anna Banet (Coordinator - Institute of Chemical Research of Catalonia, Spain)
13.35 – 13.55	Lessons learnt and best practices - MSCA-ITN-2018 Project ASIMIA Followed by Q&A	Charles Hirsch (Coordinator - Cadence Design Systems Belgium)
13.55 - 14.10	Keynote speech: the value of industrial doctorates for innovation and career development	Prof Marja Makarow (President of Academia Europaea)
14.10 – 15.00	Roundtable discussion with Q&A	Benjamin Martínez Sanchis (Coimbra Group) Murat Gunes (Marie Curie Alumni Association) Rob Smeets (Philips) Kristine Henriksen (Innovation Fund Denmark) Moderator: Claire Morel (Head of Unit, DG EAC)
15.00 – 15.15	**Coffee break**	
15.15 – 16.15	Conclusions from the 6 parallel workshops + Q&A	Rapporteurs
16.15 – 16.30	Closing remarks: Summary of the event and follow up	Begoña Arano (Head of Department, MSCA, REA)
16.30	End of the event	

ANNEX B: Preparatory survey

MSCA European Industrial Doctorates in Horizon 2020

Past and current experiences of EID projects

Fields marked with * are mandatory.

Introduction

With this questionnaire, the European Research Executive Agency (REA) aims to collect information regarding the implementation of the MSCA European Industrial Doctrorates (EID) projects in order to assess their success from a participants' perspective and improve future MSCA Work Programmes.

All Horizon 2020 MSCA EID beneficiaries are invited to complete this questionnaire by 30/4/2022.

We sincerely thank you in advance for your time.

Please note that if your organisation participates in more than one EID projects, you should complete this questionnaire for each project separately.

SECTION 1 – Participant and Project data

* **Project Number**

Only values between 100000 and 999999 are allowed

* **Project Acronym**

* **Organisation Name**

* **Organisation Role**

- ○ Coordinator
- ○ Beneficiary

* **Organisation Type**

- ○ Higher or Secondary Education Establishments
- ○ Research Organisations (including RTOs -research and technology organizations)
- ○ Public bodies (excluding Research Organisations and Secondary or Higher Education Establishments)
- ○ Private for-profit entities (excluding Higher or Secondary Education Establishments)
- ○ Other (e.g., non-profit organizations)

If other, please indicate:

* **Are you an SME or a Large Industry?**

- ○ SME (see definition)
- ○ Large Industry
- ○ Not applicable

SECTION 2 – Role and Achievements

* **What were the main roles of your organisation in the project?**

- [ ] Recruiting and hosting ESRs
- [ ] Supervising ESRs
- [ ] Hosting secondments
- [ ] Offering access to infrastructure or laboratories
- [ ] Project management / Administration
- [ ] Other

If other, please provide additional information:

* **What were the main reasons for your organisation to apply for an EID project?**

- [ ] Obtain funding and attract top PhD candidates
- [ ] Knowledge exchange across sectors and disciplines
- [ ] Establishing long-lasting collaborations and partnerships between non-academic and academic sectors
- [ ] Acquire access to research / industrial infrastructures
- [ ] Improve the quality of the training programmes and supervision
- [ ] Increase visibility / internationalisation of your organisation
- [ ] Paving the way for new business opportunities, e.g., start-up or spin-off
- [ ] Other

If other, please provide additional information:

* **What were/are the benefits for your organisation in participating in an EID project?**

- [ ] Long-lasting cross-sectoral collaborations
- [ ] Access to further opportunities through the network
- [ ] Innovation gains (e.g., new patents, products, services etc)
- [ ] Potential commercialisation, identifying new business opportunities
- [ ] Human capital gain (e.g., new recruitments from the ESRs)
- [ ] Other

If other, please provide additional information:

* **Are there any follow-up collaborations stemming from your EID project?**

- ( ) Yes, there were already
- ( ) Yes, highly likely in the future
- ( ) To some limited extent
- ( ) Not likely

Please provide additional details concerning the option selected above:

* **Based on your experience in the MSCA EID project, would you consider the participation beneficial for your organisation?**

- ( ) Yes, and I would be keen in joining a new ID project
- ( ) Yes, but there were many issues and I would not like to join a new ID project
- ( ) No, there were many issues and little benefit

Please provide any relevant comments.

SECTION 3 – Main issues and challenges

* **Please indicate whether you encounter significant challenges linked to the following aspects:**

- [ ] IPR (patents, publications)
- [ ] Joint supervision and monitoring
- [ ] Open Access
- [ ] Curriculum and credits
- [ ] Other
- [ ] No significant challenge

Please provide additional details with respect to the issues selected above.

* **Please select the most challenging administrative barriers encountered by your organisation:**

- [ ] Intersectoral mobility
- [ ] International mobility
- [ ] Joint selection and admission arrangements
- [ ] ESRs resignation
- [ ] ESR contract duration
- [ ] Compliance with the ESRs' minimum 50% working time in the non-academic sector
- [ ] Joint project governance
- [ ] Other
- [ ] No significant challenge

Please provide additional details regarding the aspects selected above

* **From your experience, what were the key issues faced at Consortium level (not necessarily by your organisation)?**

- [ ] Signature of the Consortium Agreement
- [ ] Agreement on financial management, e.g., the use of the institutional budget
- [ ] Joint PhD supervision
- [ ] Compliance with the 50% rule of the ESRs' working time in non-academic participant
- [ ] Timely arrangement of the ESRs' secondments
- [ ] Change of focus of the ESRs' due to the transition across sectors
- [ ] Other
- [ ] No major issue

Please provide additional details regarding the aspects selected above

Based on your experience, do you have any specific suggestions or recommendations that could help overcome any of the barriers or limitations identified throughout your project?

Do you have any further suggestions for the overall improvement of the EID programme?

Please note:

The data collected in this survey will be processed lawfully, fairly and in a transparent manner and it will be used for the sole purposes of the analysis and improvement of the MSCA Industrial Doctorates funding scheme.

The raw data collected will be accessible only to the REA and other European Commission services, and it will not be made accessible to third parties.

An analysis of the results however may be presented in relevant reports and articles published by REA without identifying individual respondents.

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

– at the following standard number: +32 22999696, or

– by email via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications from: https://op.europa.eu/en/publications. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

Open data from the EU

The EU Open Data Portal (http://data.europa.eu/euodp/en) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

JW-07-23-347-EN-N

Publications Office
of the European Union

ISBN 978-92-95234-15-4