



FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions (MSCA)

EXECUTIVE SUMMARY

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Executive summary

This report presents the main conclusions and recommendations from the ex-post evaluation of Marie Skłodowska-Curie Actions (MSCA) under FP7 and the interim assessment under Horizon 2020 (H2020).

In accordance with the Commission's Better Regulation Guidelines, the evaluation focused on five evaluation criteria: relevance, efficiency, effectiveness, coherence, and EU added value.

ES1 Overview of the Marie Skłodowska-Curie Actions

Article 179 of the Treaty on the Functioning of the European Union foresees a European Research Area (ERA) in which researchers, scientific knowledge and technology circulate freely. In this regard, the MSCA as a flagship programme for researcher mobility and training are embedded in the EU legal basis. The MSCA ensure excellent and innovative research training as well as attractive career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers, to better prepare them for current and future societal challenges.

2017 marked the twentieth year of MSCA and the funding of the 100 000th fellow.

ES1.1 Programme design and objectives

Figure ES1 illustrates the types of actions through which the programme is implemented.

Figure ES1 The main Marie Skłodowska-Curie Actions (Horizon 2020)

ITN Innovative Training Networks	IF Individual Fellowships	RISE Research & Innovation Staff Exchange	COFUND Co-Funding of Regional, National & International Programmes
What does it offer? High-quality research training delivered through interdisciplinary networks, industrial doctorates or joint doctorates.	What does it offer? Opportunities to work on personal research projects by moving between countries and possible sectors to acquire new skills.	What does it offer? The exchanges of staff members involved in research and innovation to develop sustainable collaborative projects and the transfer of knowledge.	What does it offer? Regional national or international programmes to foster excellence in training mobility and career development of researchers
Who applies? International networks of research organisations from the academic and non-academic sectors	Who applies? Individual researchers together with the host organisations	Who applies? International networks of research organisations from the academic and non-academic sectors	Who applies? Organisations funding or managing doctoral or fellowships programmes
Who is funded? Researchers at doctoral level (less than 4 years of full-time research experience and no doctoral degree)	Who is funded? Postdoctoral researchers	Who is funded? Researchers, technical administrative and managerial staff of any nationality and at all career levels	Who is funded? Researchers at doctoral and postdoctoral level

Source: European Commission

Beyond the overarching objectives of Horizon 2020, and while also contributing to a number of issues which are cross-cutting throughout the Horizon 2020 programme, MSCA addresses four specific objectives:

- Specific Objective 1 (SO1) – “Fostering new skills by means of excellent initial training of researchers” This specific objective aims at training a new generation of creative and innovative researchers, and enabling them to convert knowledge and ideas into products and services for economic and social benefit across Europe. It is mainly implemented through the Innovative Training Networks (ITNs).
- SO2 – “Nurturing excellence by means of cross-border and cross-sector mobility” This specific objectives aims to enhance the creative and innovative potential of researchers at all career levels by creating opportunities for cross-border and cross-sector mobility. It is mainly implemented mainly through Individual Fellowships (Ifs).
- SO3 – “Stimulating innovation by means of cross-fertilisation of knowledge” This specific objective aims to reinforce international cross-border and cross-sector collaboration in research and innovation by means of exchanges of research and innovation personnel. It is mainly implemented through Research & Innovation Staff Exchanges (RISE).
- SO4 – “Increasing structural impact by co-funding activities” This specific objective aims to increase the numerical and structural impact of MSCA and to foster excellence at national level in researchers' training, mobility and career development by leveraging additional funds and co-funding activities at the international, national or regional level, and is implemented through COFUND actions.

In addition to these four specific objectives, the programme also aims to raise awareness of the attractiveness of research careers, and disseminating research and innovation results emerging from MSCA projects. This is addressed largely through the annual European Researchers' Night.

There is a high degree of continuity between MSCA's objectives under Horizon 2020 and the preceding FP7.¹ However, the objectives and structure of MSCA have evolved over time to reflect emerging needs by:²

- Giving greater prominence to inter-sectoral mobility and addressing societal needs;
- Giving greater prominence to societal and innovation impacts, as is the case across the Horizon 2020 framework programme;
- Addressing emerging cross-cutting issues in research and innovation, such as Open Science, or Responsible Research and Innovation, and
- Giving stronger emphasis to the implementation and adoption of the Charter & Code for Researchers as well as the Principles for Innovative Doctoral Training (IDT)³.

ES1.2 Programme activities and funding

Overall, the programme saw a large increase in demand from FP7 to Horizon 2020, which was only partially met by an increase in programme budget.

¹ COUNCIL DECISION of 19 December 2006 concerning the specific programme "People" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013) (2006/973/EC). Available: <http://eur-lex.europa.eu/eli/dec/2006/973/oj>

² PPMI (2013) FP7 Marie Curie Actions Interim evaluation. Implementing Framework contract EAC/50/2009. Final Report.

³ As evidenced by the introduction of the Industrial Doctorates scheme and the revised setup of COFUND, which under H2020 co-funds doctoral training and focuses on the adoption of the IDT principles.

During FP7, MSCA funded over 11 000 projects involving 50 000 researchers with a budget of EUR4.8 billion. Under Horizon 2020, the MSCA are part of the Excellent Science pillar and has a budget of EUR6.2 billion to involve 65 000 researchers. This represents a 30% increase compared to FP7 and is a clear sign of recognition from stakeholders – including the Member States and the European Parliament – of the strong European added value of the programme and its proven track record over the past twenty years.

At the time of the evaluation, EUR EUR2 billion had been allocated to MSCA projects through the various calls under the first three years of Horizon 2020.

Brain circulation is a characteristic of the programme, where both movements towards more established countries are visible, as well as a certain trend of fellows returning to their country of nationality. EU Member States performing strongly in science and innovation, such as the UK, Germany and France, host the largest share of fellows. On the other hand, particularly Greece, Cyprus, Spain, Italy and Hungary have seen large proportions of fellows 'returning' to their country of nationality under MSCA in Horizon 2020 so far.

ES2 Method of approach and sources of evidence used

The evaluation covered the MSCA under FP7 (2007-2013) and under Horizon 2020 for the period 2014-2016. A mixed method approach was used to answer evaluation questions listed in Annex 2. The method consisted of the following elements:

- An in-depth literature review (including previous evaluations and MSCA related studies) to provide context for the evaluation;
- A review and analysis of programme data⁴, including programme activities up to 1st January 2017;
- Four online surveys of funded researchers and a comparison group of researchers, as well as funded organisations and a comparison group of organisations that applied for MSCA funding but were unsuccessful⁵ (circa 19,500 respondents in total: 8 500 organisations and 11 000 individual researchers);
- 60 telephone interviews with EU stakeholders, national policymakers, researcher representatives and experts on human resources in research;
- 18 case studies of individual MSCA projects, presenting a purposive selection of different types of actions across FP7 and Horizon 2020;
- Bibliometric analysis of MSCA supported researchers (MSCA fellows) and a comparison group of established researchers;
- A social network analysis of the MSCA programme throughout FP7 and Horizon 2020 up to June 2016.

Whilst the approach chosen was robust and introduced new elements compared to previous evaluations, limitations to the data available were also evident. In particular, improving availability and quality of data on individual level participants (i.e. fellows) as well as applicants would help to add value in future evaluations of the programme.

ES3 Conclusions and recommendations

This section presents the evaluation conclusions and recommendations with regards to the five evaluation criteria relevance, efficiency, effectiveness, coherence, and EU added value.

⁴ In most cases, FP7 and H2020 data are presented separately but, where appropriate, data for the years covering FP7 and H2020 may have been combined.

⁵ Organisations included universities, research institutions, business and other socio-economic actors, such as civil society organisations.

Overall the study concluded that the programme is very attractive and relevant for its intended target groups, and there are high levels of demand across the different types of actions supported. On the whole, the evidence collected suggests that the programme is structured coherently, and run effectively and efficiently. One important issue is the large oversubscription evident in application numbers. The programme furthermore offers strong EU added value. Accordingly, the evaluation puts forward a number of recommendations to improve the programme but does not propose any radical changes.

As regards the quality and availability of data discussed below, the study teams suggests to reflect on how this can be improved.

→Recommendation 1: The European Commission should aim to improve availability and quality of data on fellows, in particular collecting more meaningful information on fellow mobility, possibly through the new European initiative to track graduates⁶, and improving data quality/availability on researchers who applied for MSCA fellowships but were not funded.

ES3.1 Relevance⁷

MSCA is a highly relevant programme: the objectives of MSCA – to invest in people to produce internationally leading (excellent) research and innovation – remain central in the current context. They are expected to contribute to the achievement of growth and competitiveness, and to the solution of complex problems. As the European Commission recently noted: “highly-trained researchers are necessary to advance science and business competitiveness, which, in turn, are important factors in attracting and sustaining investment in Europe”.⁸

The bottom-up approach of the programme provides the space for researchers to come up with their own solutions to major societal and research challenges, and stakeholders agreed that this bottom-up approach should continue.

Equality and diversity are important elements in the programme. To date, 40% of MSCA-supported researchers are women (37% in FP7) – this is higher than the average percentage of female researchers in Europe. Around 41% of MSCA grants funded in Horizon 2020 until January 2017 take into account the gender dimension, higher than the 25% of all grants funded in that period across Horizon 2020. The proportion of women participating in each individual MSCA scheme has generally increased between FP7 and Horizon 2020. MSCA grants under Horizon 2020 so far have also seen a larger share of female coordinators (47%), when compared to the Framework Programme (33%). However, there is a smaller representation of women as supervisors in Individual Fellowships (21%), which reflects the glass ceiling apparent among academic staff and research boards.

→Recommendation 2: While the programme performs well in relation to gender equality, it is recommended that the Career Re-start Panel be enhanced – for example in terms of its duration – to further stimulate this aspect. It is also recommended that additional support be provided to people with disabilities, in order to facilitate their participation in the programme.

⁶ European Commission (2017) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a renewed EU agenda for higher education. SWD (2017) 164 final. p.5.

⁷ Relevance refers to the extent to which an intervention (still) matches the (current) needs and problems.

⁸ European Commission (2017) European Commission Staff Working Document: Interim Evaluation of H2020. Annex 2. SWD 221 final. p.133. 29-05-2017.

The programme does not currently include an objective related to widening participation. EU-13 countries tend to submit fewer proposals than EU-15 countries and the quality of EU-13 countries' proposals is, on average, also lower than those of EU-15 countries. In 2016 the Council invited "the Commission and Member States to foster and adequately reward all types of mobility, including virtual mobility, while taking into account the need to close the research and innovation divide across Member States and regions"⁹. The Commission is already actively working towards closing the research and innovation divide. In its recent Communication on a renewed EU Agenda for higher education the Commission included a commitment to "Develop opportunities within the Marie Skłodowska-Curie actions that help close the research and innovation divide between Member States and regions and help address brain drain from less developed regions".¹⁰

→Recommendation 3: In this context, and given that the programme aims to support excellence and competitiveness across Europe, the inclusion of an objective and associated actions in MSCA to address this divide deserves consideration.

The four specific objectives of MSCA are highly relevant, as they are focused on the development of excellent researchers (and in particular the next generation of researchers), mobility and cross-fertilisation across sectors in order to make Europe's science system more attractive and further extend its contribution to innovation and growth. More specifically, the following aspects can be noted:

SO.1 Fostering new skills by means of excellent initial training of researchers

MSCA has a key role in "building competence in the long term, focusing strongly on the next generation of science, systems and researchers, and providing support for emerging talent"¹¹ to consolidate the ERA and make the Union's science system more competitive and attractive globally. The stimulation of excellent and innovative research training and mobility opportunities (geographical, sectoral, disciplinary – see below for further details) are tools that the MSCA uses to better prepare researchers to address current and future challenges. The majority of current EU doctoral candidates will not take up an academic career, and the need to develop the skills that they require to be employed in non-academic sectors has become a major concern. There is a need to broaden their skill base and provide them with interdisciplinary and transferable skills. MSCA aims to achieve this objective primarily through its ITNs and the doctoral programmes in COFUND – see also section ES3.3 on Effectiveness below.

The need to make Europe's science system more competitive remains. For example, the US has a larger proportion of high-impact publications than the EU, while producing fewer scientific publications. This suggests that the US is more efficient at producing the very best scientific outputs. Emerging countries, such as China, are increasingly producing cutting-edge research. This underlines the importance of actions, such as MSCA, to further develop the skills and training of current and future generations of European researchers.

→Recommendation 4: MSCA should continue to place strong emphasis on the development of skills of researchers, in particular of the next generation of

⁹ Council of the European Union (2016) Measures to support early stage researchers, raise the attractiveness of scientific careers and foster investment in human potential in research and development. 14301/16. Brussels, 18 November 2016. P.6.

¹⁰ European Commission (2017) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a renewed EU agenda for higher education. SWD (2017) 164 final. p.9.

¹¹ Council Decision of 3 December 2013 establishing the specific programme implementing Horizon 2020.

researchers. This training should continue to be tailored to the diversity of career pathways that doctoral candidates are likely to pursue.

SO.2 Nurturing excellence by means of cross-border and cross-sector mobility

Geographical mobility produces significant benefits for researchers. In Europe, researchers with international experience tend to exhibit a higher scientific impact. Mobility is also a key tool to develop international cooperation, which strengthens the EU's research excellence and attractiveness by providing access to new resources, and can provide access to research test beds and advancements in innovation in areas where European countries are less specialised. This suggests that actions to stimulate mobility continue to be needed.

Almost 140 nationalities have received MSCA funding since 2014. Around one in four MSCA fellows are researchers attracted to Europe from countries outside the EU Member States or the Horizon 2020 Associated Countries. There are imbalances in the mobility of European researchers, with low levels of mobility towards emerging countries such as Brazil, China and India. However, MSCA does seem to be attractive for non-EU researchers and organisations from outside the EU: participations in MSCA account for around 80% of all US participations across Horizon 2020 while for the other top four countries in terms of participation (China, Australia, Canada and Brazil) the share is so far around 50% or higher.

→Recommendation 5: MSCA is a relevant instrument to stimulate mobility to emerging countries. Given the strategic importance of these countries, this could be enhanced further. In this respect, it is recommended that the European Commission considers ways in which Global Fellowships could make mobility towards emerging destinations more attractive, without compromising the programme's emphasis on excellence. This could entail, for example, providing additional information about leading centres in those countries to potential MSCA applicants, or other forms of awareness raising. Participation of emerging destinations in RISE and ITN projects could also be further promoted, as this would enable European-based research staff, including PhD candidates, to spend short periods of up to one year in these countries.

MSCA's emphasis on cross-sectoral collaboration, for example through Industrial Doctorates, continues to be relevant and welcomed by stakeholders. Over the course of H2020, it is expected that 65 000 researchers experience international mobility funded by MSCA, and that "for just under half of them, this will also include mobility or exposure to the non-academic sector or vice-versa"¹². In 2016, a new pilot, the Society and Enterprise Panel for experienced researchers within the IF was launched. This reflects efforts to better meet the needs of the non-academic sector.

A recent Commission communication campaign addressed specifically at businesses has been associated with an increase in the number of applications from businesses in H2020, although "a number of businesses still lack information about certain specific aspects of the MSCA", including its relevance and potential benefits to them¹³.

→Recommendation 6: It is recommended that the Commission continues its efforts to promote MSCA to the private sector, in line with the recommendations from the recent study of business participation and entrepreneurship in MSCA.

¹² European Commission (2017) European Commission Staff Working Document: Interim Evaluation of H2020. Annex 2. SWD 221 final. 29-05-2017. P.176.

¹³ PPMI, AIT and Optimity (2017) Study of business participation and entrepreneurship in MSCA actions (FP7 and Horizon 2020). Final report to DG Education, Youth, Sports and Culture. P.120.

Interdisciplinary research is gaining relevance because complex societal challenges increasingly require collaboration between different disciplines for their solution. At the individual level, interdisciplinary knowledge is seen to enhance employability. The proportion of all researchers in the EU working in the private sector (48% in 2014) is significantly below the levels of US, Japan, Korea, Canada or China. Collaboration between sectors in terms of public-private co-publications is also comparatively low in Europe. The main barriers to cross-sectoral mobility include researchers' lack of the particular skills to cooperate with industry (see also SO.1).

Around 30% of MSCA-IF proposals are deemed to have included interdisciplinary research. This is a strong signal of the importance of interdisciplinarity within MSCA. The importance of interdisciplinarity does not feature as explicitly in the MSCA objectives as geographical and cross-sectoral mobility, although this does not proscribe the adoption of actions to the work programme in order to enhance interdisciplinarity.

→Recommendation 7: It is recommended that ways to further enhance interdisciplinary work within the MSCA are promoted. This may include increased flexibility of calls and researcher positions, such as combined positions or part-time work – not to limit the possibilities of entrepreneurial activity or formal training to enhance interdisciplinary knowledge – and secondments. Actions could also be adopted so that interdisciplinary researchers are assessed according to their profile: for example, recognising that interdisciplinary researchers may have profiles that differ from the standard track record of other excellent researchers.¹⁴

SO.3 Stimulating innovation by means of cross-fertilisation of knowledge

Europe lags behind main international competitors such as the US, Canada and Australia in terms of innovation. MSCA's emphasis on cross-fertilisation and sharing of knowledge from research to market (and vice-versa) is pursued through the mobility of highly skilled research and innovation staff. Commercial and innovation outcomes were given a more prominent role in H2020 compared to FP7, to more decisively address this objective.

RISE provides a critical mass, with almost 23 000 planned secondments with staff exchanges to or from non-academia and to or from third countries in the first three years of H2020. A number of stakeholders (policy-makers) view the RISE action as being related primarily to the building of long-term relationships, rather than excellent science.

SO.4 Increasing structural impact by co-funding activities

There is a clear rationale for the establishment of mechanisms that enable European stakeholders to pool resources and combat fragmentation in terms of objectives and actions. There is also a clear rationale to spread the best practices generated by MSCA as aimed by the MSCA COFUND scheme. COFUND aims to achieve a "structural impact" as the leverage of additional resources leads to increases in the number of available mobility opportunities (geographical, sectoral, interdisciplinary) across Europe. COFUND also aims to help to reshape existing mobility schemes and spread the adoption of innovative training and the improvement of employment conditions for researchers, which as discussed previously, are highly relevant in the current context.

Raising awareness of research careers

MSCA aims to raise awareness of researchers' work amongst the general public (in particular young people), and help change public perception of science, in order to

¹⁴ See also European Commission (2017) European Commission Staff Working Document: Interim Evaluation of H2020. Annex 2. SWD 221 final. 29-05-2017. P.148.

enhance the recognition of research and innovation activities and the attractiveness of research careers. While all MSCA projects include dissemination activities, the European Researchers' Night through its funded projects around Europe and beyond specifically addresses these aims of the programme. The majority of European countries have a lower share of doctorate holders (compared to their population) than international competitors such as the US, Australia or Canada, and there is a significant lack of awareness and understanding of researchers' work and its importance for the EU.

ES3.2 Efficiency¹⁵

The implementation of the programme is appropriate and efficient.

There is consensus among stakeholders that the budget is insufficient, reflected by high oversubscription leading to low success rates, particularly affecting ITNs. Indeed, the programme's oversubscription rate has doubled between FP7 and Horizon 2020. This continued oversubscription reduces the overall programme impact, and provides clear indication that the programme impact could be larger if more EU budget were to be made available. The oversubscription rate is highest for ITN, with ten times more high quality proposals not funded compared to proposals funded, under H2020. IF received around five times as many high quality proposals than it could fund, and RISE around two times as many. The insufficient programme budget could result in a loss of talent with wider implications on research and innovation capacity across the EU.

→Recommendation 8: It is recommended that the European Commission considers increasing the programme budget in order to reduce current oversubscription rates (ITN are in particular need of a budget increase).¹⁶

A further option to reduce oversubscription, at least for single beneficiary actions, would be to limit the ability for resubmission similar to restrictions imposed by the European Research Council. For instance, coordinators of proposals below a certain threshold (but above the quality threshold) could be asked to resubmit but with a delay of one year. There are however numerous issues that would need to be examined with respect to the practical aspects of such restrictions, e.g. would the individual researcher funded and/or the coordinator be prevented from re-applying?

→Recommendation 9: It is recommended that the European Commission studies the implications of adding resubmission restrictions.

The administrative budget committed by REA to MSCA in H2020 constitutes only a small proportion of the operational MSCA budget, averaging 2.5% between 2009 and 2015, and therefore consistently below the legal objective of maximum 5%. In addition, the proportion of the MSCA budget devoted to management is also consistently lower than the maximum 5%. The use of unit costs in MSCA means that the programme has a very low risk of errors in financial management, contributing further to the efficiency of programme management.

→Recommendation 10: While the relative management costs of MSCA remained consistently below the legal maximum of 5% between 2013 and 2016, it is recommended that the European Commission continues to efficiently monitor these costs.

¹⁵ Efficiency considers the relationship between the resources used by an intervention and the changes that intervention has generated.

¹⁶ Alleviating the oversubscription of ITN would be most costly, but given the strong EU added value of the ITN such change would have the largest potential for delivering additional programme results.

REA's operational commitment and payment appropriations for the (non-differentiated) administrative appropriations were almost completely fulfilled between 2011-15. The evaluation process is well designed and managed. The average time-to-grant for MSCA projects decreased significantly between 2009 and 2015. Monitoring indicators are fit for purpose. REA's overall processing and completion of payments also improved between 2012 and 2015.

Furthermore, survey respondents were generally satisfied with the level of funding received. In line with the interim review of MSCA unit costs conducted by ICF¹⁷, there is strong evidence that the programme offers adequate and attractive levels of funding.

The European Researchers' Night, with an annual budget of EUR 4 million, can be considered cost-effective as it manages to reach out to more than one million citizens every year, right across the EU, in particular informing young people about a possible career in research.

ES3.3 Effectiveness¹⁸

Drawing on analysis and data over several years¹⁹, a large body of evidence shows that MSCA continue to have a positive impact on individual researchers, organisations, and at the system level. It should be noted however that no MSCA projects under Horizon 2020 had been completed at the time of writing. It is thus clear that the measurable output at this stage of the Horizon 2020 programme implementation is somewhat limited. Moreover, as the full value and impact of mobility and opportunities opened up by MSCA is often revealed after many years, the results of some FP7 projects have been used where appropriate.

ES3.3.1 Individual level

ES3.3.1.1 Training and skills development

MSCA's training and professional development dimension is strong: Over three quarters of participants are (very) satisfied with the training and professional development opportunities they received during their MSCA fellowship. The training is effective in equipping fellows with both skills specific to the research profession and transferable skills. ITN stands out in terms of the volume of training followed by fellows (30% of ITN fellows who responded to the survey had followed more than 20 days of training per year) and fellows' satisfaction with the training areas covered (66% of ITN survey respondents were (very) satisfied), indicating that the strong intended focus of ITN on intensive initial training for Early Stage Researchers (ESR) is indeed put into practice. Almost 60% of MSCA fellows who responded to the evaluation survey indicated that there were areas in which they would have liked more training such as in the area of report and proposal writing, new and/or advanced scientific methods, and team management and leadership skills.

→ Recommendation 11: It is recommended that the European Commission continues to stimulate the availability of relevant training as part of the programme. This could include the development of online-training modules to enhance equal access of MSCA fellows to high quality training opportunities in areas of specific relevance to the MSCA

¹⁷ ICF (2017). Mid-term review of MSCA unit costs.

<https://publications.europa.eu/en/publication-detail/-/publication/0f44192e-5499-11e7-a5ca-01aa75ed71a1/language-en/format-PDF/source-31288412>

¹⁸ Effectiveness analyses the progress made towards achieving the objectives of the intervention – exploring whether or how the changes were linked to the intervention. Effectiveness analyses the progress made towards achieving the objectives of the intervention.

¹⁹ This includes projects financed under FP7 and H2020. It also draws largely on surveys of MSCA fellows and organisations carried out for this evaluation in 2016.

programme (e.g. setting up modules in interdisciplinary research, entrepreneurship, open science). At the same time, it is important to ensure the right balance between the training and secondments as part of ITN projects with the need to produce high quality research and complete the thesis in the timeframe foreseen.

ES3.3.1.2 International mobility and collaboration

MSCA fellows are much more internationally mobile than other researchers throughout their careers, in particular IF fellows. Evaluation findings suggest that over the past 10 years, one third of IF fellows have changed their country of employment at least twice, compared to 1 out of 10 researchers in the comparison group. More than half of the publications of IF fellows between 2007 and 2016 were publications involving international collaboration. This was 15 percentage points above the comparison group of researchers similar to IF.

Some 80% of fellows created collaborations with researchers abroad (i.e. in countries other than the country of the fellowship) during MSCA fellowships, and these collaborations tend to be sustained.

Data show that MSCA is open to the world with around one in four MSCA fellows attracted to Europe from countries outside the EU Member States or the Horizon 2020 Associated Countries. In terms of international third-country participation, MSCA plays a strong role in ensuring the international orientation of Horizon 2020. So far, MSCA accounts for around 50% of all third country participation in Horizon 2020. Moreover, RISE is the most international scheme across Horizon 2020, with around 32% of its total participations coming from third countries. IF(11%) and COFUND (7%) also exhibit international participation levels above the Horizon 2020 average.

ES3.3.1.3 Cross-sectoral mobility and collaboration

MSCA contributes to cross-sectoral mobility of researchers during and after the MSCA projects. Over the first three years of RISE 2014-16, there were 6 510 planned secondments from academia to non-academia and 4 302 from non-academia to academia. Moreover, around 12 000 of the approximately 27 000 fellows that have been funded under the budget of the MSCA calls for the years 2014-16 are estimated to experience some form of cross-sectoral mobility out of or into an academic setting. In addition, the survey of MSCA fellows shows that 11% of MSCA fellows mainly hosted in the academic sector during their fellowship moved to the non-academic sector after the end of the fellowship (RISE/IAPP: after terminating employment with the sending organisation). 38% of these attribute this move to a (very) large extent to MSCA participation. Cross-sectoral mobility after the end of the fellowship is particularly high under ITN (19% of fellows moved to the non-academic sector) and RISE (28% of those who leave their sending organisations move to the non-academic sector). With regard to cross-sectoral collaboration in research, ITN fellows perform strongly: their share of academic-corporate cross-sector publications (4.3%) is significantly higher than the world average (2.6%) and also higher than the cross-sector publication shares of the comparison group of researchers similar to ITN (3.8%).

ES3.3.1.4 Interdisciplinary mobility

The MSCA programme is effective in stimulating cross-fertilisation of knowledge across fields: one in four MSCA fellows moves to a new field of research as part of their first employment after their fellowship, and more than half of them believe that this is to a (very) great extent the result of participating in MSCA. The share of fellows who move to a new field of research after the end of their fellowship is particularly high in ITN (27%) and RISE (39% of those changing employers).

ES3.3.1.5 Employment/ careers/ excellence

There is strong evidence that the MSCA programme is effective in boosting the career of researchers. Around 60% of past MSCA fellows believe that it would have taken them more time to attain their subsequent career stage without the MSCA fellowship, and 12% believed they would not have attained the subsequent career stage at all.

There is also compelling evidence that MSCA helps produce the next generation of leading researchers: overall, MSCA fellows are twice as likely as the average researcher to have publications that belong to the Top 1%, Top 5% and Top 10% of cited publications. IF fellows perform up to three times better than the average researcher with regard to Top 1% cited publications and out-performed the comparison group of successful, established, high profile researchers constructed for this evaluation on important indicators of excellence (i.e. Top 5% and Top 10% cited publication share of total output).

Among former IF fellows, 95% reported that they were in employment at the time of the survey (end 2016).

The evidence shows MSCA had helped create new jobs in addition to staff directly funded by the project. In total, 23% of organisations had created (or will create) one additional full time equivalent job while 12% of organisations had created two or more FTE posts as a result of participation in MSCA.

ES3.3.2 Organisational level

At organisational level, MSCA has a larger impact on the quality of training than on the breadth of training offered. The quality of the training available to researchers in the organisation is often enhanced by the knowledge and skills brought to the organisation by the fellows, in particular for IF. ITN organisations are successful in providing fellows with exposure to industry (52% of ITN fellows versus 29% of comparison group researchers).

Evidence shows that organisations participating in MSCA are more often complying with the Charter and Code with regard to the openness and transparency of recruitment procedures. Around 55% of MSCA fellows perceive the recruitment procedures at the institution where they did their fellowship to be open and transparent to a (very) great extent, compared to 43% of researchers in the comparison group.

Organisations participating in the ITNs tend to implement the Principles of Innovative Doctoral Training. 72% of ITN fellows rate the quality of supervision they receive/have received as (very) good (15% report it to be fair). A similar percentage is (very) satisfied with the quality, amount and coverage of training received, more so than researchers in the comparison group. ITN fellows also tend to have more exposure to industry work places during their doctoral studies than researchers in the comparison group. New collaborations resulting from MSCA projects are more often international than national (84% versus 45% for new collaborations with (other) academic organisations, and 53% versus 30% for (other) non-academic organisations).

With regard to organisations' research capacity, MSCA's impact is greatest on the internationalisation and interdisciplinarity of organisations, and their capacity to bid for other research funds.

Organisations are highly effective in delivering the publications (90% of the organisations in the evaluation survey reported to have achieved their publication objectives) and prototype development and demonstrations and new improved technical codes and standards (80% of organisations) proposed as part of their MSCA project application. The share of organisations that achieved patent/trademark

applications, new or improved products, services or clinical trials as initially planned is lower (45%, 47% and 57% respectively).

→ Recommendation 12: The European Commission should investigate in more detail why only about half of organisations which planned patent/trademark applications, new or improved products, services or clinical trials reported to have achieved these plans, i.e. whether this is due to a time lag between the end of the MSCA project and achieving this output, whether project proposals were too ambitious or whether this is due to the risk of failure implied in research.

ES3.3.3 System level

Around 45% of ITN fellows (40% of MSCA fellows overall) reported that they were not very likely to have pursued a research career in the absence of MSCA funding. There is thus a role for MSCA as a contributing factor in the attraction into / retention in research careers of a substantial proportion of participants. Moreover, more than one quarter of organisations report that the MSCA programme has helped them to retain excellent researchers who would have left Europe otherwise.

COFUND has a substantial effect on opportunities for researchers for cross-border mobility in a country, both through the creation of new programmes and the opening of existing programmes for transnational mobility. One third of COFUND organisations which responded to the survey report that participation in COFUND has increased the number of transnational fellowships to a (very) large extent. Fewer organisations report that participation in COFUND has increased the number of intersectoral or interdisciplinary fellowships to a (very) large extent (6%). A tangible structural impact of COFUND with regard to increasing the number of international, interdisciplinary and cross-sectoral fellowships can be expected in countries with several parallel-running COFUND projects. A structural impact on working conditions of fellows has been reported when national schemes are adjusted to fit the COFUND requirements in view of applying for COFUND.

The creation of a genuine open labour market for researchers is one of the priorities of the European Research Area (ERA). In this regard, the MSCA continue to have a pronounced structuring impact on ERA and institutional practices by contributing to the systematic implementation of the European Charter and Code of Conduct for the Recruitment of Researchers and in particular by setting standards for quality (doctoral) training, attractive employment conditions and open recruitment for all EU researchers. For example, all funded MSCA participants are required to apply the principles of the European Charter for Researchers and Code of Conduct, and this evaluation shows that indeed the majority of MSCA fellows (55%) perceive the recruitment procedures at the institution where they did their fellowship to be open and transparent to a (very) great extent.

MSCA is also contributing to the ERA by creating collaboration among academic organisations, and between academic and non-academic organisations, which this study shows are highly sustainable.

Furthermore, in particular, ITNs contribute to the wide promotion and implementation of the EU Principles for Innovative Doctoral Training which identify the need to provide young researchers with quality supervision, (transferable) skills training, sustainable professional networks, and exposure to industry and other employment sectors. Compliance with the IDT of organisations participating in ITN is confirmed by ITN fellows consulted as part of this evaluation study. Moreover, evidence from interviews suggest that in some countries ITNs have had an impact on national doctoral programmes as they set best practice examples which are followed by other organisations, also those not receiving EU funding.

ES3.3.4 Cross-cutting issues

MSCA performs well in relation to cross-cutting objectives such as gender balance, societal challenges, Responsible Research and Innovation (RRI) and open access.

The general openness of and bottom-up approach taken by MSCA has allowed a large majority of institutions to train and upgrade the skills of a new generation of researchers able to tackle a broad range of current or expected societal challenges. Moreover, MSCA funding addresses societal challenges to a significant extent, above the Horizon 2020 average and well ahead of the other areas in the excellence pillar.

MSCA has performed strongly in relation to gender equality, as discussed above. MSCA performs in line with Horizon 2020 in relation to other cross-cutting objectives, such as Responsible Research and Innovation (RRI) or open access. It is worth noting that ITN fellows had a significantly higher share of their articles published in 'gold' open access compared to their comparison group (42% compared to 33% between 2006 and 2016). This suggests that the programme is nurturing new cultures of publishing in the next generation of Europe's leading scientists.

There is a broad consensus among participating organisations that the European Researchers' Night projects contribute to establishing direct contacts between researchers and the public at large and that it increased the visibility and understanding of researchers' work.

European Researchers' Night projects attract more than one million citizens across Europe and have enabled the participating organisations to better involve various groups of stakeholders compared to previous or other events, in particular the young.

ES3.4 Coherence²⁰

MSCA is coherent with other H2020 actions. MSCA is particularly supportive of the international participation objectives of H2020. MSCA has helped beneficiaries to acquire additional FP7 and H2020 funds post-participation. This is suggestive of the complementarity between these policy instruments. The reduction of actions under H2020 has contributed to the clarity and coherence of its integrating parts. Some stakeholders reported a degree of overlap with the Horizon 2020 SME Innovation Associate Initiative (IAI), that funds the recruitment of doctorate holders in SMEs.

→Recommendation 13: Given the commonalities between both initiatives it is recommended that the Commission ensures coherence and complementarity between the actions, and considers the possible incorporation of IAI into MSCA.

The programme includes a coherent set of actions. A small number of stakeholders questioned the coherence of NIGHT with other actions. NIGHT was seen as less directly linked with the core concern of the programme around excellence than other actions. NIGHT aims to raise awareness and recognition of the public on research and innovation activities and research careers. Its coherence and synergies with other parts of the programme could be enhanced by modifying NIGHT's narrative in order to present NIGHT as a platform that aims to "showcase" excellent research to the general public.

→Recommendation 14: In order to enhance the coherence of the European Researchers' Night with other actions, NIGHT's narrative and activities could be modified to more clearly emphasise its role in showcasing excellent research – in particular, excellent research associated with MSCA – and connect it more strongly to other parts of MSCA. This showcasing of excellent research could include an explicit

²⁰ Coherence refers to how well an intervention works internally and with other interventions to achieve common objectives or as complementary actions.

European dimension, for example by linking MSCA projects (including completed projects) on selected topics through ICT. It is also recommended that the EU continue to exchange good practice among the national coordinators of the NIGHT.

MSCA exhibits a high degree of coherence with other EU policy initiatives including Europe2020, its flagship initiatives, the New Skills Agenda for Europe and the European Research Area (ERA). It is also coherent with ET2020 and recent legislative developments on the conditions of entry and residence in the EU for the purposes of research. MSCA is highly coherent with EU financial instruments such as Erasmus+, the European Structural and Investment Funds (ESIF). This coherence is manifested in the mutually reinforcing character of these interventions and MSCA –see also section on EU added value.

→Recommendation 15: Given the large degree of coherence with related EU policy initiatives, it would be appropriate to maintain the mobility, training and career development of researchers through MSCA within H2020 and future Framework Programmes for research.

→Recommendation 16: Synergies with the European Structural and Investment Funds (ESIF) through the COFUND action have materialised during the implementation of MSCA. Best practices in the use of such synergies, and more formal mechanisms to develop them, should be identified and promoted to increase their uptake.²¹

MSCA is complementary to the objectives of regional and national funding for the development of research excellence. National funding for doctoral training does not normally include mobility requirements. Those national funding schemes that include mobility requirements tend to have a lower degree of flexibility than MSCA with regard to the geographical scope of the hosting institution, and tend to support either young researchers or senior researchers, but rarely both types. Most often, they aim to attract highly experienced researchers. This contrasts with MSCA's emphasis on skills development. MSCA, additionally, offers a greater emphasis on inter-sectoral research than most national programmes. The complementarity between MSCA and national funds can be seen in that a high proportion of MSCA beneficiaries reported that MSCA had helped them to acquire non-MSCA related national and/or regional research funds.

Complementarity with national funding programmes has been enhanced through the introduction, in 2016, of a Seal of Excellence, which is awarded to IF proposals which score 85% or above but for which there is insufficient funding through the MSCA budget. The Seal of Excellence provides researchers who have achieved this score with recognition for the quality of their proposals; it can be used by these researchers and the hosting institutions with whom they applied to seek alternative funding sources – for example at regional and national level²², including through the use of ESIF²².

Whilst MSCA in principle offers flexible funding arrangements, there is more that could be done to increase the flexibility of the programme. For example, the exclusivity requirement in RISE (exclusivity of work on the MSCA project during the secondment) means that sometimes long secondments under this action can be considered difficult/impractical by senior staff who would like to undertake them, but are deterred by the programme requirement not to work on other projects during the secondment period.²³

²¹ MSCA Advisory Group Report June 2016

²² European Commission (2017) European Commission Staff Working Document: Interim Evaluation of H2020. Annex 2. SWD 221 final. 29-05-2017. P.172.

²³ See http://ec.europa.eu/research/participants/portal/doc/call/h2020/msca-rise-2015/1647602-faqs_rise_2015_updated_en.pdf p.8.

The 36 month maximum period for ITN fellows does not match programme structures in some national contexts where doctoral studies are designed as 4-year programmes. In some cases this may deter participation due to difficulties to find funding for the 4th year of study and reduces the incentives of institutions to take part in ITNs. Given current levels of oversubscription in ITNs this does not seem to be a widespread problem, even though it may affect certain centres of excellence in specific locations where a 4th year is required. Funding a 4th year in those cases, however, would concentrate the budget further, reduce the number of projects and increase levels of oversubscription, unless a significant budgetary increase for the action be achieved. It should also be noted that a number of countries with 4 year structures have recently moved or are in discussions to move to a 3 year structure.

ES3.5 EU added value²⁴

Survey responses suggest that in Horizon 2020 so far, high-quality proposals equalling EU funding of around EUR9.5 billion did not go ahead in the absence of MSCA support.²⁵ The evaluation found that only 6% of unsuccessful proposals went ahead without significant changes, suggesting a remarkably low degree of deadweight.

The evaluation found EU added value of the programme across all three levels of intervention. At individual level, MSCA provides particular EU added value through its offer of structured training and career development for researchers during and after their PhD. Furthermore, both individual researchers and institutions build their networks, often facilitating long-term collaboration.

At project level, MSCA's EU added value is particularly strong in providing cross-border and cross sector mobility, which can be seen by the large amount of unsuccessful proposals which have to cut back their international and intersectoral activities in the absence of EU funding.

In addition, the international training and supervision offered within MSCA projects is considered to be of extremely high level and often adds value to training and supervision available under national schemes, according to stakeholders. MSCA is not only contributing to the quality of existing training, but also encourages the development of training tailored to the needs of MSCA fellows that would not be available otherwise.

Training offers that are reserved for MSCA fellows most often concern industry or market-related topics such as 'Marketing and sales' and 'Product development'. On the contrary, areas such as 'publishing' and 'research ethics' are usually not a specific added value of the MSCA programme. This suggests that, even if such exclusive tailored training is only reported by a minority of organisations, MSCA fellowships have a specific added value on training provided, widening their focus to topics less familiar to the academic environment.

Researchers are generally satisfied with the level of training offered, and organisations indicate that the quality of training has increased with participation in MSCA. Despite the high levels of overall satisfaction with the breadth of training offers, almost 60% of MSCA fellows who responded to the survey indicated that there were areas in which they would have liked more training such as proposal writing.

²⁴ EU added value refers to the value resulting from EU interventions that is additional to the value that would have resulted from interventions initiated at regional or national levels, by both public authorities and the private sector.

²⁵ As of January 2017, high quality proposals worth EUR13 billion were unsuccessful in winning funding under Horizon 2020. Using survey responses from unsuccessful applicants, 73% of unsuccessful proposals seem to not be implemented at all after failing to win EU funding, resulting in a loss of projects worth around EUR 9.5 billion so far.

Beneficiary organisations reported a strong effect on winning follow up funding. Looking only at projects that were not a continuation of previous research, around 51% of respondents stated that MSCA helped in obtaining extra resources.

At system level, the programme has provided EU added value through a structuring effect across Europe. MSCA contributes positively to ERA by helping to create a more effective EU research system, boosts transnational cooperation and competition and promotes an open labour market for researchers. More specifically,

- The programme serves as a delivery mechanism for the European Charter and the Code of Conduct for the Recruitment of Researchers, introducing standards and common rules that are increasingly adopted. All funded MSCA participants are required to apply the Charter and Code.
- It spreads good practice in researcher training and skill development at national level and contributes, in particular, to the promotion and implementation of standards for doctoral training through the stimulation of the use of the Principles for Innovative Doctoral Training (IDT). A further structuring effect of the programme is that it helps to introduce industry relevant training to institutional curricula.
- The MSCA bottom up approach has allowed participating organisations to upgrade their training offers and nurture a new generation of researchers.
- The MSCA has fostered international mobility and the formation of knowledge networks and collaboration across Europe.
- Finally, host institutions believe that the programme has helped to retain excellent researchers in Europe who would have otherwise left.

→Recommendation 17: It is recommended that the European Commission considers ways to encourage further added value in the training offered by host institutions beyond the structuring effect observed. Particular attention should be paid to areas where fellows indicated they would have liked more training.

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