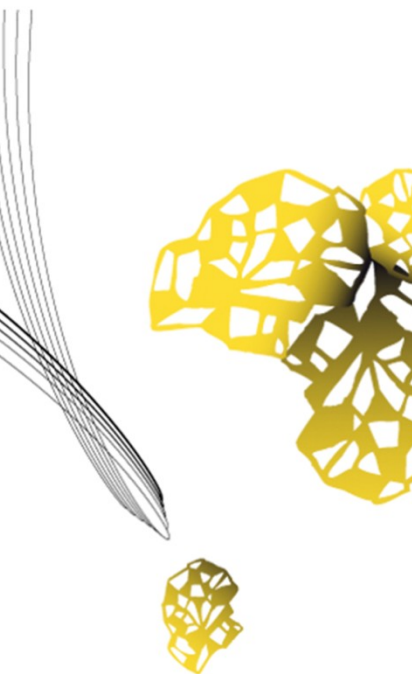




UNIVERSITY OF TWENTE.

**Achieving ‘Spreading Excellence and
Widening Participation’ without
compromising the excellence principle in
Horizon 2020**

**Master Thesis
European Studies Double Degree
University of Twente &
Westfälische Wilhelmsuniversität Münster**

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Date: 28-06-2018

Acknowledgements

I want to express my sincere gratitude towards Drs. Hans Vossensteyn (Utwente), Harry de Boer (Utwente) and Matthias Freise (WWU Münster), who guided me throughout my research on this challenging, broad and complex topic. They have played a key role in helping me build structure and maintain focus while discovering the ‘jungle’ that is EU R&I policy, while also providing me freedom to conduct research according to my own insights.

I am also grateful towards the Netherlands house for Education and Research (Neth-ER), who provided me a valuable learning experience during my internship and for inspiring me to write my master thesis on the relevant topic of the ‘R&I divide’. Neth-ER is a representation of the Dutch knowledge community in Brussels, whose aim is to influence the European policy making process in an adequate way in order for the Dutch community to optimally use European policy and instruments that Europe has to offer for the Netherlands.

Torben Vorders

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Abstract

The European Union introduced research and innovation (R&I) as key priorities to ensure its competitive position towards the rest of the world. The Horizon 2020 programme has therefore been introduced to fund excellent R&I. However, contrasting policy objectives increasingly start to interact with one another as Europe pursues broader objectives of smart, sustainable and inclusive growth. This has led to the introduction of ‘Spreading Excellence and Widening Participation’ (SEWP) under Horizon 2020, aimed towards supporting institutions from less performing EU-13 Member States. The introduction of SEWP is deemed controversial, as it threatens to compromise the core principle of excellence in Horizon 2020, which ensures only the most outstanding proposals are funded without any geographical considerations.

However the pursuit of widening participation and thereby territorial cohesion is deemed of crucial importance if the EU wants to collectively become competitive as a Union and prevent a two-speed Europe. To protect the Horizon 2020 budget intended for funding excellent R&I, the European Structural Investment Funds (ESIF) from EU cohesion policy have been suggested as alternative funding source to pursue widening objectives.

By developing a comprehensive analytical framework of the current EU R&I policy mix, consisting of different policy domains, instrument types, rationales, target actors and interactions, insights are given on how the EU can better pursue widening objectives without compromising the excellence principle in Horizon 2020. While the added-value of the small widening elements in Horizon 2020 is recognised, it is strongly recommended to provide a strict ceiling for budget dedicated to widening, while rigorously separating it from the rest of the Horizon 2020 budget. Improved synergies between Horizon 2020 and ESIF are deemed of key importance to pursue widening in the future, in which the Smart Specialisation Strategies for Research and Innovation (RIS3) under ESIF are expected to play a key role.

1. Introduction and context

Over the past decades, the process of globalisation has made the world more interconnected, leading to increased international competition. As a response, the European Union (EU) prioritised research and innovation (R&I) as essential contributors towards maintaining its competitive position towards the rest of the world, generating economic growth and jobs. The EU ambition of becoming the most competitive, knowledge-based economy was carved into the 2000 Lisbon Strategy, which involved an ambitious target of devoting 3% of GDP to research and development (R&D) activities by 2010. This was followed by the launch of the Europe 2020 Strategy with the objective to attain smart, sustainable and inclusive economic growth. To implement the Europe 2020 Strategy, the eight Framework Programme for R&I (Horizon 2020) was launched in 2014, containing a budget of almost €80 billion, whose main goal is to ensure the production of world-class science, remove barriers to innovation and enforce transnational and cross-sectoral collaboration. However, the excellence principle within Horizon 2020 is threatened of being compromised as the programme starts to focus on ‘widening participation’ towards less-performing EU Member States. This research analyses how and to what extent the current EU R&I policy mix contributes towards both excellence and widening, providing insights on how to pursue two contrasting policy objectives simultaneously (Borràs & Edquist, 2013; Davies, 2003; European Commission, 2011c; European Parliament & European Council, 2013b; Izsak & Radosevic, 2017; Propris, 2007; Sharp, 1998; Veugelers et al., 2015; Warren, 2002; Young, 2015).

1.1 Internal disparities within the EU

Despite increased policy focus towards R&I-based growth, Europe’s innovation performance remains weak towards the rest of the world. The European Innovation Scoreboard (EIS¹) indicates the EU continues to be less innovative compared to South-Korea, the United States and Japan. Meanwhile rising powers like China are quickly catching up. This underperformance is largely explained by persistent internal disparities within the EU between Member States and regions in innovative performance and capabilities, preventing the EU of becoming competitive as a union. An analysis shows that Europe maintains an innovation system with only a few well performing Member States and regions with a slow process of convergence taking place, which is threatened of coming to a halt or even be reversed (Clarysse & Muldur, 2001; European Commission, 2011a; Veugelers, 2016; Veugelers et al., 2015).

¹**EIS is based on 27 indicators spread over 10 dimensions:** 1) Human resources, 2) Excellent and attractive research systems, 3) Innovation-friendly environment, 4) Finance and Support, 5) Firm Investments, 6) Innovators, 7) Linkages, 8) Intellectual assets, 9) Employment impacts, 10) Sales impacts.

EIS scores for EU Member States (Figure 1) indeed illustrate a high heterogeneity in innovation performance in Europe between older Member States (EU-15²) and less experienced, newer Member States (EU-13³), mostly from Central and Eastern Europe (CEE). There is a large dispersion between best-performing frontier countries like Sweden, Denmark and the Netherlands and the so called less-performing catch-up countries, mainly consisting of transition economies like Romania and Bulgaria.

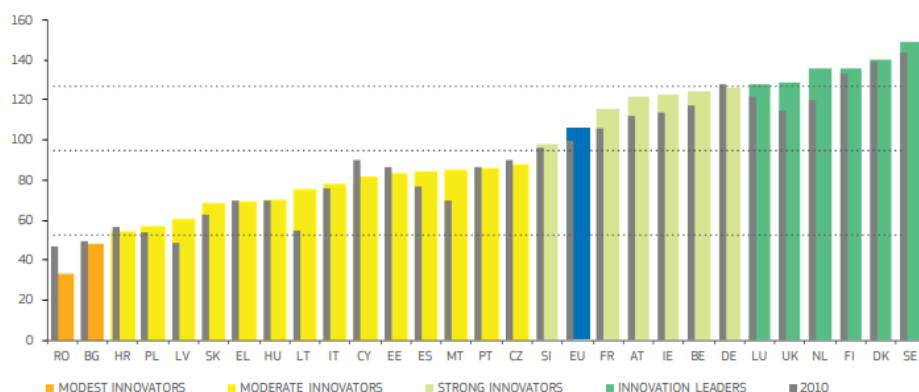


Figure 1: The Innovation Divide - Innovative performance of EU Member States according to the EIS
Source: (European Commission, 2018)

The disparity between EU-13 and EU-15 countries is also noticeable in the Framework Programmes (FPs) intended to fund excellent R&I, with Horizon 2020 being no exception. Table 1 shows that both participation rates and success rates (share of Horizon 2020 proposals successful in acquiring funding) remain much lower amongst EU-13 institutions than EU-15 institutions, resulting in EU-13 institutions only receiving 4,5% of the total amount of Horizon 2020 funding. Lower national RTD expenditure in both absolute and relative (% of GDP) terms and structural deficiencies in national research landscapes are main factors explaining as to why EU-13 countries are less likely to benefit from the Framework Programmes. Table 1 confirms that returns from Horizon 2020 funding are relatively equal between the EU-13 and EU-15 when taking national RTD expenditure (GERD⁴) into account (Izsak & Radosevic, 2017; Schuch, 2014; Sharp, 1998; Veugelers, 2016).

	EU-13	EU-15
Participation rate (% of total)	8.5%	83.1%
Success rate of applications	11.1%	14.1%
Horizon 2020 funding (% of total contribution)	4,5%	88,6%
Horizon 2020 funding per million EUR of national RTD expenditure (GERD)	29.784	31.346

Table 1: EU-13 and EU-15 participation patterns in Horizon 2020

Source:(European Commission, 2017j)

² **EU-15:** Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

³ **EU-13:** Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.

⁴ Gross Expenditure in Research and Development.

Lower efforts amongst the EU-13 illustrate that additional national investments in innovation systems are crucial in addressing underperformance in Horizon 2020. However, the 2008 financial crisis discouraged European R&I commitment on national level, leading to a discontinuation from pre-crisis R&I investments levels. The crisis most negatively affected investments in Central and Eastern European ‘catch-up’ countries, preventing convergence among EU Member States. National austerity measures in R&I caused by the crisis forced many institutions to apply for funding elsewhere, leading to a strong increase in participation in the already competitive FPs (Izsak & Radosevic, 2017; Schuch, 2014). Success rates dropped from 20% under FP7 to only 11,8% under the first two years of Horizon 2020, making it even more difficult for EU-13 institutions to reach funding. Next to the financial crisis, low efficiency of turning investments into research output among EU-13 Member States is another deterrent for these countries to fully commit to R&I and Horizon 2020 participation. Increased national investments by themselves will not sufficiently raise excellence in these Member States, due to the low efficiency of those investments (Veugelers et al., 2015). European support therefore remains of crucial importance to break the cycle and improve national R&I systems and performance amongst the EU-13.

According to many, simply reshuffling Horizon 2020 funding intended for the most competitive proposals to Europe’s innovative periphery is unlikely to solve low innovativeness. It might improve the R&I capabilities in less-performing countries in the long run, but in the short run would not likely lead to the selection of the most excellent projects that create new knowledge and technologies needed for regaining competitiveness and economic growth. The emphasis of Horizon 2020 on excellence is justified by some to realise economic growth for the whole of Europe, as resources need to be concentrated in those countries that make most efficient use of them. However, others fear the current system will maintain heterogeneity between innovation systems in Europe where some benefit more from Horizon 2020 than others and impact on growth and jobs hardly targets those countries who need them most urgently. Persistent heterogeneity would contribute to brain drain in less-performing countries, a waste of human talent and an inability to become competitive as a Union (Clarysse & Muldur, 2001; Jacob & Meek, 2013; Sharp, 1998; Veugelers, 2016; Young, 2015).

Horizon 2020 contributes to the broader Europe 2020 Strategy for smart, sustainable and inclusive growth by funding the most excellent R&I, thereby developing a competitive, knowledge-based economy. However, acknowledging that inclusive growth could only be achieved through economic, social and territorial cohesion, the Commission decided that Horizon 2020 should also contain a ‘widening’ element in which institutions from less-performing Member States are supported to participate. Rather than reshuffling existing funds and instruments from Horizon 2020 intended for excellent R&I, the Commission introduced a new set of measures within Horizon 2020 under the specific objective ‘*Spreading Excellence and Widening Participation*’ (SEWP). The Commission also

introduced other small initiatives under existing Horizon instruments. It is not uncommon that the policy mix of a particular programme is being influenced by other policy considerations outside of the R&I sphere, including trade-offs with other policy goals such as regional development (Wintjes & Nauwelaers, 2007).

1.2 The issue of widening

Increasingly concerned about internal disparities preventing global competitiveness, the Commission introduced a set of measures within the Horizon 2020 programme to help close the R&I divide under the SEWP-objective. This objective received a modest budget of 816 million euro's when compared to the entire programme budget of 80 billion euro's. The main aim of SEWP is to: *'fully exploit the potential of Europe's talent pool and ensure that the benefits of an innovation-led economy are both maximized and widely distributed across the Union in accordance with the principle of excellence'* (European Commission, 2017j).

While most stakeholders acknowledge the need to address the 'widening' issue and close the R&I divide, many question if Horizon 2020 is the right tool to do so. Some stakeholders fear that introducing 'widening goals' will initiate a shift in rationale between Horizon 2020 and previous FPs, diluting Horizon 2020 from the core 'principle of excellence', leading to positive discrimination and lower quality proposals, lowering the long-term competitiveness of the EU (Sharp, 1998; Wintjes & Nauwelaers, 2007). Horizon 2020 is no longer just a platform of open competition, but has become a distribution mechanism with discursive powers. Hereby, the SEWP initiative continues the trend from the seventh Framework Programme (FP7) of including cohesive components.

Being competitive programmes, the 'principle of excellence' has always guided the design of FPs and the distribution of their funding (Sharp, 1998). Under Horizon 2020, the importance of excellence reached its culmination, where open competitive calls for proposals and independent selection procedures are determined solely on criteria of quality and capability without any consideration of geographical distribution (European Commission, 2011a). Many stakeholders repeatedly emphasized that 'widening' goals are beyond the scope of Horizon 2020 and recommend the issue should instead be tackled by EU cohesion policy. The budget from the European Structural and Investment Funds (ESI Funds or ESIF) earmarked for R&I has often been mentioned as an alternative funding source (European Parliament & European Council, 2013b; Veugelers et al., 2015). Synergies between FPs and ESIF have been on many stakeholder agendas, but problems in strategically using or aligning these schemes also have long traditions (Schuch, 2014).

Other stakeholders fear that a stronger focus on excellence would only reinforce heterogeneity between innovation systems in Europe, favouring the already strong elite research groups and making it doubtful that institutions from all countries would equally benefit from Horizon 2020 funds

(European Commission, 2011a; Sharp, 1998; Veugelers et al., 2015; Young, 2015). These stakeholders believe it is relevant for Europe to address its internal disparities in order to stay competitive as a Union towards the rest of the world, realising the broader Europe 2020 goals of economic growth and jobs (Davies, 2003; Veugelers et al., 2015). For this reason, introducing widening elements in Horizon 2020 is justified for some. Another argument in this regard is that the ‘widening approach’ cannot be separated from the ‘excellence creation approach’, because excellent organisations are needed to compete and perform successfully in Horizon 2020 (Schuch, 2014).

1.3 Prioritising conflicting objectives

On June 2015, the implementation of the new European Fund for Strategic Investments (EFSI) required an initial cut of 2.7 billion euro’s in the budget of Horizon 2020. Through negotiations between the Commission and the European Parliament, the planned budget cuts were reduced to 2.2 billion, downsizing the Horizon 2020 budget from 77 billion to 74.8 billion euro’s. After negotiations with the Parliament, the Commission decided that funds intended for ‘*Spreading Excellence and Widening Participation*’ (SEWP) would not be touched. Also valued funds for excellence, like the European Research Council (ERC) and Marie Skłodowska Curie Actions (MSCA), would not suffer any budget cuts in order to fund EFSI (Figure 2). The redistribution of budgets across the different EU programmes gives an indication of the importance that the European Parliament and Commission put on both objectives of excellence and widening in Horizon 2020.

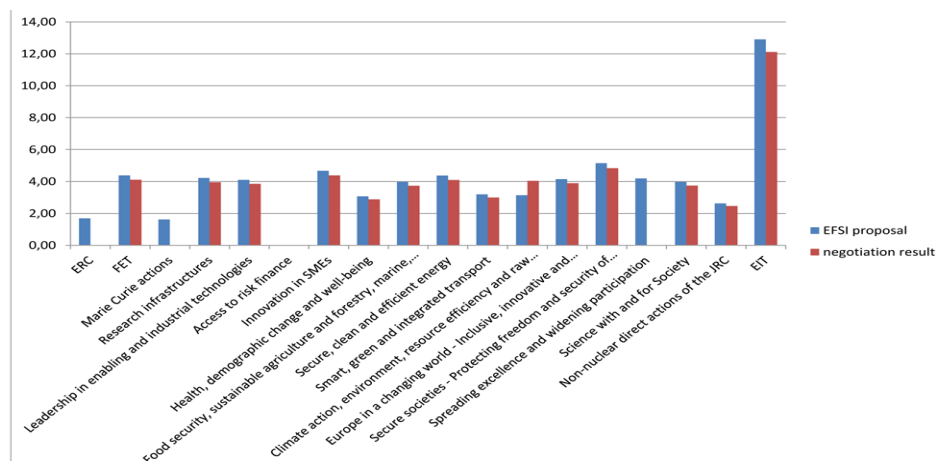


Figure 2: Final Budget Cuts for Horizon 2020 Parts (in % of initial H2020 budget of December 2013)
Source: (ERA-Portal Austria, 2015)

Figure 2 illustrates the duality within the EU as it pursues two important, but conflicting objectives, being widening and excellence. The EU has always had its roots in the idea of an economic union, with economic growth remaining at the heart of the project. Over the years the economic context changed from post-War reconstruction to one of globalisation and the knowledge-society, putting even more emphasis on excellence. Within the EU context, excellence in R&I became key towards increasing Europe’s internal and external competitiveness and realising a knowledge-based economy

that fosters economic prosperity (smart growth). However in the 1980s a growing conviction developed within the EU that economic growth could only be achieved if social policy was in place to ensure social and territorial cohesion, promoting equal opportunities for participation for disadvantaged groups (inclusive growth). This is how the narrative of social exclusion became woven into the EU rationale. A two-speed Europe would cause poverty, exclusion and frustration in the weakest regions and social groups, threatening the ‘ever-closer Union’. The goals of competitiveness and cohesion became intertwined towards achieving the broader goal of economic growth, which becomes increasingly dependent on knowledge and skills (Figure 3) (Burke, 2016; Davies, 2003; Jacob & Meek, 2013; Kennedy, 1997; Kettley, 2007; Warren, 2002; Whiteford, Shah, & Nair, 2013).

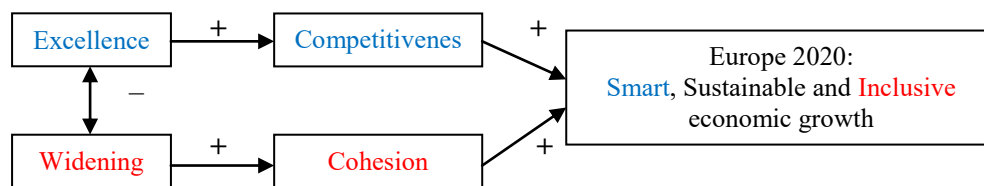


Figure 3: Interactions between the concepts of excellence, widening, competitiveness, cohesion and economic growth within EU policy

The trend of pursuing increasingly broad policy objectives heavily affects the development of policies, both within and outside the R&I sphere, creating more interdependencies between different policy domains (Wintjes & Nauwelaers, 2007). As illustrated in figures 2 and 3, both objectives of widening and excellence are highly valued as both contribute towards strengthening the global competitiveness and cohesion within the Union, in line with the broader Europe 2020 policy objective of smart and inclusive economic growth. As these conflicting objectives are simultaneously being pursued, EU policy makers are increasingly focusing on interactions between different policy domains, especially between R&I and cohesion policy (European Parliament & European Council, 2013b). To create synergies between instruments from different policy domains, designing an appropriate policy mix is becoming increasingly relevant. While literature exists describing the policy mix, nobody has yet applied this literature to the specific context of EU R&I policy.

1.4 Research questions and approach

As shown in previous sections, internal disparities between EU-13 and EU-15 institutions in R&I performance are preventing the creation of a competitive and cohesive knowledge-economy which realises smart and inclusive economic growth. Institutions from less-performing Member States therefore have to be supported in Horizon 2020 participation. While much responsibility in addressing the R&I divide lies at national and regional level to increase investments, the Commission also deems it relevant to take action at European level, introducing SEWP and other small measures under Horizon 2020 to contribute towards widening. However the position of these measures in Horizon 2020 is controversial, as they could introduce new rationales that compromise the core principle of

excellence. Therefore ESIF budget earmarked for R&I is considered as alternative funding source to pursue widening.

Working towards two seemingly contradicting goals in the same programme is a challenge in terms of policy making, with many stakeholders questioning how or whether it can be achieved. To give new insights into this policy problem, the goal of this research is to analyse the current EU R&I policy mix, explaining how and to what extent this combination of policy instruments contributes to both goals of ‘widening’ and ‘excellence’. Based on detected gaps, overlaps, complementarities and tensions, recommendations will be given for the current policy mix to better realize both objectives. The policy design question (Punch, 2016) this research wants to answer is:

‘How can the EU R&I policy mix better address the challenge of ‘Spreading Excellence and Widening Participation’ towards institutions from less-performing Member States (EU-13) without compromising the principle of excellence in Horizon 2020?’

The main research question will be answered through the following sub-questions. The first will be answered through literature study, whereas other questions will be answered through the development of an analytical framework that will be applied to relevant EU policy documents and regulations:

1. *Which conceptualisations and operationalisations of ‘excellence’ and ‘widening’ are applicable within the EU R&I policy context?*

The EU context is currently defined by a lack of clarity and consensus amongst stakeholders and EU institutions on the definition of excellence and widening. Therefore this conceptual research question aims to develop own conceptualisations and operationalisations that can be applied to the EU context.

2. *How can the EU R&I policy system be defined in terms of policy domains, policy instruments, policy rationales and target actors in regard to achieving ‘excellence’ and ‘widening’?*

Descriptive empirical question related to the current landscape of EU R&I policy. An analytical framework will be built based on identified policy domains, instruments, rationales and target actors involved with achieving widening and excellence.

3. *Which gaps, overlaps, complementarities and tensions exist within the interactions between different policy instruments under the current EU R&I policy mix in regards to achieving ‘excellence’ and ‘widening’?*

Descriptive empirical question which will be answered through the application of the analytical framework, which will map and categorise the different interactions between policy instruments within EU R&I policy mix in pursuing the objectives of widening and excellence.

Policy analysis plays a central role in understanding increasingly complex R&I policy systems, as it leads to reflection, debates about means/ends, policy learning and appropriate adaption of the design

and implementation of policies in the future. However, most approaches only include the analysis and evaluation of isolated policy interventions, which have strong limitations in systemic contexts, only giving information about part of the policy effects. Narrow individual evaluations therefore form an obstacle for a more sophisticated understanding of R&I policy. Using the ‘policy mix’ as an alternative, systemic approach to analysis will help better capture the interactive effects that characterize current complex policy systems (Flanagan, Uyarra, & Laranja, 2011; Magro & Wilson, 2013; Wintjes & Nauwelaers, 2007). By analysing the current EU R&I policy mix to better involve less-performing Member States without compromising the excellence principle, new insights will be given about contemporary EU R&I policy, which can serve as a basis for developing future policy. The academic relevance lies in how to address trade-offs between different dimensions in policy design, whereas the social relevance for this research lies in its practical implications.

1.5 From S&T to R&I policy

Before analysing the EU R&I policy mix, one needs a clear understanding of the ‘R&I policy’ concept. Historically, the EU definition of ‘Research, Technology and Development (RTD) policy’ shared many similarities with ‘Science and Technology (S&T) policy’ applied in academic literature. S&T policy follows a *neoclassical approach*, encouraging scientific research in universities and other research institutions by promoting an efficient allocation of resources for increased competitiveness. In the early years of RTD policy, the EU primarily occupied itself with similar objectives. In 1986, the Single European Act established RTD as community policy with the main goal to ‘strengthen the S&T basis of European industry to become more competitive at international level’ (European Commission, 2017k; European Community, 1986; European Union, 2016; Laranja, Uyarra, & Flanagan, 2008; Lundvall & Borràs, 2005).

However, the 1980s also marked the uptake of innovation policy and with it, the *systemic approach* in academic research. Rather than solely focussing on allocating resources to promote scientific research, innovation policy focused on interactions between different elements of the innovation system. This resulted in a switch from policy supporting individual actors, towards policies designed to foster the conditions necessary for innovation. Therefore innovation policy started to expand its scope, including all parts of the economy that impact the innovation process like science, research, technology and development. This led to the integration of S&T policy into the ‘innovation policy’ concept, creating a twofold in policy aims: maintaining high quality scientific research and keeping creative tension between science and the industrial structure (Borràs, 2008; Dodgson & Bessant, 1996; Gassler, Polt, & Rammer, 2008; Schuch, 2005; Uyarra, 2004).

The growing relevance of innovation policy and the systemic approach became visible in EU policy. In 2000, the EU decided to work towards a European Research Area (ERA), while in 2008 the

European Institute of Innovation and Technology (EIT) became the first EU initiative to integrate all three sides of the ‘knowledge triangle’: education, research and innovation. Innovation policy was even integrated into Horizon 2020, which broke the naming tradition of the previous seven Framework Programmes for RTD, instead being titled ‘*the eight Framework Programme for R&I*’. This meant Horizon 2020 would encompass the whole spectrum of activities related to R&I (European Commission, 2011c, 2016). Horizon 2020 moved beyond its formal role as funding mechanism to strengthen coordination efforts across the Union (Schuch, 2005; Young, 2015).

Over the years, combining research and innovation in the same policy package has become the general trend. R&I policy now differs radically from previous generations of S&T policy in three key aspects that resonate well with the needs of low and middle-income countries (Olsson & Cooke, 2013):

- It promotes public-private partnerships as a key mechanism for achieving linkages between the research and the economy.
- It embraces the system perspective
- It emphasises the need for universities and other public research providers to pursue research agendas that are anchored in the needs of the society which they inhabit.

The theoretical framework in chapter 2 gives a more detailed explanation of the rise of systemic rationales and the ‘policy mix’ concept, explaining their added value towards dealing with the increased complexity in R&I policy analysis. Based on academic literature and EU policy documents, an analytical framework matrix for the EU R&I policy mix has been developed. Chapter 3 compares different theoretical conceptualisations of widening and excellence, creating measurable concepts applicable to the EU R&I policy context and identifying key terms. Chapter 4 describes methodology, whereas chapter 5 briefly describes the most important EU R&I policy instruments under Horizon 2020 and ESIF. Chapter 6 applies the analytical framework matrix to relevant secondary data (e.g. EU policy documents and regulations) collected through desk research. Each relevant instrument of EU R&I policy is analysed to categorise its type, under which policy rationale it operates, the extent it contributes to widening and/or excellence, which actors are targeted and with which other policy instruments interactions occur. The matrix clarifies existing gaps and overlaps, complementarities and tensions between different policy instruments. Finally, based on the outcomes of the analysis, Chapter 7 will provide recommendations on how to improve the current policy mix and work towards a stronger EU R&I policy in the future.

2. Theoretical Framework

In recent years, the panorama of policies designed to stimulate and facilitate R&I has undergone heavy growth and evolution. Contemporary R&I policies are characterized by different underlying rationales and instruments, leading to increased policy complexity. As a result, the term ‘policy mix’ was imported from economic and environmental policy debates to innovation policy to better deal with the increasingly complex, multi-level, multi-actor reality by which different innovation policies emerge, interact and have effects (Flanagan et al., 2011). This section will describe the rise of the ‘policy mix’ concept in innovation policy and how it contributes in dealing with this increasingly complex reality. The chapter concludes with the development of an analytical framework matrix for EU R&I policy.

2.1 Emergence of the ‘policy mix’ concept in innovation policy

The term policy mix focuses on the interactions and interdependencies (trade-offs) between different innovation policies as they affect the extent to which policy goals or outcomes are realised. The EU was already introduced to the concept of the policy mix during economic policy debates surrounding the Economic and Monetary Union (EMU), in which fiscal and monetary policy became increasingly interconnected. In the early 1990s, the concept expanded to other public policy areas. The most significant diffusion of the concept has been into literature on environmental policy (Flanagan et al., 2011; Ring & Schröter-Schlaack, 2011) and higher education (HE) policy (Capano, Pritoni, & Vincentini, 2017). Mostly via environmental and economic policy discourses, the ‘policy mix’ concept found its way into innovation policy at the beginning of the new millennium.

The uptake of the ‘policy mix’ concept reflects two developments in innovation policy. Firstly, innovation policy makers started to tackle a broader set of societal challenges alongside traditional economic challenges, leading to increased policy complexity. By pursuing new and broader objectives, it became more common that different innovation policies would co-exist, each employing different instruments based on different rationales and targeted towards different actors, but also corresponding to different policy domains. Innovation policy started to ‘invade’ the agendas of other policy domains like education-, energy- and cohesion policy, which entailed that instruments intended to achieve other policy goals could now be co-opted to achieve goals of innovation policy (Borràs, 2008; Borràs & Edquist, 2013; Flanagan et al., 2011; Laranja et al., 2008; Magro & Wilson, 2013; Martin, 2016; Wintjes & Nauwelaers, 2007).

The second development is the dispersal of power from modern nation states to the growing number of non-state, supra- and sub-national actors. The development from government to governance dictated these actors to be involved in designing and implementing R&I policy. Traditional state-centric

models of government were replaced by new ideas and models based on New Public Management (NPM) and multi-level governance. This creates a risk of creating a governance gap between different administration levels of innovation policy (EU, national, regional, local), in turn leading to gaps or overlaps among different policy initiatives. The role of the state needed to shift from ‘top-down steering power’ to a ‘mediator’ facilitating alignments between stakeholders and networks. The policy complexity caused by the pursuit of broader goals and multi-level governance will only increase in the future, with the danger of policy makers underutilising the full portfolio of policy instruments available to them and overlooking interactions in the policy mix (Flanagan et al., 2011; Magro & Wilson, 2013; Martin, 2016; Smits & Kuhlmann, 2004).

2.2 Policy rationales and the rise of the ‘systemic approach’

Policy rationales or ‘*policy goals*’ aim to provide logic and reason behind any particular policy intervention or mix of policy interventions, explaining when, how and especially why governments should intervene. Therefore, policy rationales are heavily interconnected to the failures that need to be addressed, providing justification for policy intervention in achieving policy objectives. Policy rationales can be distinguished and categorised under either the *neoclassical or systemic approach*, responding to either *market failures* or *systemic problems* (Arnold, 2004; Chaminade & Edquist, 2010; Klein-Woolthuis, Lankhuizen, & Gilsing, 2005; Magro & Wilson, 2013)

To address complex R&I challenges, involving different policy domains and governance levels, innovation policy could no longer solely rely on the *neoclassical approach*, which considers innovation as a linear process with a fixed sequence of phases. The neoclassical approach focuses on addressing *market failures* in which there is no optimal allocation of resources. These market failures emerge due to *uncertainty*, *low appropriability* and *indivisibility* that surrounds the knowledge creation process of R&I. The costly and risky nature of R&I are often considered disincentives for potential innovators to invest. Hard policy instruments like intellectual property rights (IPR) and the provision of subsidies and infrastructures are aimed at individual actors to push reality towards an ideal scenario. The neoclassical rationale assumes market mechanisms will gradually eliminate economic disparities within and between nations, provided there are no barriers to the working of market forces. These barriers are to be removed by a single rational policy maker who attempts to maximize social collective benefits (Arnold, 2004; Borràs, 2008; Borràs & Edquist, 2013; Chaminade & Edquist, 2010; Flanagan et al., 2011; Klein-Woolthuis et al., 2005; Laranja et al., 2008; Magro & Wilson, 2013; Martin, 2016; Smits & Kuhlmann, 2004; Wintjes & Nauwelaers, 2007).

With the neoclassical rationale unable to fully explain the complex reality of innovation policy, the *systemic rationale* started to emerge alongside it, stressing that innovation is never created in isolation. This rationale responds to *systemic problems*, in which interactions between different actors and

components within an innovation system are insufficiently supported at either sectoral, regional, national or supra-national level, preventing knowledge creation and interactive learning. Systemic problems also include capacity problems for learning, causing cognitive and absorptive deficiencies in certain institutions. The rise of the systemic rationales led to a shift in policy instruments from *hard, economic instruments* focusing on resource allocation to individual R&D actors, towards more sophisticated instruments. These *soft policy instruments* aim to construct, support and coordinate interactions between different innovation system components by supporting collaboration between actors, developing networks and clusters and provide information within innovation systems. Over the past decades, R&I policy has been characterised by an increased focus on collaboration and knowledge exchange across institutions, sectors, disciplines and countries that promote collective learning (Arnold, 2004; Borràs, 2008; Borràs & Edquist, 2013; Chaminade & Edquist, 2010; Flanagan et al., 2011; Klein-Woolthuis et al., 2005; Laranja et al., 2008; Magro & Wilson, 2013; Martin, 2016; Smits & Kuhlmann, 2004; Wintjes & Nauwelaers, 2007).

2.3 Policy instruments in the policy mix

Policy instruments are techniques of governance which influence the utilization of resources and power, in order to ensure (or avoid) the social change needed to achieve policy objectives (Borràs & Edquist, 2013; Martin, 2016). Traditionally, innovation policy research has been oversimplifying policy instruments as a combination of neutral tools, from which the most optimal should be selected. However in reality, policy instruments contain interpretive flexibility, carrying different meanings among different times, places and actors. The policy mix contains an ever changing contextual nature in which policy instruments are continuously (re)interpreted in the light of changing rationales. Because of its existence in a policy mix, it is uncertain to which extent a certain policy instrument is responsible for an observed effect, making extremely difficult to fully evaluate a single policy instrument. It is important to look at both individual features, as well as complementary, synergetic or contrasting effects of instruments within the specific policy mix in which it is embedded (Borràs & Edquist, 2013; Flanagan et al., 2011; Wintjes & Nauwelaers, 2007).

With the rise of the systemic rationale and the policy mix concept, the interest in R&I policy instrument became more prominent. More frequently instruments are chosen, designed and implemented for a specific problem, within a specific policy context, at a specific point in time and in a specific political-ideological situation. However, the strong contextual nature of policy instruments does not impede their classification according to the logic behind public action. The following three-fold typology of policy instruments will be applied to the EU R&I context, as it is most widely used in practical contexts, allowing to best make sense of policy complexity and navigate in the ocean of different R&I policy instruments (Borràs, 2008; Borràs & Edquist, 2013; Izsak & Radosevic, 2017):

1. *Regulatory instruments*: legal tools for the regulation of social and market interactions. There are different types, all obligatory in nature, meaning they are backed by threats of different types of sanctions in cases of non-compliance. Next to sanctions, normative authority of governments is another important element of regulatory instruments. Examples of regulatory instruments in innovation policy include: IPR, regulations of research institutions and ethical regulations.
2. *Economic instruments*: providing (dis)incentives through economic means, these instruments have been traditionally extensively used in innovation policy. Positive incentives can be provided through cash transfers, grants, subsidies, reduced-interest loans or loan guarantees to encourage or promote certain activities. Non-monetary positive incentives can be provided through government provision of goods or services. Disincentives involve taxes, charges, fees, tariffs or customs duties to discourage or restrain certain activities.
3. *Soft instruments*: Characterized as voluntary and non-coercive and based on persuasion, they are tools encouraging the mutual exchange of information and less-hierarchical forms of cooperation among actors. Examples include: codes of conduct, consulting services, voluntary agreements or public/private partnerships. The shift from government to governance and the rise of NPM have been responsible for a strong growth of soft policy instruments. Despite their growing relevance, soft instruments are still considered complementary in regard to the more traditional regulatory and economic instruments (Smits & Kuhlmann, 2004).

2.4 Policy interactions and trade-offs in the policy mix

Public policy rarely pursues a single goal or hierarchical set of goals. Rather, policy pursues a broad and ever-changing range of goals and objectives, many of which will conflict in the sense that one can only be obtained at the expense of another. Interactions between different innovation policies do not necessarily result in policy outcomes that correspond neatly with the stated aims of the individual policies. Policy rationales and the instruments to enforce them are often in tension or conflict in a policy mix. Policy instruments clearly interact and affect each other in a complex and often unpredictable manner. An individual instrument may optimally address a certain problem or enhance the outcome of other instruments, but can also jeopardise the effect of conflicting policy instruments aimed at different problems. The idea of interactions and trade-offs between policy instruments from different administrative levels and policy domains is therefore fundamental to the policy mix concept. As policy instruments are flexible and evolve over time, depending on the changes in the wider environment in which they operate, their interactions may also change over time, place or context (Flanagan et al., 2011; Magro & Wilson, 2013; Martin, 2016; Wintjes & Nauwelaers, 2007).

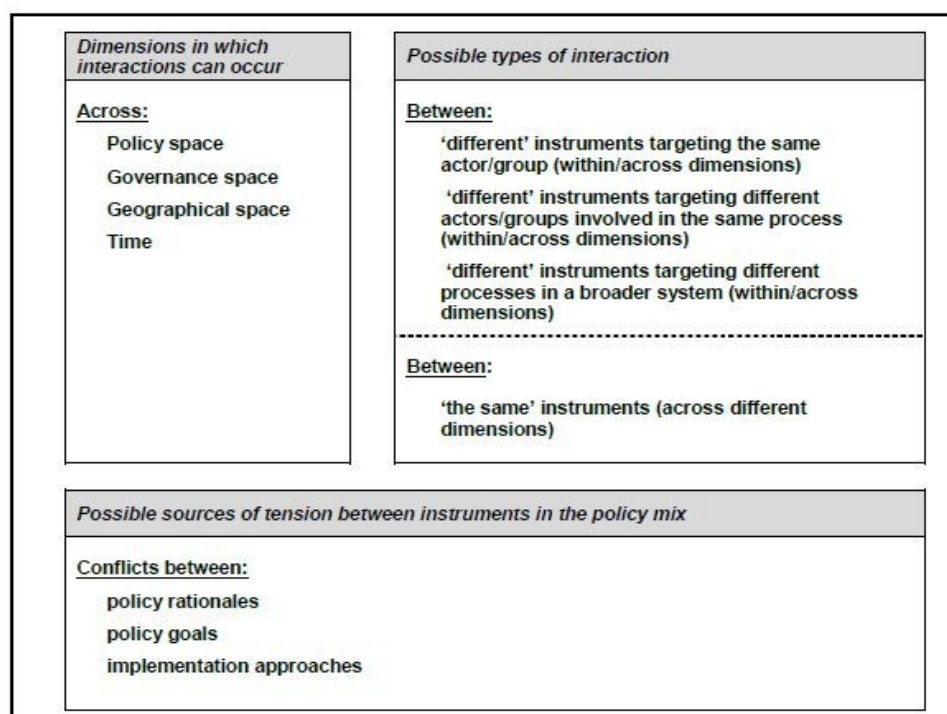


Figure 4: Conceptualising policy mix interactions: dimensions, types and potential sources of tension
Source: (Flanagan et al., 2011)

Figure 4 identifies four dimensions in which interactions occur between different policy instruments:

- Policy space: between instruments from different related policy domains (e.g. innovation policy and cohesion policy).
- Governance space: between instruments from different levels of governance (e.g. local, regional, national and EU level).
- Geographical space: between instruments within a particular physical location (e.g. a particular region, country or continent).
- Time: between instruments implemented at different times and therefore different contexts.

Given the four dimensions in which policy interactions can occur (Figure 4), this research primarily focuses on interactions within the geographical, policy and governance space. The geographical space covers all EU-13 Member States, whereas the policy space includes EU R&I and cohesion policy domains (Horizon 2020 and ESIF). Although there is a clear focus on EU policy, the governance space is also taken into consideration, as ESI funds are implemented by national and regional authorities. The time dimension is left out, as there are too many documents and instruments from previous FPs that need to be taken into consideration for analysis. However, its value for analysing and evaluating policy mixes is recognised, as it considers the irreversibility and path-dependency of public policies, as each policy is build in a context of pre-existing policy mixes and institutional frameworks, limiting the range of options available for future decision makers. Due to time constrains, further research is recommended to compare policy mixes between past, present and future FPs.

There are also different types of interactions between policy instruments. It is possible for similar instruments to interact with one another across different dimensions (e.g. between different levels of governance or between different policy domains). Interactions can also take place between different instruments targeting the same actor (group) within or across dimensions, between different instruments targeting different actors or groups involved in the same process and between different instruments targeting different processes in the broader system (Flanagan et al., 2011).

The different dimensions and types of policy interactions show the complexity of contemporary innovation policy mixes. Better governance and co-ordination could minimise negative interactions, while maximising positive ones, taking into account the specific characteristics of the target sector. Yet, introducing new co-ordination mechanisms often adds further complexity to the system by adding new actors, roles or institutions. In a complex world with potentially conflicting policy goals, co-ordination between agents should be dynamic, adaptive, mutual and ongoing, which is difficult to achieve in reality. A key role for innovation policy studies should be to highlight trade-offs and tensions inherent in any policy mix and promote open debates (Flanagan et al., 2011; Magro & Wilson, 2013; Martin, 2016).

2.5 Towards an analytical framework

The application of the policy mix concept into innovation policy research is a recent development. The understanding of its implications for the design, implementation and evaluation of innovation policies remain unclear. It is deemed unrealistic to identify unambiguously good policy mixes applicable to all contexts (Flanagan et al., 2011; Laranja et al., 2008; Wintjes & Nauwelaers, 2007). However, it is possible to analyse mixes within specific contexts by effectively drawing boundaries about what is ‘in’ and ‘out’ of the frame of enquiry. The next section will describe the step-by-step process in developing an analytical framework that can be applied to the EU R&I policy context (Magro & Wilson, 2013).

Table 2 describes three of the six steps towards evaluating a policy mix. This research will solely focus on the first three steps which are related to the analysis of the EU R&I policy mix. The goal of policy mix analysis is to provide policy-makers with enhanced internal intelligence on the overall functioning and interactions within the policy system to improve future policy. While it is impossible to capture in detail all possible interactions between innovation policies, this protocol helps analyse complexity in a way that facilitates policy learning at each step, showing overlaps, gaps, tensions and complementarities between different policy instruments from different domains and/or following different rationales. Future research can build further on the foundations laid by this analysis (Magro & Wilson, 2013).

Step 1	Draw the policy system and establish its boundaries in terms of domains, instruments and rationales
Step 2	Select a policy rationale
Step 3	Analysis of the mix of domains and instruments that fall under each selected rationale, looking for overlaps and complementarities

Table 2: First three steps for policy mix analysis

Source: (Magro & Wilson, 2013)

Firstly, clear boundaries need to be established in terms of policy rationales, domains and instruments (table 2), allowing to draw the policy system⁵ and sufficiently simplify complex reality. Drawing effective boundaries of a policy mix is a challenging trade-off between completeness and simplicity. The second and third step involve an in-depth analysis of all involved policy instruments, each following different policy rationales and domains, looking for gaps, overlaps, tensions and complementarities. To picture the functioning of a policy system as a whole, the analysis has to take into account the interactions between policy instruments following similar rationales, but also between instruments following different rationales (Borràs & Edquist, 2013; Capano et al., 2017; Flanagan et al., 2011; Laranja et al., 2008; Magro & Wilson, 2013).

2.6 Building the analytical framework matrix

Following previous steps, an analytical framework matrix has been developed based on policy mix theory. This section will elaborate each element of the analytical framework matrix presented in table 3, as well as provide categorisations and/or operationalisations within each element. The analysis considers three possible outcomes: I) a policy mix dominated by excellence, II) a policy mix dominated by widening, III) a policy mix balancing both excellence and widening.

Policy Instruments	Instrument Type	Policy Rationale	Target Groups	Interactions	Focus E/W
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Table 3: Elements of the analytical framework matrix

2.6.1. Policy domains

It has been stated that pursuing broader policy objectives like the Europe 2020 Strategy, creates more interdependencies between different policy domains (Flanagan et al., 2011; Wintjes & Nauwelaers, 2007). With Horizon 2020 pursuing both excellence and widening to develop smart and inclusive growth, EU R&I policy domain increasingly comes into contact with other EU policy domains, in particular cohesion policy. The necessity to draw boundaries of the EU policy mix regarding excellence and widening leads to the analytical framework matrix being applied to only these two policy domains, containing three sets of instruments. Being the main EU programme under the R&I policy domain, Horizon 2020 instruments are analysed, with SEWP instruments analysed in a separate matrix, as they are particularly relevant in the context of widening. Finally, instruments under the

⁵ Placing policies within precise domains and rationales is a process open to some degree of subjectivity.

cohesion policy domain (ESIF) are analysed to what extent they contribute to R&I policy objectives, in particular widening and how they interact with Horizon 2020 instruments, providing insights into possible synergies between these programmes from different policy domains.

2.6.2. Policy instrument types

The matrix follows the three-fold typology of policy instruments as described by Borràs & Edquist (2013) in section 2.3. Different instrument types can be identified by looking at their descriptions in relevant secondary data like legislation and policy documents:

- Regulatory instruments: laws, rules, directives.
- Economic instruments: cash transfers, grants, subsidies, reduced-interest loans, loan guarantees, taxes, charges, fees, tariffs, government provision of goods.
- Soft instruments: consulting services, codes of conduct, voluntary agreements, public-private partnerships and other forms of cooperation.

Being funding programmes, most Horizon 2020 and ESIF instruments are categorised as economic. However, the rise of innovation policy and the systemic approach has allowed Horizon 2020 to move beyond its formal role as funding mechanism to strengthen coordination across the Union, leading to an increase in soft policy instruments (Laranja et al., 2008). The analysis considers whether these new soft policy instruments will be more focused on excellence or widening and how these instruments will interact with existing regulatory and economic instruments.

2.6.3. Policy Rationales

Policy rationales are key when conducting policy mix analyses. Strongly related to the causes (*market failures* and *systemic problems*) underlying policy design and implementation and outlining the logic through which interventions are expected to lead to intended outcomes, they provide justification for policy makers when deciding which policy instrument or instrument mix to use. Policy rationales are also useful in identifying synergies, complementarities and overlaps between instruments sharing a rationale. When analysing a policy mix, it is important to focus on policy rationales rather than theoretical rationales derived from scholarly theories. The policy process is a complex primeval soup in which scholarly ideas are never perfectly translated into policy rationales and instruments. Rather, a plethora of scholarly ideas compete with each other with only a few coming to prominence through the policy window. Attractive elements of these scholarly ideas are then cherry picked by policy makers with different norms and goals to justify their policy choices. Since theoretical rationales contain high levels of interpretive flexibility, they rarely provide clear implications for policy design, implementation or evaluation (Borràs & Edquist, 2013; Flanagan et al., 2011; Laranja et al., 2008; Magro & Wilson, 2013).

However, theoretical rationales can still serve as building blocks for developing specific policy rationales within a particular policy context. Building on relevant theoretical rationales from academic policy mix literature, relevant policy rationales for Horizon 2020 and the R&I component of ESIF have been identified from EU policy documents and have been categorised under neoclassical and systemic approaches (table 4). Each of the policy rationales is aimed at addressing market failures and systemic problems identified by the EU that prevent an optimal performance of European R&I (European Commission, 2011b; European Parliament & European Council, 2013b):

- An insufficiently strong science base.
- Insufficient technological leadership and innovation capabilities of actors.
- Insufficient contribution to R&I tackling societal challenges.
- Insufficient cross-border coordination.

Neoclassical approach responding to market failures	
1.	Encourage and support R&I activities and investments.
2.	Stimulate and support the development, maintenance and use of R&I infrastructures.
Systemic approach responding to systemic problems	
3.	Improve national and regional governance to strengthen and coordinate linkages among heterogeneous actors and components within national and regional R&I systems.
4.	Develop, strengthen and coordinate transnational cooperation within the broader European R&I system.
5.	Develop, attract and maintain human resources through mobilisation, training and capability development.

Table 4: Classification of EU R&I policy rationales for Horizon 2020 and the R&I component of ESIF
Scholarly sources: (Arnold, 2004; Chaminade & Edquist, 2010; Edler & Georghiou, 2007; Flanagan et al., 2011; Izsak & Radosevic, 2017; Jacob & Meek, 2013; Klein-Woolthuis et al., 2005; Laranja et al., 2008; Magro & Wilson, 2013; Wieczorek & Hekkert, 2012)
Policy sources: (European Commission, 2011b; European Parliament & European Council, 2013b, 2013d; Georghiou, Rigby, & Cameron, 2002)

This section will shortly elaborate each policy rationale:

1. The financial crisis strongly increased *market failures* by enhancing the three main sources responsible for those failures. *Uncertainty* of the R&I process makes it impossible to fully know the outcomes and risks attached. *Low appropriability* implies firms cannot fully capture economic gains from their innovations due to externalities emanating from the R&I process, as knowledge created by R&I is a non-rival and non-excludable good. Externalities include consumer benefits of having access to better products without being charged a corresponding price increase and competitor benefits of being able to use the technology produced by the innovator without paying. The risky and public good nature of R&I activities creates disincentives for actors to invest in R&I, preventing an optimal allocation of resources. R&I activities have high social rates of return, creating strong benefits for the economy and society, yet private rates of return for potential innovators are often too low to invest. The goal of supporting R&I activities and investments through subsidies, grants, loans, guarantees or IPR,

is to address these *market failures* by reducing or sharing risks. Union level intervention helps leverage additional public and private investments, leading to a socially optimal situation.

2. *Indivisibility* of knowledge is the third source of *market failures*, implying a large minimum investment being required before any knowledge can be created, making R&I very costly with low initial rates of return. The EU therefore supports the establishment of costly research infrastructures that produce relevant research outcomes, which otherwise would not have been produced. This also includes maintenance and improvements towards existing infrastructures. The EU considers research infrastructures to include physical facilities (e.g. labs or scientific equipment), knowledge-based resources (e.g. archives or data), e-infrastructures (e.g. computing systems) and services used by research communities to conduct R&I in their fields.
3. There is often a lack of cooperation, coordination and complementarity between R&I activities of heterogeneous actors in national or regional innovation systems, known as *systemic problems*. EU programmes can play a supportive role by strengthening national and regional governance and institutions, which are needed to discover, promote, support and coordinate linkages, collaboration, networks and clusters between actors and system components, thereby facilitating information exchange, interactive learning and knowledge generation.
4. In reality, the scope of regional political jurisdiction may not coincide with the geographical space in which relevant learning interactions should be promoted. Many contemporary relationships have become extra-regional. *System dysfunctions* sometimes require knowledge outside the national or regional R&I system. Therefore, the EU promotes and support external linkages to other R&I systems to mitigate network problems. These external linkages can either be horizontal between regional innovation systems across borders, or vertical between regional, national and European innovation systems. Linkages can be achieved by promoting, supporting and strengthening different types of transnational cooperation, partnerships and networks in R&I activities, which should be sufficiently coordinated to avoid duplication.
5. EU R&I policy focuses on the development of human resources by supporting the career development of promising researchers through the provision of transnational mobility and training. This will promote the attractiveness of research careers across the union to draw foreign talent. Mobility is a key factor for interactive learning and knowledge transfer, promoting collaboration between academics, research institutions and industry across borders within the Union, facilitating network building, transnational research communities and overcoming the fragmentation of national policies. Mobility is an indispensable prerequisite for countries with modest scientific resources to build capacity and achieve strong scientific, social and human capital. Specific training programmes also need to be created to help develop capabilities (skills, experience, expertise, know-how) lacking among certain actors, allowing them to better utilize their resources.

In practice, contemporary R&I policy is never solely based on neoclassical or systemic rationales. Different rationales may imply different policy instruments, but new rationales do not invalidate the instrument choices and goals associated with previous rationales. Rather, they have the ability to change existing instruments while adding new ones, thereby increasing the complexity of public policy (Nauwelaers & Wintjes, 2003; Smits & Kuhlmann, 2004). So were grants traditionally considered to be hard, neoclassical instruments, providing R&I incentives. However, the rise of cooperative research grants shows that the original objectives of traditional policy instruments can be modified to fit into new rationales. For this reason, it is considered possible for a single policy instrument to respond towards multiple policy rationales, addressing both market and system failures.

2.6.4. Target Actors

The actors targeted by policy instruments are essential in identifying which type of interactions might take place between them (Flanagan et al., 2011). Wieczorek & Hekkert (2012) have created a universal categorisation of target actors that can be universally applied on global or regional level, while also considering of the rise of innovation policy and the systemic rationale (Klein-Woolthuis et al., 2005; Wieczorek & Hekkert, 2012):

- Knowledge institutions: universities or other higher education institutions, public or private research organisations and academic communities consisting of individual researchers.
- Businesses: industry, entrepreneurs, start-ups, SMEs, large firms and multinationals.
- Civil society: citizens (as consumers or users) and civil society organisations.
- Government organisations: national, regional or local public authorities and policy makers.
- Other parties: financial intermediaries like banks or other financial institutions, legal organisations, consultants.

2.6.5. Type of interactions

Interactions are key elements when analysing the policy mix, as they allow for the identification of gaps, overlaps, tensions and complementarities between different policy instruments. The categorisation of policy mix interactions given by Flanagan et. al. (2011) in figure 4 of section 2.4 will be applied for this analysis:

- Interaction between similar instruments across different dimensions.
- Interaction between different instruments targeting the same actor (group) within/across dimensions.
- Interactions between different instruments targeting different actors involved in the same process within/across dimensions.
- Interaction between different instruments targeting different processes in a broader system within/across dimensions.

The policy instruments described in different EU communications, legislations and policy documents will be analysed whether they refer to interactions with other instruments. To dig deeper into the EU vision on policy instrument interactions within its R&I policy mix, the EU policy document on ‘enabling synergies between Horizon 2020 and ESIF’ will be analysed separately to explain the motivation behind intended policy mix interactions. These interactions will be categorised according to the classification provided by Flanagan et. al. (2011).

2.6.6. Focus Excellence and Widening

Although widening and excellence are not necessarily mutually exclusive (Whiteford et al., 2013), both concepts do seem to provide strong contrasts, where a stronger commitment to excellence might lead to less emphasis on widening and vice versa. Therefore an ordinal ranking scale will be used with five different code categories as depicted in table 5. It is important to consider that policy instruments can be strongly focused towards excellence, while also containing small elements that promote widening and vice versa. Category 3 (balance between excellence and widening) consists of two different classifications, as it refers to either high or low commitment to both policy goals.

(1)	Strongly widening focused
(2)	Moderately widening focused
(3)	Balance between excellence and widening
(4)	Moderately excellence focused
(5)	Strongly excellence focused

Table 5: Ordinal ranking scale excellence and widening

Content analysis will be applied to relevant regulations and policy documents to look at the extent policy instruments support and promote excellence and/or widening. The analysis will be performed through coding of both manifest and latent content (Babbie, 2010). The analysis looks through the lens of the conceptualisations and operationalisations developed in Chapter 3, considering the prevalence of explicit references to either excellence or widening, as well as implicit references to key terms. The analysis will consider latent content to better tap into the underlying meaning of the different types of communications.

2.6.6. Analytical framework matrix

The combination of policy mix literature from the previous sections enables a fully developed analytical framework matrix that can be applied to the EU policy context, providing categorisations and/or operationalisations for each element as provided in table 6.

Policy Instruments	Instrument Type	Policy Rationale	Target Groups	Interactions	Focus E/W
H2020 - SEWP ESIF	1. Regulatory 2. Economic 3. Soft	1. R&I investments 2. R&I infrastructures 3. Regional governance 4. Transnational linkages 5. Human resources & capability development	1. Knowledge institutions 2. Businesses 3. Civil society 4. Government 5. Other actors	1. Similar instruments Different instruments 2. Same actors 3. Different actors 4. Different processes	Prevalence: -Key terms E -Key terms W

Table 6: Analytical framework matrix for SEWP-, other Horizon 2020- and ESIF instruments

Sources: (Arnold, 2004; Borràs & Edquist, 2013; Chaminade & Edquist, 2010; Flanagan et al., 2011; Georghiou et al., 2002; Izsak & Radosevic, 2017; Klein-Woolthuis et al., 2005; Laranja et al., 2008; Magro & Wilson, 2013; Wieczorek & Hekkert, 2012)

3. Conceptualisation and operationalisation

The EU R&I policy context is characterised by ambiguity and a lack of consensus on the conceptualisation of both widening and excellence. Whereas different stakeholders apply different interpretations of excellence which best serve their interests, the concept of widening has only recently been introduced in EU R&I policy. This section aims to capture the current ambiguity, based on which a multidimensional interpretation of both concepts will be developed and used to analyse EU policy documents.

3.1 Conceptualisation of Excellence

Over the past years, the concept of excellence rapidly gained prominence in R&I policy literature (Tijssen, 2003). Due to the increased internal competition within Horizon 2020 as well as the growing need for external competitiveness, the EU has put more emphasis on excellence in its evaluation and selection procedures, aiming to optimally allocate limited R&I funds. However, despite the EU developing quantitative indicators to measure ‘research excellence’ on Member State level, the concept of excellence has yet to be clearly defined within the Horizon 2020 context. This allows involved stakeholders to develop different interpretations of excellence, depending on their own needs. This sections will describe the limitations of ‘research excellence’, emphasising the need for a broader definition that can be applied to the reality of Horizon 2020, characterised by conceptual ambiguity and a lack of consensus (Clarysse & Muldur, 2001; Sharp, 1998; Tijssen, Leeuwen, & Visser, 2002; Young, 2015).

3.1.1. Research excellence and Scientific excellence

Excellence is often considered synonymously with high quality R&I, going ‘beyond a limit or standard’. However, the increasing need for allocative efficiency has led excellence to take on a more utilitarian and economic guise, marked by an increased emphasis on competitiveness. Excellence emerged at the forefront of R&I evaluation as a comparative performance measure denoting superiority to others through best scores based on quantitative indicators. This more comparative and measurable interpretation is known as ‘research excellence’. By developing the ‘Composite Indicator for Scientific and Technological Research Excellence⁶’ (CISTRE), EU policy also started to consider the use of research excellence to enable cross-country comparison (European Commission, 2013; Radosevic & Lepori, 2009; Sorensen, Bloch, & Young, 2016; Tijssen, 2003; Tijssen et al., 2002).

Yet, research excellence is considered a limited interpretation with an excessive focus on relative comparison. An alternative interpretation of scientific excellence also considers intrinsic quality embedded within research(ers) or institutions. Scientific excellence is rooted in academic virtues, in

⁶ Based on 4 indicators: 1) Publications, 2) ERC grants, 3) Top knowledge institutions, 4) Patent applications.

which evaluation is performed through peer reviews by expert panels. While research excellence limits itself by solely focusing on research activities, scientific excellence also covers additional activities like PhD training and the transfer of research findings to innovations. Scientific excellence also covers additional organisational variables such as intellectual capital, participation in research networks and access to facilities and equipment. Being only applicable for cross-country comparison, CISTREs interpretation of research excellence has low validity when applied to the individual proposals in Horizon 2020 and ESIF. Excellence might improve through the lens of this indicator, but in reality institutions may be performing worse (Sorensen et al., 2016; Tijssen, 2003; Young, 2015). Discussions surrounding this duality of the concept of excellence (intrinsic quality vs. relative comparison) eventually started to grow stronger within the Horizon 2020 context.

3.1.2. Excellence in Horizon 2020: an ambiguous concept

Pushing knowledge frontiers and creating breakthroughs, the importance of the pursuit of excellence has never been questioned among research communities within the EU. Yet, excellence is a broad, multidimensional and ambiguous concept. The notion of excellence is context-dependent and varies per Member State and organisation, each of which containing different goals, stakeholders, policies and collective beliefs. Stakeholders have overlapping or conflicting ideas on the definition of the concept, emphasising different key features. One must always consider the context-dependency, flexible boundaries and interrelated dimensions when analysing the complex concept of excellence (Tijssen, 2003; Tijssen et al., 2002; Young, 2015).

Based on an analysis of EU policy documents and position papers on Horizon 2020, Young (2015) describes the difficulty for stakeholders to argue against the self-justifying concept of excellence. However, despite consensus on its importance, Young also claims there to be no common understanding on the meaning of excellence within Horizon 2020, both between EU institutions and especially between stakeholders from different Member States. In table 7, Young identified two types of excellence that exist in Horizon 2020: Threshold excellence and Zero-sum excellence, which are used differently by stakeholders to project their own understanding on the definition depending on their needs and circumstances, which may conflict or compete with interpretations of other actors (Tijssen, 2003; Young, 2015).

		Type of Excellence	
		Threshold	Zero-Sum
Discourse	Quality	excellence means: of a predetermined standard	excellence means: the best
	Distributive	excellence coexists with other criteria	excellence is the sole criteria

Table 7: Types and discourses of excellence among Horizon 2020 stakeholders
Source: (Young, 2015)

In the distributive discourse, excellence is used politically in FP debates to counter arguments for distributive justice. The discourse entails an opposition between a redistribution system used by ESIF, based on pre-allocation and supporting the catch-up of weaker Member States, and a redistribution system with excellence as sole criterion and an absence of any *juste retour*⁷. In the quality discourse, excellence is often described as a competitive concept, where only ‘the best’ are funded without any geographical considerations. This shows strong interconnections between quality and distributive discourses, as funding the best often leads to a departure of *juste retour*, leading to EU-13 countries ‘subsidising’ more competitive countries. ‘The best’ mostly refers to proposals, but could also refer to science, innovation, researchers, ideas or infrastructures. Criteria may be set by different specialists or expert groups and vary across different instruments, but according to Zero-sum excellence, it is always about continent-wide competition to select ‘the best’ (European Commission, 2011a; Young, 2015).

The EU’s understanding of excellence lies closer to the interpretation of Zero-sum Excellence, resting on the assumption of excellence being a limited resource decided by relative and competitive means. There can only be so much excellence, and as researchers improve, the excellence target moves with them. Horizon 2020 and its instruments follow the logic of a comparative ranking system with a clear cut-off point, ensuring that only the most highly ranked proposals are funded. Threshold excellence is based on the assumption that excellence is unlimited and defined by its intrinsic quality, rather than its relative position among its competitors. Following this conceptualisation, excellence is a stable target allowing multiple proposals to be excellent, therefore being better compatible with the distributive justice arguments used by EU-13 stakeholders to encourage a broader distribution of funds. Threshold excellence allows other allocation criteria to be included, once the threshold for excellence has been met, including cost efficiency, relevance to economic growth and inclusiveness (Young, 2015).

3.1.3. Analysing excellence in the Horizon 2020 context: intrinsic and comparative quality

This research combines different aspects of different interpretations of excellence: both as comparative and competitive expression to denote superiority to others (Zero-sum) and having high intrinsic quality (Threshold) (Tijssen et al., 2002). While putting more emphasis on Zero-sum excellence, the EU still considers interpretations of Threshold excellence. This is clearly expressed through the introduction of the ‘Seal of Excellence’ (Figure 5), a high-quality label rewarded to proposals that managed to pass a certain quality threshold, yet did not receive funding due to limited budget (European Commission, 2015c). The EU emphasises that there are some proposals not receiving funding which could still be considered excellent and that focus on funding ‘the best’ is mainly the result of over-applications and resource limitations.

⁷ Principle where funding granted to project participants from a given country or region is in proportion to the budget contributed by that country or region

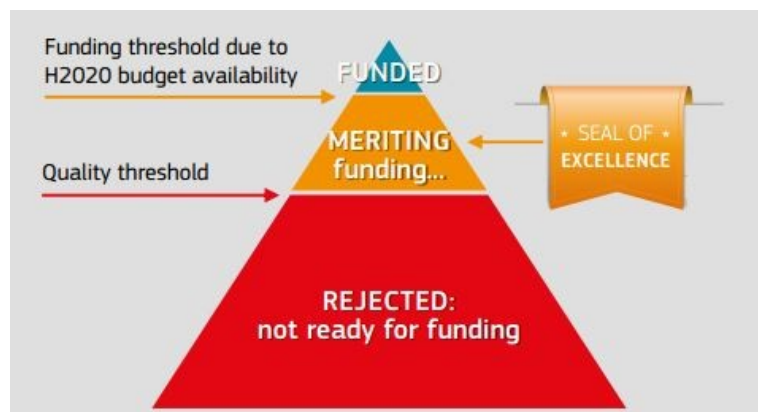


Figure 5: The Seal of Excellence
Source: (European Commission, 2015c)

Apart from the ‘Seal’, EU’s dual interpretation has also become apparent by describing excellence as ‘primary funding criterion’, rather than describing it as the sole criterion. This allows excellence to coexist with other (widening) criteria, like inclusiveness. For the analysis it is essential to keep the concepts of excellence and widening separated. Because the coexistence of excellence with other criteria can blur the differentiation with widening, this threshold excellence characteristic is excluded from our conceptualisation. Based on the classification and conceptualisations of Young, relevant key terms have been identified for Zero-sum and Threshold excellence. The key terms will be used for the analysis of the policy mix by looking at their prevalence in Horizon 2020 and ESIF policy documents and regulations, while considering their underlying meaning.

Key terms	
Threshold excellence (Intrinsic)	excellence, centres of excellence, quality, outstanding, peer review, expert groups
Zero-Sum excellence (Comparative)	the best (proposals, ideas, researchers, institutions, infrastructures etc.), competition, superiority, exclusion

Table 8: Key terms for the analysis of excellence in EU policy documents

3.2 Conceptualisation of Widening

In the late 1980s the narrative of social exclusion became woven into the EU rationale, as a growing conviction developed that economic growth and competitiveness could only be achieved if social policy was in place to ensure cohesion. This led to the rise of the concept of widening in the EU, corresponding to a number of trends and developments: growth in number of Member States, knowledge and skills becoming key requirements for economic growth and employment and the development of EU institutions and legal bases for action in a growing number of policy domains (Burke, 2016; Davies, 2003; Kennedy, 1997; Kettley, 2007; Warren, 2002; Whiteford et al., 2013).

3.2.1 The origins of widening participation: higher education policy

The concept of widening first moved from UK to EU education and training policy, which faced similar challenges compared to EU R&I policy. The widening participation agenda in education policy

is predicated on the notion that particular (social) groups are unfairly under-represented due to access inequalities. Widening participation policies target initiatives towards these disadvantaged groups, in higher education being working-class students, adult learners, young people, women or ethnic minorities. In this context widening participation is understood as: *‘increasing access and providing opportunities for participation and success to a much wider cross-section of the population than is currently the case’* (Kennedy, 1997). Widening participation is based on the principles of social justice and equity, which dictate that all should have equal opportunities to fulfil their potential and succeed. Therefore both ‘equal access to’ and ‘equal opportunity in’ participation are key within the widening participation concept (Burke, 2016; Davies, 2003; Gorard & Smith, 2006; Kennedy, 1997; Kettley, 2007; Whiteford et al., 2013).

Many policies aiming to increase participation lack targeting strategies to identify disadvantaged groups, often providing opportunities and resources to already privileged participants, thereby reproducing inequalities. Those who fail to fulfil their potential or have underachieved in the past, would lose out in competition. The concept of widening adds-on the crucial element of diversity to participation. Restraining from widening participation would increase the gap between the haves and have-nots and puts at risk social unity and economic prosperity. In the age of economic efficiency, not managing to achieve equal opportunities can lead to a waste of talent. Developing capacity for all is central to achieve a social cohesion, competitiveness and economic growth (Burke, 2016; Davies, 2003; Kennedy, 1997; Kettley, 2007).

Widening addresses barriers to participation that prevent a perfect relationship between ability, opportunity and performance. Barriers to higher education are explained in terms of familial, cultural, educational and socio-economic processes like financial constraints, lack of family support or lack of access to informal networks, rather than a limited pool of talent. These barriers are comparable to the market and system failures preventing EU-13 participation in Horizon 2020. One needs to consider the interaction between different barriers or failures to address them properly (Burke, 2016; Gorard & Smith, 2006; Kennedy, 1997; Kettley, 2007).

Following the egalitarian view on widening participation, the delimitation of opportunities based on previous attainment, background or geographical location represents a denial of basic human rights. The level of preparedness rather than intelligence was a main issue for access to and participation in higher education. Globally there is a growing corpus of evidence that social inclusion initiatives in higher education policy has worked well without compromising quality outcomes or having a negative impact on academic standards (Whiteford et al., 2013). This shows both objectives of equity and excellence are not necessarily mutually exclusive. However, commitment to widening participation requires resource provision to develop capabilities, build capacity and ‘buy in’ relevant stakeholders

for networking. Governments and other relevant institutions need to support the development of environments in which all participants can realise their potential (Davies, 2003).

Combining conceptualisations from UK and EU higher education policy, the following characteristics of widening participation are identified (Burke, 2016; Davies, 2003; Kennedy, 1997; Kettley, 2007):

- Based on principles of *equality, equity and social justice*.
- Promotes more *diverse participation* by addressing the under-representation of *disadvantaged groups* with high levels of *potential to catch-up*.
- Strengthens *cohesion* by promoting *openness, accessibility* and *inclusion*: fair access and equal opportunities in participation.
- Requires dedicated resources to *support* disadvantaged groups through *capacity building, capability development, network integration* and *preparation* for participation.

3.2.2 Analysing ‘widening’ in the Horizon 2020 context

From education and training policy, the Commission slowly allowed elements of the widening concept to be transferred into the R&I policy sphere, as both policy domains faced similar developments.

During the late 90s, the EU developed a set of general principles for the construction and performance all of its S&T initiatives. It was the first time the integration principle appeared alongside the valued principle of excellence under the FPs. The integration principle entailed that all FPs should foster cohesion within the EU, in which Member States with lower S&T capabilities should be drawn into co-operation with those that have stronger capabilities. However, the set of identified principles to whom excellence and integration belong to, is not always consistent in itself (Schuch, 2005).

The term widening participation appeared during the drafting process in Horizon 2020 in early Commission communications, stressing to: ‘*ensure Horizon 2020 is open to a wide range of participants, including new entrants*’. Regulation 1291/2013 establishing Horizon 2020 required the programme to support ‘*initiatives aimed at widening awareness and facilitating access to funding under Horizon 2020, in particular for those regions or types of participants that have a relatively low participation*’. These citations clearly show an identification of an under-represented, disadvantaged group in Horizon 2020, victim of the innovation divide, to which commitments were made to improve and increase accessibility and ensure more diverse participation (European Commission, 2011c, 2015b, 2017a; European Parliament & European Council, 2013b; European Union, 2016).

Transferring a concept to a new policy context is met with several challenges related to the different characteristics of that new context. So do Horizon 2020 target groups differ from the disadvantaged social groups (students) targeted by education policy. When talking about diversifying participation, Horizon 2020 targets different groups depending on the pillar or instrument: individual researchers

(ERC) from different fields (Societal Challenges pillar), businesses and SMEs (Industrial Leadership pillar), young researchers (MSCA), female researchers and third countries. However in SEWP, the primary target groups are institutions from low-performing regions or Member States, also known as ‘Widening Countries’. Because the EU interpretation of widening is broad and multi-dimensional, the analysis of Horizon 2020 and ESIF policy documents will solely focus on the geographical dimension of widening that targets disadvantaged EU-13 participants (European Commission, 2011a, 2015b, 2017a; European Parliament & European Council, 2013b).

Widening is strongly related to the structural barriers that impede disadvantaged EU-13 Member States from participating in Horizon 2020. The majority of barriers are related to a lack of national commitment to R&I (*market failure*) and the legacy of previous governance systems (*systemic problem*), as most of the EU-13 are former communist CEE countries which joined the EU simultaneously. The transformation process towards a capitalist market economy in EU-13 Member States during the 1990s led to a downturn in economic activity and subsequently, a decrease in R&I investments. The transformation phase also caused the de-capitalisation of physical research infrastructure and weakening of the human resource base due to brain drain caused by low salary levels (Galsworthy & McKee, 2013). Weak national, regional and local governance caused insufficient possibilities for networking, clustering and coordination between different national, regional and local stakeholders. Next to a lack of local cooperation, the EU-13 also struggle with cross-border networking, as the EU-15 mostly seem to collaborate with familiar partners in so called old boys’ networks (Schuch, 2014). Another barrier is the lack of experience among EU-13 institutions, as research shows that the probability of succeeding in Horizon 2020 is strengthened by prior participation (Enger & Castellacci, 2016).

Table 9 combines all previous conceptualisations of widening from higher education policy and EU R&I policy into relevant key words that will be used for the analysis of Horizon 2020 and ESIF policy documents.

Key terms

Widening participation	widening, social justice, equity, equality, inclusion, cohesion, openness, accessibility, (geographically) diverse participation, disadvantaged groups, potential, barriers, support, catch-up, capacity building, capability development, integration.
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Table 9: key terms used for the analysis of widening in EU policy documents

4. Methodology

This exploratory research aims to analyse different aspects of the EU R&I policy mix through desk research, performing document analysis. Most importantly, it analyses the extent to which each individual policy instrument contributes to either excellence and widening and how these different policy instruments interact with each other in regard to achieving both policy goals. This section will describe the methodology towards identifying the unit of analysis and unit of observation.

4.1 Unit of analysis and unit of observation

Since the main goal is to better understand the workings of EU R&I policy, the EU R&I policy mix will be analysed to the extent it addresses excellence and widening. The unit of analysis is therefore EU R&I policy, whereas the unit of observation will be social artefacts (Babbie, 2010), primarily EU communications, legislation and policy documents on Horizon 2020 and ESIF. Relevant social artefacts to be analysed will include Regulation 1291/2013 establishing Horizon 2020 and Regulation 1303/2013⁸ providing common provisions for all ESI Funds, as well as the communications that precede them. As for policy documents, the most recent Work Programmes (WPs) of individual Horizon 2020 policy instruments will be analysed. These standardised WPs do not exist for ESIF, as they are implemented at national and/or regional level and strongly differentiate per national and regional context. Instead, individual regulations of the European Regional Development Fund⁹ (ERDF) and European Social Fund¹⁰ (ESF) will be analysed. As Horizon 2020 is still running, the setting will primarily focus on the timeframe from 2014 to present time.

Again, this research solely considers geographical widening towards researchers and institutions from less-performing Member States, in particular the newer EU-13. The Commission used the Composite Indicator for Research Excellence to identify ‘Widening Countries¹¹’ to be targeted by SEWP and other supporting initiatives. These Widening Countries include the entire EU-13, but surprisingly also Portugal and Luxembourg. Although concepts of Widening Countries and the EU-13 are used interchangeably in literature, it is of key importance to stress the difference between both. This research will mostly refer to EU-13 as institutions from CEE countries face similar barriers caused by market or system failures following the transition from communist states to capitalist market economies. While associated countries¹² from outside the EU are eligible for widening support, they will also be excluded from the analysis to keep focus on the R&I divide within the EU (European Commission, 2013, 2015b, 2017a).

⁸ Also known as Common Provisions Regulation (CPR)

⁹ Regulation 1301/2013.

¹⁰ Regulation 1304/2013.

¹¹ Countries ranked below 70% of the EU average of CISTRE scores.

¹² Associated Countries: Albania, Armenia, Bosnia & Herzegovina, Faroe Islands, Former Yugoslav Republic of Macedonia, Georgia, Moldova, Montenegro, Serbia, Tunisia, Turkey and Ukraine.

5. Horizon 2020 and ESIF policy instruments

This section will shortly describe the Horizon 2020 and ESIF instruments that are to be included in the analytical framework matrixes. Firstly describing the overall structure of Horizon 2020 and ESIF, each individual instrument is briefly described in terms of their functions and goals.

5.1 Horizon 2020 policy instruments

In order to identify tensions or complementarities between policy instruments, it is important to know which instruments are being used. The next section will describe the most relevant R&I policy instruments within Horizon 2020.

As stated, Horizon 2020 strongly deviates from its predecessors by including innovation policy in its programme, promoting the development of ideas and supporting their transition to the market. This development coincides with a different institutional set-up. As seen in Figure 6, Horizon 2020 is the first Framework Programme to be divided into three interrelated priority areas or ‘pillars’, each of which divided into more specific instruments with their own specific objectives. The three pillars are (European Commission, 2011a, 2014c; European Parliament & European Council, 2013b):

- *Excellent Science (€24,4 billion)*: Aims to raise the level of excellence of Europe’s science base to make the EU R&I system more competitive on a global scale.
- *Industrial Leadership (€17 billion)*: Aims to speed up the development of technologies and innovations that underpin tomorrow’s business.
- *Societal Challenges (€29,7 billion)*: Responds directly to the policy priorities identified in the Europe 2020 strategy and aims to bring together critical mass of R&I efforts (knowledge and resources) needed to achieve these EU policy goals through a challenge-based approach.

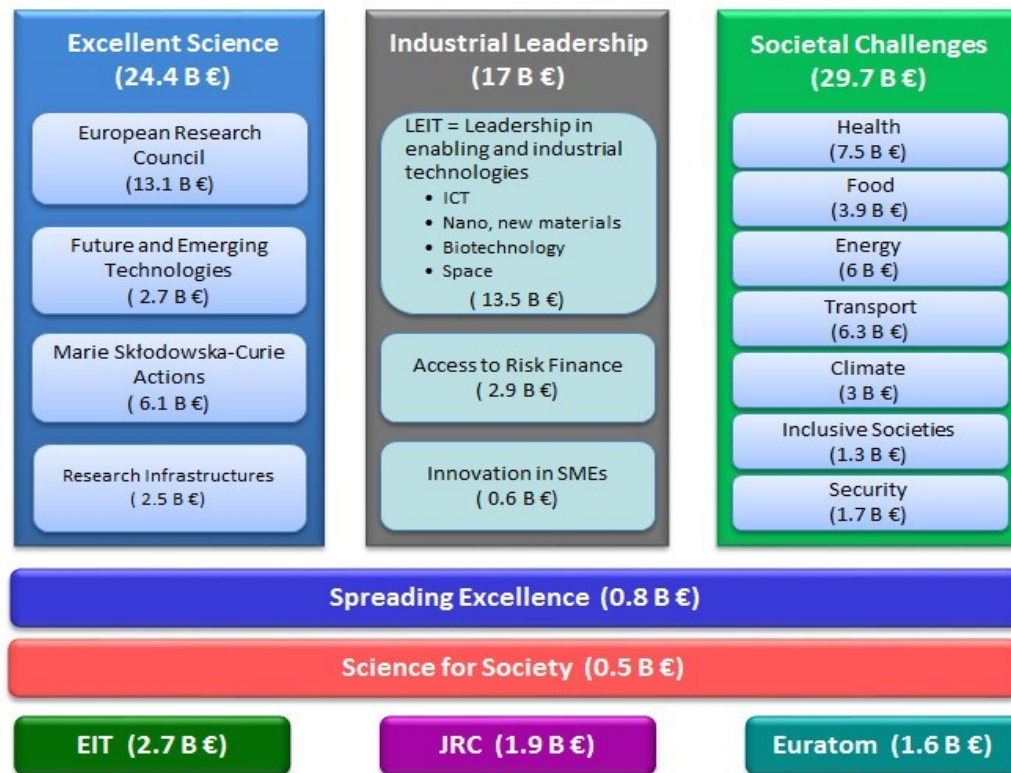


Figure 6: Horizon 2020 structure
Source: (European Parliament & European Council, 2013b)

5.1.1 Instruments Pillar I: Excellent Science

The excellent science pillar consists of 4 main instruments, each containing specific policy objectives (European Commission, 2011a, 2014c, 2017c, 2017d, 2017g, 2017i; European Parliament & European Council, 2013a, 2013b; European Research Council, 2016a, 2016b, 2017):

- European Research Council (ERC): Reinforce the excellence, dynamism and creativity of European frontier research, by awarding attractive, long-term funding¹³ to the best researchers and research teams to pursue ground-breaking, high risk/high gain frontier research of the highest quality, based on pan-European competition. The ERC operates autonomously, with an independent Scientific Council having full authority on the type of research being funded. Evaluation is based on a peer review process by panels composed of renowned scientists and scholars, assisted by independent experts, with excellence being the sole criterion. ERC initiatives help boost levels of investment and activity in frontier research. ERC grants also award additional funding to cover eligible start-up costs related to moving costs by the investigator to the EU, the purchase of major equipment or access to large facilities.

¹³ ERC provides three main type of research grants for excellent investigators to set-up or consolidate their own independent research team or programme: 1) Starting grants for investigators awarded their first PhD 2-7 years ago, 2) Consolidator grants for investigators awarded their first PhD 7-12 years ago, 3) Advanced grants for established researchers leaders. The ERC also provides Synergy grants that bring together complementary skills, knowledge and resources of 2-4 investigators to jointly address ambitious research problems, and Proof of Concept grants funding further work to verify the innovation potential of ERC funded projects.

- ERC Fellowships: During the running time of Horizon 2020, the ERC Scientific Council acknowledged the low international exposure of researchers from certain European countries, hindering the recognition of the full research potential in those countries. Therefore in early 2016, the ERC encouraged national/regional authorities and organisations to set up visiting fellowship programmes, funding potential ERC candidates to visit teams of ERC grant holders. This allows candidates to increase their international exposure, while strengthening their research profile and vision before applying for competitive ERC grants. So far, mostly less-performing EU-13 countries¹⁴ have set up fellowship programmes to allow future ERC applicants to visit existing ERC grantees, helping them prepare a competitive ERC proposal.
- Future and Emerging Technologies (FET): Support interdisciplinary collaborative research exploring high-risk/high gain ideas to foster radically new S&T innovations. Radical breakthroughs increasingly rely on intense collaboration across S&T disciplines involving a broad range of players. *FET Open* fosters small-scale, exploratory research efforts that mobilises complementary knowledge from different disciplines. *FET Proactive* builds interdisciplinary R&I communities and European innovation eco-systems around emerging research themes and technological paradigms. *FET Flagships* are large-scale research initiatives aimed at addressing grand S&T challenges over a substantial period of time, building research collaboration across academia and industry and across national research programmes, thereby stimulating coordination between European, national and regional agenda's.
- Marie Skłodowska-Curie Actions (MSCA): Ensure the optimal development of Europe's human capital base by equipping researchers with knowledge, skills and international and intersectoral exposure. Through competitive funding, the best and most promising researchers are supported, either through excellent training opportunities and/or periods of placement in another country or sector to work on R&I, making Europe a more attractive destination to develop research careers. *MSCA Innovative Training Networks (ITN)* support early-stage researchers through joint research training and/or doctoral programmes¹⁵, implemented by partnerships of universities, research institutions, businesses and other socio-economic actors from different countries. *MSCA Individual fellowships (IF)* support experienced researchers aiming to acquire new skills, through advanced international and intersectoral mobility. The scheme in particular supports the return and reintegration of European researchers from outside Europe, career restarts and mobility between academic and non-academic sectors. *MSCA R&I Staff Exchange (RISE)* promotes international and cross-sectoral collaboration and partnerships through joint R&I projects aimed at knowledge sharing through R&I staff exchanges (mobility). *MSCA Co-fund* helps improve coordination of European research training, mobility and career development by co-funding regional, national and

¹⁴ Czech Republic, Estonia, Hungary, Poland and Slovenia.

¹⁵ Partnerships take form of collaborative European Training Networks (ETN), European Joint Doctorates (EJD) or European Industrial Doctorates (EID).

international doctoral or fellowship programmes, leveraging funds to create new programmes or adapt existing ones in line with similar and complementary goals. Finally, the *European Researchers' Night* brings researchers closer to the general public by increasing awareness of R&I activities and encouraging young people to embark on research careers.

- **Research Infrastructures (RI)**: Endow Europe with world-class research infrastructures (RIs) and fully exploit their potential for R&I. While Member States remain central in financing infrastructures, the EU plays an important catalytic, leveraging and coordinating role in fostering the emergence of new integrated facilities and the major upgrades of existing ones. The RI-instrument helps pool and integrate resources and ensure financial commitments of national stakeholders across Europe to design, implement, maintain and operate large-scale, complex and costly RIs, as no single country has enough resources to support all infrastructures it needs. Through RI support for the European Strategy Forum on Research Infrastructures (ESFRI) roadmap, a coordinated implementation of new research infrastructures of pan-European interest into the European RI landscape is encouraged, ensuring consistency between regional, national and European policies, avoiding duplication and fragmentation of efforts. Integrated Activities (IA) strengthen collaboration by mobilizing, integrating and coordinating key national and regional RIs from different Member States in a certain field of European interest, leading to sharing of knowledge and technologies. IA funding will support cooperation between RIs, scientific communities, industries and other stakeholders through networking activities, ensuring wider transnational and virtual access to RIs for all European researchers from academia and industry and establish joint research activities to improve integrated services provided by the infrastructures. Through the European Open Science Cloud (EOSC) and European Data Infrastructure (EDI), complementarities between RIs are also strengthened through enhanced access and exchange of research data, promoting their interoperability. Finally, the RI-instrument strengthens the European human resource base, being used beyond research to provide training and/or exchanges of staff managing and operating RIs.

5.1.2 Instruments Pillar II: Industrial Leadership

The industrial leadership pillar consists of 3 main instruments, each containing their own specific policy objective (European Commission, 2011a, 2014c, 2017b, 2017d, 2017e, 2017f; European Parliament & European Council, 2013a, 2013b):

- **Leadership in Enabling and Industrial Technologies (LEIT)**: Maintain and build global leadership by stimulating R&I in Key Enabling Technologies (KETs)¹⁶, ICT and Space, which underpin the competitiveness of European industry. The activities under LEIT strongly focus on leveraging and combining private sector R&I investments with public investments from different administrative

¹⁶ KETs: nanotechnology, advanced materials, advanced manufacturing and processing, biotechnology and photonics.

levels towards multi-disciplinary, knowledge and capital-intensive projects. Strategic investments are aimed at innovative projects and activities covering the whole value chain, including R&D, large-scale pilots and demonstration activities, test beds and living labs, prototyping and product validation. LEIT also promotes Union level cooperation via public-private partnerships (PPPs).

- *Access to Risk Finance*: Address market failures preventing access to risk finance to pursue R&I activities, primarily for innovation-driven companies, including SMEs, but also universities and research organisations. Due to the high-risk, high-cost nature of innovation, commercial banks are often unwilling to provide necessary finance for R&I activities in emerging or established companies, not considering wider societal benefits. It is uncertain at the start of an R&I investment whether efforts will result in successful innovation and even if they do, there still exists uncertainty on whether the company will be able to exclusively appropriate the benefits deriving from it. This instrument will improve the attractiveness of risk profiles of R&I activities, thereby increasing access to finance while leveraging investments from companies themselves. The '*Debt facility*' provides loans and guarantees for public and private entities and partnerships, pooling a critical mass of resources from both Union budget and other private financial institutions on a risk-sharing basis. The '*Equity facility*' provides cross-border equity finance for early and growth-stage investments to boost the European venture capital market, supporting new companies in crossing the 'valley of death' where public research grants stop and it is not yet possible to attract private finance. This instrument also supports a number of inducement prizes.
- *Innovation in SMEs*: Strengthen innovation capacity of SMEs by: 1) implementing a dedicated *SME instrument*¹⁷ providing funding to support high-risk R&I activities of promising SMEs covering the whole innovation cycle from concept to market. 2) Providing direct support for innovation activities of *cluster projects* aimed at building new industrial value chains, ensuring collaboration, integration and networking between innovation actors across borders and sectors. 3) Launching an *Innovation Associate pilot*, providing grants to visionary SMEs to attract and train a highly skilled, experienced researcher who will explore the potential of an innovative idea and turn it into an innovation project. 4) Supporting *workplace innovations* aimed at improving working conditions, learning capabilities, skills and motivation of employees. 5) Providing small grants to *national or regional innovation support agencies*¹⁸ to engage in mutual policy learning on the design and implementation of innovation support programmes for SMEs. 6) Setting up an *European Open Innovation Network* in advanced technologies, aimed at matching innovation needs from large industries with SME solutions. 7) Developing a *tool* to support decision making for investors financing high-potential innovative SMEs, reducing information asymmetries and

¹⁷ With the start of the Work Programme 2018-2020, the SME instrument moved from 'Innovation in SMEs', towards the European Innovation Council (EIC) pilot umbrella. Yet, the dedicated SME shall be considered under the current instrument to prevent unnecessary complexity.

¹⁸ An 'innovation support agency' is defined as an entity entrusted by national or regional government to develop and/or implement innovation support programmes for SME's.

prevent risk aversion. 8) Providing intermediated support for SMEs via the *Enterprise Europe Network (EEN)*¹⁹, providing tailored services like innovation management capacity building, networking and brokering. 9) Providing a top-up to the *EUREKA/Eurostars JPI* budget, which provides funding for market-oriented, transnational collaborative R&D projects led by R&D performing SMEs, overcoming SMEs size related problems by pooling together resources, integrating competences and enhancing access to larger markets. 10) Supporting *studies* on the effectiveness of public innovation support for SMEs.

5.1.3 Pillar III: Instrument to address Societal Challenges (SC)

In line with the Europe 2020 policy priorities, the EU has identified seven priority challenges in which targeted R&I investments can have impact, benefitting society as a whole. The third pillar heavily breaks with previous pillars by focusing on a broad set of activities within these predetermined challenges. All funded activities must take a challenge-based approach and include basic research, applied research, knowledge transfer or innovation. The emphasis lies on bringing together a critical mass of resources and knowledge across different fields, technologies, scientific disciplines and borders to address each challenge (European Commission, 2011a, 2014c, 2017d; European Parliament & European Council, 2013a, 2013b):

1. *Health, demographic change and well-being*
2. *Food security, sustainable agriculture and forestry, marine, maritime and inland water research and bio-economy*
3. *Secure, clean and efficient energy*
4. *Smart, green and integrated transport*
5. *Climate action, environment, resource efficiency and raw materials*
6. *Europe in a changing world - inclusive, innovative and reflective societies*
7. *Secure societies*

5.1.4 Spreading Excellence and Widening Participation instruments

The main objective is to unlock untapped R&I potential and ensure the benefits of an innovation-led economy are maximised and widely distributed, which is vital for Europe's competitiveness. Being a horizontal programme not belonging to any of the three pillars and 'only' containing 800 million euro's of funding, covering around 1% of the total available budget (Figure 6), the SEWP instrument is considered one of the smaller initiatives under Horizon 2020. However, due to their controversial nature within Horizon 2020 and relevance towards achieving widening, SEWP-instruments receive additional attention (European Commission, 2011a, 2014c, 2015b, 2017a, 2017d, 2017h; European Parliament & European Council, 2013a, 2013b):

¹⁹ The Enterprise Europe Network is established for the period 2015-2021 under COSME.

- Teaming: Support the creation of new or upgrade of existing ‘Centres of Excellence’ (CoE) in low R&I performing Member States on the basis of partnerships between excellent and internationally leading research institutions and promising partner institutions from those low R&I performing countries. The establishment of a CoE does not only promote collaboration and networking between promising and internationally leading institutions, it also provides training and education to ensure high quality human resources are provided to absorb the innovation potential of the new centre. It also strengthens regional cluster formation by involving national/regional authorities in its implementation. The creation of a new CoE is expected to increase scientific capabilities of the host country, improving their chances of seeking competitive funding in international fora. Teaming grants cover administrative, operational and personnel costs of the future centre and cannot be used for infrastructure and equipment investments.
- Twinning: Strengthen a defined field of research in an emerging EU-13 university or research organisation by linking it to at least two internationally leading research institutions from other Member States, encouraging networking, knowledge transfer and exchange of best practises through joint research projects. This instrument addresses network deficiencies between institutions from EU-13 and EU-15 countries, as the traditionally best research institutions tend to collaborate in closed groups, producing a crowding-out effect for a large number of promising institutions. Twinning activities include several measures like short-term staff exchanges, expert visits, on-site or virtual trainings, workshops, conference attendance etc. Just like Teaming, infrastructure and equipment costs are not covered by the Twinning budget, as are research costs. Twinning mainly covers costs related to administration, networking, coordination, training, management and travel.
- ERA-Chairs: Create appropriate conditions for EU-13 institutions with high potential for excellence to attract, maintain and increase high quality human resources. Installing an outstanding researcher (ERA-Chair holder) and a number of team members for full-time positions in a promising EU-13 institution will help to facilitate change, raise standards and attract more high level staff and money from other sources, allowing these institutions to fully unlock their potential and modify their R&I landscape. Full commitment of the ERA-Chair holder is expected during the duration of the grant. Grants mainly cover costs related to the appointment of the ERA-Chair holder (recruitment, salary, administration, travel and subsidence) and costs of measures aimed at facilitating structural changes in the institution (training, meetings and publications). It will not cover costs related to research or infrastructure.
- European Cooperation in Science and Technology (COST): Established as intergovernmental network in 1971 and now supported by Horizon 2020, COST promotes cooperation among researchers in Europe through networking activities. It support access to European and international networks for researchers and innovators who lack sufficient involvement, to gain international experience. COST actions are bottom-up, cross-border S&T networks open to all

researchers and stakeholders, containing a range of networking tools, such as workshops, conferences, training schools, short-term scientific missions and dissemination activities. Through its openness and inclusiveness policies, COST brings promising, but not well-integrated researchers and research institutions from Widening Countries in contact with excellent researchers and institutions, building foundations for new future partnerships.

- *Policy Support Facility (PSF)*: Offer expert advice to national or regional public authorities in low R&I performing Member States, helping them towards a better formulation of national or regional R&I policies, making them more competitive at European level. The expert advice offered by PSF is voluntary, tailor-made and provided through: 1) Peer reviews of national R&I systems, strategies, programmes and institutions, performed by experts and government officials from other countries, 2) Mutual learning exercises to exchange good practices between countries focused on a specific R&I challenge, 3) Specific support to national or regional authorities requesting ad-hoc support in policy design, implementation, evaluation or reform, 4) Dissemination/outreach activities. PSF also supports national and regional policy makers through an innovation policy database and interactive innovation policy helpdesk, which provide access to evidence-based expertise and evaluation results.
- *National Contact Points (NCPs)*: Provide guidance, practical information and assistance on Horizon 2020 participation to all participants, free of charge. Actions under SEWP will facilitate transnational co-operation and coordination between NCPs through joint workshops, benchmarking, cross-border brokerage events and training, thereby helping less-experienced NCP's in low performing Member States or regions to bridge the knowledge gap and rapidly acquire know-how accumulated in other countries. A transnational NCP network shares good practices among individual NCPs to raise the standard of support for applicants, in particular those with less-experience, enabling wider access to Horizon 2020 funding opportunities.
- *Widening Fellowships*: Provides an additional opportunity to researchers of any nationality to perform R&I in widening countries through trans-national fellowships. It diversifies individual competences in terms of skill acquisition and knowledge transfer through advanced training and international and intersectoral mobility. The first results of MSCA revealed the existence of a mobility gap across Europe and discrepancies between European countries in their ability to attract funding. Therefore proposals for *MSCA Individual Fellowships*, in which the host is located in an eligible widening country, will be automatically resubmitted to this call in case proposals fail to reach an adequate ranking under MSCA.
- *JPI Urban Europe*: Implements an opening-up strategy of JPI Urban Europe, enlarging and widening participation towards more partners, including EU-13 countries, as fragmented national R&I programmes represent an obstacle for European collaboration. JPI Urban Europe enhances knowledge exchange and capacities to support urban transition towards sustainability in Europe.

5.1.5 Other Horizon 2020 instruments

Next to SEWP-instruments, there are several smaller initiatives integrated into Horizon 2020 during its inception (European Commission, 2011a, 2014c, 2015c, 2017d; European Parliament & European Council, 2013a, 2013b):

- European Institute of Innovation and Technology (EIT): Integrate the knowledge triangle of higher education, research and innovation of the highest standards into Knowledge and Innovation Communities (KICs) to reinforce the Union's innovation capacity. KICs are highly integrated ventures, bringing together higher education institutes, R&T institutes and industry from across the Union into cross-border configurations. By bringing together different partners, the goal is to leverage investments and commitment from public and private actors at national and EU level, in order to optimally tackle high-risk, large-scale challenges. The EIT also strengthens human resources by providing cross-disciplinary, EIT-labelled Master and PhD degrees, intended to emerge as internationally recognised brands of excellence.
- Seal of Excellence (SoE): A high-quality label, awarded to proposals submitted for funding under Horizon 2020, which succeeded in passing all of the stringent selection criteria, but could not be funded under the available call budget. The 'Seal' identifies promising project proposals, providing them opportunities to reach merit funding from alternative public or private sources on regional, national, European or international level. The SoE pilot was launched in 2015 under the SME instrument because project proposals are mostly led by a single SME and address small-scale R&I actions close to the market with territorial impact.

Some instruments do not consider the 'innovation divide' and will therefore be excluded from analysis.

- Science with and for Society (SWAFS): Build effective cooperation between science and society to recruit new talent for science and to pair science with social awareness.
- Joint Research Centre (JRC): Provide independent, evidence-based S&T support for EU policies, allowing a sound assessment of policy options and facilitating consensus between stakeholders and policy makers.
- Euratom: Complements Horizon 2020 in the field of nuclear research and training.

5.2 ESIF policy instruments

Solely considering budget, ESIF massively outweighs Horizon 2020. For the 2014-2020 period, 454.5 billion euro's of the EU budget has been reserved for ESIF, on top of which a Member State contribution of 183.7 billion euro's is expected (European Union, 2017). Large ESIF investments are needed to realise Fund-specific missions of strengthening economic, social and territorial cohesion by

reduce disparities between development levels of various EU regions²⁰, thus contributing to the Europe 2020 strategy for smart, sustainable and inclusive growth. Every European region is able to benefit from ESIF support. Rather than being implemented by the Union itself, responsibility for ESIF is allocated to the Member States and their managing authorities, who are responsible for preparing, implementing, monitoring and evaluating ESIF Partnership Agreements and Operational Programmes (European Commission, 2015a; European Parliament & European Council, 2013c, 2013d, 2013e).

Through *Partnership Agreements* between Member States and the Commission and subsequent *Operational Programmes*, national authorities are required to set out a comprehensive, coherent strategy on how to effectively and efficiently implement ESIF in the 2014-2020 programming period. It ensures an integrated approach to territorial development which ensures coordination and complementarity between ESI Funds, but also with other EU funding instruments, while involving relevant regional and local public authorities, economic and social partners and bodies representing civil society. The Partnership Agreement ensures alignment with the Europe 2020 strategy, as Member States need to specifically describe how each Operational Programme contributes to Europe 2020 objectives. During the preparation of Partnership Agreements and Operational Programmes, Member States also need to ensure *ex-ante conditionalities*²¹ are fulfilled (European Commission, 2015a; European Parliament & European Council, 2013d).

Consistent with the *Partnership Agreement*, each *Operational Programme* includes arrangements to ensure effective, efficient and coordinated implementation of ESI Funds. Each programme defines *priority axes* which contain *specific objectives* with indicators and targets to measure progress towards the achievement of those objectives. To ensure an integrated approach, each *priority axis* may cover one or more categories of regions, one or more ESI Funds and may combine one or multiple investment priorities under one Thematic Objective or, in duly justified cases, combine complementary investment priorities from different Thematic Objectives (European Commission, 2015a; European Parliament & European Council, 2013d).

To effectively target ESIF investments towards interventions that bring the greatest added-value to economic, social and territorial cohesion and thereby smart, sustainable and inclusive growth, the EU established eleven *Thematic Objectives* (TOs)²² based on relevance and whether they can be addressed by other European, national and regional instruments (table 10). TOs are translated into *investment priorities* that are specific to each ESI Fund.

²⁰ Art. 174 TFEU

²¹ Ex-ante conditionalities are a set of legal, policy and institutional requirements laid down by ESIF regulation, which should be fulfilled by Member States before the submission of the Partnership Agreement and Operational Programmes, ensuring they meet the prerequisites necessary for effective ESIF support.

²² Art. 9 Regulation 1303/2013.

The EU gives particular attention to growth-friendly investments like strengthening RTDI (TO1), for which 43.7 billion euro's of the ESI Funds (primarily ERDF) has been reserved, topped with 22 billion euro's from national and regional co-financing (European Union, 2017). Those EU-13 Member States that used ESI Funds as main source for R&I suffered less from national austerity measures that followed the financial crisis (Izsak & Radosevic, 2017). Table 10 shows how TOs can encourage synergies and coordination between different EU policy instruments, making it easier to combine ESIF with Horizon 2020 instruments in a more complementary way.

Europe 2020 goals	Thematic Objectives	Horizon 2020 instruments that correspond to similar objectives
1) Smart Growth	- TO1: Strengthening RTDI - TO2: Enhancing access to and use of quality ICT - TO3: Enhancing the competitiveness of SMEs	- TO1: all of Horizon 2020 - TO2: FET, RI-instrument, LEIT - TO3: Innovation in SMEs, SCs, LEIT, Access to Risk Finance
2) Sustainable Growth	- TO4: Supporting the shift to a low-carbon economy - TO5: Promoting climate change adoption, risk prevention and management - TO6: Preserving and protecting the environment and promoting resource efficiency - TO7: Promoting sustainable transport and removing bottlenecks in key infrastructures	- TO4: SC 2, 3, 4, 5 - TO5: SC 2, 5 - TO6: SC 2, 5 - TO7: SC 4
3) Inclusive Growth	- TO8: Promoting sustainable and quality employment and support labour mobility - TO9: Promoting social inclusion, combating poverty and discrimination - TO10: Investing in education and training for skills and lifelong learning - TO11: Enhancing institutional capacity of public authorities and efficient public administration	- TO8: MSCA, RI, ERA-Chairs, Widening and ERC Fellowships - TO9: SC 6 - TO10: MSCA, RI-instrument, EIT - TO11: Innovation in SMEs, SCs, PSF, NCPs, EIT, SoE
ERDF primarily supports TO1-4 ESF primarily support TO8-11		

Table 10: Thematic Objectives towards achieving Europe 2020 goals of smart, sustainable and inclusive growth
Source: Adapted from European Structural Investment Funds, Official Text and Commentaries (European Commission, 2015a; European Union, 2018)

A *Common Strategic Framework* (CSF) has also been established to provide strategic guidance to Member States and regions for an integrated development approach, taking into account the key territorial challenges and specific national, regional and local contexts. It promotes coherence and consistency among ESI Funds to optimally contribute to social, economic and territorial cohesion, ensure an integrated use of ESI Funds and coordination between ESIF and other relevant Union policies and instruments. The CSF facilitates the preparation of *Partnership Agreements*, which translate CSF elements into the national context. The following tools are offered:

- *Integrated Territorial Investment:* An urban or territorial development strategy aimed at addressing specific territorial challenges, combining ERDF, ESF and CF investments towards more than one priority axis or one or more Operational Programme in a pre-determined territory.

- *Community-led Local Development*: a coherent set of operations focused on specific local or sub-regional areas, designed and implemented by local action groups composed of representatives of local public or private socio-economic interest. Local development strategies take into account local objectives, needs and potential in a bottom-up manner, while taking into account programme priorities at higher level. Operations promote cooperation and networking in the local context.
- *Joint Actions Plans*: enables Member States to implement a (group of) project(s) using a result-based approach towards a predefined goal in line with the specific objectives of Operational Programmes. Output and result indicators agreed upon between Member State and Commission are linked with funding, making it possible to make payments based on achievement levels.

ESIF consists of five funds (European Commission, 2015a; European Parliament & European Council, 2013c, 2013d, 2013e; European Union, 2007):

- *The European Regional Development Funds (ERDF) (€196.4 bil.)*: Finances actions aimed at strengthening economic, social and territorial cohesion in the EU by redressing development imbalances between its regions through sustainable development and structural adjustment in regions whose development is lagging behind²³. Infrastructure plays a big role.
- *The European Social Fund (ESF) (€81.1 bil.)*: Improves employment opportunities throughout Europe by enhancing labour mobility and strengthening Europe's human capital through accessible and high-quality education and training to improve skills²⁴. ESF also combats poverty and promotes social inclusion, non-discrimination, gender equality and equal opportunities.
- *The Cohesion Fund (CF) (€63.4 bil.)*: Funds transport and environment projects in countries whose gross national income per inhabitant is less than 90% of the EU average.
- *The European Agricultural Fund for Rural Development (EAFRD) (€93.4 bil.)*: Focuses on resolving the particular challenges facing EU's rural areas.
- *The European Maritime and Fisheries Funds (EMFF) (€5.7 bil.)*: Helps fishermen to adopt sustainable fishing practices and coastal communities to diversify their economies.

Both EAFRD and EMFF support R&I investments related to their respective fields (e.g. agriculture, food, forestry, fisheries). However, these efforts are relatively small. Infrastructure projects funded by Cohesion Funds are only related to transport and environment and do not cover research infrastructures. For these reasons, these funds are excluded from analysis. ESF and ERDF will be analysed, complementary to 'Smart Specialisation Strategies' (RIS3) (European Commission, 2014b, 2015a; European Parliament & European Council, 2013c, 2013d, 2013e):

²³ Art. 174 & 176 TFEU.

²⁴ Art. 9 & 162 TFEU.

- ERDF: Supports all TOs, but funding is concentrated on investment priorities under TO1-4. The allocation of ERDF resources is concentrated at least 80% in more-developed regions, 60% in transition regions and 50% in less-developed regions, towards two or more of TO1-4²⁵. Following TO1 investment priorities²⁶, ERDF focuses on enhancing investments in R&I infrastructure, equipment and capacities to develop R&I excellence and promoting centres of competence of European interest. ERDF also promotes business investment in R&I and develops links between enterprises, R&D centres and the higher education sector. Finally, activities under the *European Territorial Cooperation* (ETC) goal are supported by financing Interreg, which include sharing facilities and human resources across borders in all regions to strengthen cross-border and interregional cooperation. Other investment priorities fall under TO10: developing training and education infrastructures and TO11: enhancing institutional capacity of public authorities and efficient public administration and services related to ERDF implementation.
- ESF: Primarily focuses on investment priorities within TO8-11, but also supports TO1-4. Allocation of ESF resources will be concentrated at least 80% in more-developed regions, 70% in transition regions and 60% in less-developed regions towards TO8-11. Following the investment priorities under TO1, ESF supports the development of post-graduate studies and entrepreneurial skills, the training of researchers and networking activities and partnerships between higher education institutions, R&I centres and enterprises. ESF also contributes to TO11 by investing in institutional capacity of public authorities and in the efficiency of public administration and public services at national, regional and local level, with a view to reforms, better regulation and good governance. Investment priorities under TO11 are aimed in particular towards less developed regions or Member States eligible for CF support.
- Research and Innovation Smart Specialisation Strategies (RIS3): As ex-ante conditionality for Member States, RIS3 demands the development of national and regional R&I policy strategies towards well-performing R&I systems. RIS3 are based on SWOT analyses, concentrating resources on a limited set of R&I priorities in line with a county's or regions competitive strengths, while also outlining measures to leverage private R&I investments towards those priorities. RIS3 forces national and regional managing authorities to discover and involve relevant innovative and entrepreneurial stakeholders (e.g. universities and other HE institutions, industry and social partners) on national or regional level to create critical mass focused on a region's competitive strengths (Estensoro & Larrea, 2016). This *entrepreneurial discovery process* is an interactive bottom-up approach in which participants from different fields discover new partners

²⁵ The level of ERDF and ESF support depends on each regions position relative to GDP per capita of the EU-27, distinguishing three categories of regions: 1) Less developed regions (< 75% of EU-average), 2) Transition regions (75%-90% of EU-average), 3) More developed regions (> 90% of EU-average).

²⁶ Common output indicators for ERDF support under TO1: 1) Number of new researchers in supported entities, 2) Number of researchers working in improved research infrastructure facilities, 3) Number of enterprises cooperating with research institutions, 4) Private investment matching public support in RDI projects, 5) Number of enterprises supported to introduce new products.

and opportunities for new activities through common interaction and networking, thus integrating fragmented knowledge into clusters, orientating R&I actions towards the needs of the industry and public sector and achieve regional synergies. Additionally, a RIS3 platform improves cross-border visibility of the thematic priority areas among European regions and institutions, allowing for new and stronger transnational linkages between regions with similar priority areas. RIS3 reinforces coordinated strategic programming within the Union, preventing unnecessary overlap of efforts and allow Horizon 2020 and ESIF funds to be used more efficiently.

6. Analysis

Based on the analytical framework matrixes for Horizon 2020-, SEWP- and ESIF-instruments depicted in tables 11,12 and 13, the EU R&I policy mix aimed at achieving widening and excellence is analysed. The matrixes categorise all relevant instruments under their specific types, describe to which policy rationale(s) they respond, which actors they target, with which other instruments they interact and the extent to which they address excellence and/or widening. Many of the policy instruments contain characteristics of different instrument types and multiple policy rationales. Therefore, the most prominent types and rationales are capped in bold.

Horizon 2020	Instrument type	Policy Rationale	Target groups	Interactions	Focus E/W
Excellent Science € 24.441.000.000					
• ERC € 13.094.000.000	Economic	(1) R&I investments (2) R&I infrastructures (4) Transnational cooperation (5) Human resources	Knowledge institutions	ERC Fellowships	(5) Strong E focus
• ERC Fellowships -	Soft	(4) Transnational cooperation (5) Human Resources	Knowledge institutions Governments	ERC	(2) Moderate W focus
• FET € 2.963.000.000	Economic Soft	(1) R&I investments (4) Transnational cooperation	Knowledge institutions Businesses Civil Society Governments	FET Proactive: LEIT & SC FET Proactive HPC: LEIT-ICT & RI-EDI	(4) Moderate E focus
• MSCA € 6.162.000.000	Economic Soft	(4) Transnational cooperation (5) Human resources	Knowledge institutions Businesses Civil Society	MSCA: EIT, Innovation in SMEs, Erasmus+ MSCA IF: Widening Fellowships MSCA Cofund: ESF	(3) Balance E/W
• RIs € 2.488.000.000	Economic Soft	(2) R&I infrastructures (4) Transnational cooperation (5) Human resources	Knowledge institutions Businesses Governments	RI-EDIs: LEIT-ICT & FET Proactive HPC RIs & RPF: ERDF	(3) Balance E/W
Industrial Leadership € 17.015.000.000					
• LEIT € 13.557.000.000	Economic Soft	(1) R&I investments (2) R&I infrastructures (4) Transnational cooperation	Knowledge institutions Businesses	LEIT: FET Proactive & SC LEIT-ICT: FET Proactive HPC & RI-EDI SME instrument: SC & Inn. in SMEs, Access to Risk Finance & COSME LEIT: ESIF	(4) Moderate E focus
• Access to risk finance € 2.842.000.000	Economic	(1) R&I investments	Knowledge institutions Businesses Other (financial intermediaries)	Debt & Equity facilities: SME instrument & COSME Innovation in SMEs: ESIF	(4) Moderate E focus
• Innovation in SMEs € 616.000.000	Economic Soft	(1) R&I investments (3) Regional governance (4) Transnational cooperation (5) Human resources	Businesses (SMEs) Governments Other (investors)	SME instrument: LEIT & SC, Access to risk finance & COSME SME innovation associate pilot: MSCA Innovation for SMEs: SoE	(4) Moderate E focus
Societal Challenges € 29.679.000.000	Economic Soft	(1) R&I investments (2) Transnational cooperation (3) Regional governance	Knowledge institutions Businesses Government Civil society	SC: FET Proactive & LEIT SC6: COST & PSF SME instrument: LEIT & Inn. in SMEs, Access to Risk Finance & COSME SC: ESIF	(4) Moderate E focus
Other H2020 initiatives					
• EIT € 2.711.000.000	Economic	(1) R&I investments (4) Transnational cooperation (5) Human Resources	Knowledge institutions Businesses Government	EIT: MSCA EIT: ESIF	(4) Moderate E focus
• Seal of Excellence -	Soft	(3) Regional Governance	Businesses (SME instrument) Government Other actors (Private banks)	SoE: SME Instrument SoE: ESIF	(2) Moderate W focus

Table 11: Analytical framework matrix for Horizon 2020 policy instruments (initial budget in million EUR)

	Instrument type	Policy Rationale	Target groups	Interactions	Focus E/W
SEWP € 816.000.000					
Teaming € 372.850.000	Economic Soft	(3) Regional Governance (4) Transnational cooperation (5) Human resources	Knowledge institutions Government	ESIF	(2) Moderately W focus
Twinning € 126.240.000	Economic Soft	(4) Transnational cooperation (5) Human resources	Knowledge institutions	ESIF	(2) Moderately W focus
ERA-Chairs € 97.510.000	Economic Soft	(4) Transnational cooperation (5) Human resources	Knowledge institutions	ESIF	(2) Moderately W focus
COST € 156.670.000	Economic Soft	(4) Transnational cooperation	Knowledge institutions	SC6	(1) Strong W focus
PSF € 2.500.000	Soft	(3) Regional governance	Government	SC6	(2) Moderate W focus
NCPs € 2.000.000	Soft	(4) Transnational cooperation (5) Human resources	Knowledge institutions Businesses Government	ESIF	(2) Moderate W focus
Widening Fellowships € 18.000.000	Economic Soft	(4) Transnational cooperation (5) Human resources	Knowledge institutions	MSCA-IF ESIF	(2) Moderately W focus
JPI Urban Europe € 2.750.000	Soft	(4) Transnational cooperation	Governments	ESIF	(2) Moderately W focus

Table 12: Analytical framework matrix for SEWP-instruments

	Instrument type	Policy Rationale	Target groups	Interactions	Focus E/W
ESIF				MSCA, RI-instrument, LEIT, SC, SEWP-instruments, EIT	
• ERDF	Economic	(1) R&I investments (2) R&I infrastructures (3) Regional governance (4) Transnational cooperation	Knowledge institutions Businesses Government Civil Society	RI-instrument, Teaming	(1) Strong W focus
• ESF	Economic	(3) Regional governance (4) Transnational cooperation (5) Human resources	Businesses Government Civil Society	MSCA, ERA-Chair	(1) Strong W focus
• RIS3	Regulatory	(3) Regional governance (4) Transnational cooperation	Knowledge institutions Businesses Government Civil Society		(2) Moderate W focus

Table 13: Analytical framework matrix for ESI Funds and RIS3

6.1 Types of instruments

Both Horizon 2020 and ESIF primarily contain economic instruments, providing EU funding and other types of financial support to beneficiaries. Under Horizon 2020²⁷, funding takes form of grants (reimbursement of a proportion of eligible costs or reimbursement based on unit costs, lump-sums or flat-rates), subsidies, recognition or inducement prizes, procurement (pre-commercial procurement and procurement of innovative solutions) and financial instruments (equity finance, loans, guarantees or other forms of risk-bearing mechanisms). ESI Funds²⁸ provide support in the form of grants, prizes, repayable assistance and financial instruments or a combination thereof. Under Horizon 2020, financial instruments are the main form of funding for activities close to the market (e.g. Access to Risk Finance), whereas ERDF and ESF double the use of financial instruments compared to the previous programming period due to their leverage effect, allowing to attract and combine other public and private resources. Funding under Horizon 2020 and ESIF can also be provided through *Cofund actions*, which supplement individual calls or programmes funded by non-EU entities.

Horizon 2020 also contains softer characteristics through the promotion of and/or participation in public-public or public-private partnerships²⁹, established through voluntary contractual arrangements in which each partner specifies its respective commitment to the development and implementation of joint R&I activities and programmes. Some primarily economic instruments under Horizon 2020³⁰ also contain soft characteristics, often implemented through *Coordination and Support Actions*³¹ (CSAs). SEWP-instruments focused on strengthening cooperation (most of which categorised as CSAs), ERC Visiting Fellowships and the Seal of Excellence are considered to be one of the few primarily soft policy instruments under Horizon 2020. Accepting ERC Visiting Fellows, participating in PSF peer reviews or supporting ‘excellent’ projects identified by the SoE with dedicated national/regional funding schemes are of purely voluntary nature for ERC grantees or national and regional authorities.

Regulatory instruments are not often used under Horizon 2020 or ESIF, mostly being applied indirectly. In cases where R&I results are capable of commercial or industrial exploitation, Horizon 2020 obligates participants owning these results to examine the possibilities of protecting them via IPR. When a participant decides not to protect or abandon protection of results, the Commission may assume ownership of these results to ensure adequate protection. In cases in which IPR protection is

²⁷ Art. 6 Regulation 1290/2013 & Art. 10 Regulation 1291/2013.

²⁸ Art. 66 Regulation 1303/2013.

²⁹ Art. 185 and 187 TFEU.

³⁰ FET, MSCA, RIs, LEIT, Innovation in SMEs, SCs.

³¹ Coordination and Support Actions (CSA): actions that do not cover R&I itself, but primarily consist of accompanying measures: standardisation, dissemination, awareness-rising and communication, networking and coordination, support services, policy dialogues and mutual learning exercises, studies and complementary activities of strategic planning, networking and coordinating between programmes in different countries.

not necessary for exploitation, participants are encouraged to disseminate research results and data (Open Access). RIS3 is the only instrument that can be categorised as regulatory, being an obligatory ex-ante conditionality under TO1, backed by the threat of suspension of interim payments in case of non-fulfilment or non-compliance.

6.2 Policy rationales

Instruments under Horizon 2020 and ESIF each encompass different combinations of the five identified policy rationales, allowing for gaps and overlaps to exist between them.

6.2.1 R&I Investments

In its regulations, the EU strongly expresses its commitment towards achieving the Europe 2020 objectives of smart, sustainable and inclusive growth through the creation of a competitive knowledge economy. As R&I are considered key drivers towards this objective, the EU set itself the goal of increasing its R&D spending in order to attract private investment of up to two thirds of total investments. Leveraging other private or public sources of funding on a risk-sharing basis to address market failures like suboptimal investment levels became a key principle for the Horizon 2020 budget and for financial instruments under ESIF. The EU thereby contributes towards a more socially optimal situation in which 3% of the EU GDP is invested in R&D. Both ESIF and Horizon 2020 ought to be designed and implemented in accordance with *State-aid rules*, which prevent market distortions such as crowding out of private funding, the creation of ineffective market structures or the preservation of ineffective firms.

To prevent market failures and ensure financial commitment within the programme itself, Horizon 2020 established a *Participant Guarantee Fund*. This fund acts as safeguard mechanism, mitigating risks associated with defaulting participants. If a participant defaults, the Commission may transfer amounts due from the *Participant Guarantee Fund* to a project coordinator if the R&I action is still ongoing and the remaining participants agree to implement the action according to the same objectives, ensuring its continuation.

Despite several Horizon 2020 instruments containing elements of systemic rationales³², most of these Horizon 2020 instruments dedicate the majority of their budgets towards the neoclassical rationale, financially supporting high-risk and sometimes large-scale *R&I actions*³³, often leveraging and pooling public and private funding. EU financial support to actions close to the market are expected to attract a larger share of additional funding from other sources, illustrated by the lower maximum

³² ERC Synergy Grant, FET, LEIT, Innovation in SMEs and SCs.

³³ Research and Innovation Actions (RIA): activities aiming to establish new knowledge and/or explore the feasibility of a new or improved technology, product, process, service or solution.

reimbursement rate of Horizon 2020 grants under *Innovation actions*³⁴, being only 70% of total eligible direct costs. Maximum reimbursement rates for *R&I actions*, which are more prominent under Pillar I, may reach up to 100%. One of the most prominent market failures identified by Horizon 2020 is a lack of access to risk finance, to which Horizon 2020 responded by developing a specific neoclassical policy instrument under Pillar II to provide debt and equity finance to reduce uncertainty and risk associated with R&I. The increasing importance of leveraging investments from other sources is illustrated by the rise in risk finance instruments under Horizon 2020, indicating how it prioritises spending with immediate impact on growth and jobs, particularly under Pillar II.

6.2.2 R&I Infrastructures

Horizon 2020 also invests in research infrastructures to conduct R&I. So does the ERC reserve small amounts of additional funding for the purchase of major equipment or access to large facilities, whereas LEIT-ICT supports e-infrastructures by investing in R&I activities aimed at their development. The RI-instrument naturally supports the development of new and existing infrastructures under Horizon 2020 most directly, while surprisingly strongly following systemic policy rationales of transnational cooperation and human resources.

Investments towards the actual construction of R&I infrastructures primarily come from ESIF rather than the RI-instrument. Enhancing R&I infrastructures and capacities is an TO1 investment priority under ERDF³⁵, with the only ex-ante conditionality being prioritisation of investments linked to Union priorities and the ESFRI roadmap. The implementation of ESFRI ensures coordination, complementarity and avoidance of duplication of efforts, identifying the needs of the European scientific community to coherently integrate new infrastructures within the European RI-ecosystem in accordance with the EU objective of balanced territorial development. ESF on the other hand, specifically excludes the purchase of infrastructure as eligible costs³⁶.

6.2.3 Regional Governance

There are only a few Horizon 2020 instruments aimed at strengthening regional governance. So does ‘Innovation in SMEs’ provide small grants for national or regional innovation support agencies to engage in mutual policy learning and exchange good practices to improve the design and implementation of innovation support programme’s for SMEs. Societal Challenges contain CSAs that provide support to Member States to better address governance challenges and implement adequate policy mixes of their own. Some SEWP-instruments also support regional governance to a larger or

³⁴ Innovation Actions (IA): activities aiming at producing plans or designs for new, altered or improved products, processes or services. It may include prototyping, testing, demonstrating, piloting, large-scale product validation and market replication of innovations not taken up by the market due to market failures.

³⁵ Art. 5.1a Regulation 1301/2013.

³⁶ Art. 13.4 Regulation 1304/2013.

lesser extent. So are applicants under the first phase of Teaming obligated to produce a business plan, which demonstrates the potential of the future CoE to develop new or connect with existing regional clusters. PSF is introduced explicitly to support national and regional authorities to improve the design, implementation and evaluation of national/regional R&I strategies, programmes and institutions.

Regional governance is promoted throughout ESIF under TO11, aiming to enhance institutional capacity of public authorities for efficient public administration and ensure better regulation and good governance. Through the *Common Strategic Framework, Partnership Agreements* and *Operational Programmes*, guidance is provided to Member States to set-up a comprehensive and coherent strategy for optimal ESIF implementation, involving relevant national, regional and local public authorities and stakeholders. Under CSF, Member States are requested to conduct place-based analyses of the development potential, capacity and major challenges at national, regional or local level when preparing Partnership Agreements and Programmes. *Community-led local development* promotes cooperation and networking between local and regional authorities, economic and social partners and organisations representing civil society, resulting in development strategies providing tailor-made solutions to the challenges of specific territories, taking into account local needs. ESIF may also be used to provide technical assistance, supporting actions involving the preparation, management, monitoring, evaluation, information and communication, networking, audit and control of the Funds.

SoE supports national and regional funding authorities to identify promising and high-impact project proposals from innovative companies. By making their potential visible to national and regional authorities, SoE allows innovative companies to enhance their regional knowledge economy in line with the smart specialisation strategies of that region. RIS3 remains the most important instrument supporting regional governance under ESIF, providing national and regional authorities with the tools to identify their region's competitive strengths and discover and bring together relevant innovative and entrepreneurial stakeholders, creating critical mass, integrating fragmented knowledge and achieve regional synergies.

6.2.4 Transnational Cooperation

Next to the Europe 2020 strategy, another EU objective early indicated in Horizon 2020 regulations has been the achievement of an integrated European Research Area (ERA) in which researchers, scientific knowledge and technology can circulate freely across borders. To achieve this, the EU promotes transnational R&I cooperation between partners throughout the Union. It is impossible for Member States to sufficiently strengthen cooperation and coordination of R&I efforts across the Union by themselves, thereby making EU intervention a necessity, following the principle of subsidiarity. Through its contributions toward realising the ERA, Horizon 2020 strengthens synergies and

coordination between European, national and regional R&I programmes, thereby avoiding unnecessary duplication of efforts. Horizon 2020 also promotes R&I cooperation with third countries and international organisations through joint actions and large-scale flagship initiatives in priority areas of common interest in line with Europe 2020 objectives and Societal Challenges.

Being an EU programme, it is unsurprising that Horizon 2020 has a strong focus on transnational cooperation. So does the challenge based approach of Societal Challenges not only bring together resources, but also knowledge across fields, disciplines and borders, achieving critical mass to address transnational challenges that cannot be addressed by Member States alone. Almost all Horizon 2020 instruments are implemented through transnational collaborative projects³⁷, complemented by supplementary programmes: 1) collaboration between Member States without EU participation, 2) EU participation and/or financial support in public-public partnerships undertaken by certain Member States, implemented through Joint Programme Initiatives (JPIs), 3) EU participation and/or financial support in public-private partnerships, implemented by Joint Undertakings, including Joint Technology Initiatives (JTIs). While most Horizon 2020 instruments contain systemic elements, the majority are still neoclassical in nature, devoting the majority of their budget towards funding R&I.

Despite not containing transnational cooperation requirements³⁸, CSAs also strengthen transnational cooperation through networking, coordination and mutual learning activities between programmes in different countries. Even the ERC, primarily aimed at individual investigators, strengthens transnational cooperation through its Synergy Grants, which aim to jointly and interdisciplinary address ambitious research problems impossible to achieve by individual action, bringing together knowledge and skills from different institutions, sectors and/or countries. The RI-instrument surprisingly seems most strongly focused towards transnational cooperation and coordination, not providing funding for construction costs, but rather supporting design studies, integration of RIs into the European RI-landscape and networking through joint research activities between key national and regional research infrastructures within and outside the EU.

Most dedicated to the rationale of transnational cooperation are SEWP-instruments, primarily Teaming, Twinning, COST and JPI Urban Europe. Teaming and Twinning build partnerships and networks between internationally leading research institutions and partner institutions from Widening countries, opening up the ‘old boys’ network’. For both Teaming and Twinning, it should be explained

³⁷ Art. 9(1) Regulation 1290/2013 and WP 2018-2020 Annex C: The minimum condition for participation in Horizon 2020 actions are that at least three legal entities shall participate, each established in a different Member State or Associated Country. All three legal entities must be independent of each other.

³⁸ Art. 9(3) Reg. 1290/2013: By way of derogation, the minimum condition shall be the participation of one legal entity in the case of ERC frontier research actions, MSCA-IF, SME instrument, CSAs and Co-fund actions which are not EJP and ERA-NET.

how leading scientific institutions in the partnership contribute in terms of access provision to new research avenues, as well as increased mobility of qualified scientists. COST also promotes cooperation amongst researchers in Europe by setting up networking activities. The opening-up of JPI Urban Europe also widens participation towards more European and third country partners, aligning (inter)national and European R&I programmes to enhance knowledge, capabilities and build critical mass. The NCP network facilitates transnational cooperation between NCPs via joint workshops, benchmarking and cross-border brokerage events, letting (in particular less-experienced) NCPs acquire know-how accumulated in other countries, thereby raising the general standard of support to programme applicants.

ERDF promotes territorial cooperation primarily through European Territorial Cooperation (Interreg), whereas ESF increases the maximum co-financing rate by 10 percent points, where the whole of a priority axis is dedicated to transnational cooperation. Within *Operational Programmes*, Member States shall make use of the possibility of carrying out interregional R&I actions with research institutions or clusters located in different Member States emanating from joint smart specialisation strategies.

6.2.5 Human Resources

To achieve Europe 2020 objectives, the EU deems it of great importance to make full use of its human resources. Therefore Horizon 2020 should contribute towards achieving the ERA, encouraging the conditions to help European researchers remain in or return to Europe and make Europe a more attractive destination for the world's best researchers to develop their research careers. In order to achieve the ERA, the EU should, in line with the promotion of international cooperation, contribute to cross-border and cross-sectoral mobility of researchers in the Union. Increased mobility of highly qualified people offers great opportunities to address issues associated with ensuring European competitiveness, such as skills shortage and demographic change. Additionally to strengthen human resources, education and training opportunities should also be promoted.

By setting an inspirational target for European frontier research, the ERC raise Europe's profile to attract and retain the world's best researchers, enabling to draw from a larger pool of talent than would be the case on national level. The prestige of hosting an ERC-grant holder will enhance competition between European universities and research organisations to create the most attractive conditions for top-researchers. The ERC Visiting Fellowship Programme increases mobility for researchers in those countries with low international exposure. The RI-instrument strengthens Europe's human resource base through the provision of world-class training for a new generation of researchers and engineers.

The Horizon 2020 instrument most strongly shaped by the human resources rationale is MSCA, providing joint research training and/or doctoral programmes (ITN), promoting mobility through individual fellowships (IF) and encouraging the exchange of R&I staff (RISE), thereby improving career prospects. However, through their promotion of mobility, MSCA also indirectly contributes to the systemic rationale of transnational cooperation. International mobility is key for sustainable cooperation between academics, research institutions and businesses across countries, fostering collaborative thinking, knowledge sharing and occasionally the development of new international or intersectoral collaborative networks between participating institutions. So does MSCA-ITN and MSCA-RISE exploit complementary competences of its participants through networking activities, workshops and conferences.

Some of the SEWP-instruments seem to follow the rationale of strengthening human resources to a smaller or larger extent. Teaming and Twinning contribute to the mobility of qualified scientists between participants, enforcing knowledge exchange, mutual learning and the establishment of new partnerships. So does Twinning provide staff exchanges, expert visits and joint summer school activities. However, ERA-Chairs and Widening Fellowships are most dedicated to strengthen human resources by creating the appropriate conditions for high quality researchers and research managers to move to EU-13 institutions willing to achieve excellence through research mobility.

ESIF, in particular ESF, strongly supports TO8: promoting employment and supporting transnational labour mobility. ESF investments also support TO10 to improve quality, efficiency and accessibility of tertiary education and training with a view of increasing participation, especially for disadvantaged groups, thereby developing and upgrading the knowledge, competences and skills of the workforce. Under TO1, ESF helps develop post-graduate studies and entrepreneurial skills, the training of researchers and networking activities and partnerships between HE institutions, R&T centres and enterprises. ERDF can contribute to education and training by developing education and training infrastructures.

6.3 Target actors

Horizon 2020 is aimed at a broad range of actors, aiming to attract and bring together researchers, innovators, universities, research institutions, technology centres, entrepreneurs, industry, businesses, in particular SMEs, banks, funding agencies, national/regional authorities, civil society organisations and users. For this reason, Advisory groups involved with the design, implementation and evaluation of the programme consist of a wide variety of independent experts representing different stakeholders from research, industry, civil society and government, providing necessary interdisciplinary and cross-sectoral perspectives. Horizon 2020 should in particular recognise the unique role of universities as institutions of excellence in education, research and innovation.

As Horizon 2020 is the first FP to include innovation, a standout feature is the promotion of private sector participation under the Industrial Leadership pillar. So does LEIT consider the involvement of industrial participants as crucial in maximising the expected impacts of its actions. ‘Access to Risk Finance’ primarily focuses on firms (e.g. SMEs, early-stage enterprises and small, medium or large mid-caps), while also providing risk finance for universities and R&T organisations. The RI-instrument facilitates the industrial use of research infrastructures for innovation. SME participation in particular is encouraged as cross cutting issue throughout the programme, with SMEs facing barriers in access to funding and risk finance, experiencing a shortage of (management) skills and weak cooperation networks. To address these barriers, Horizon 2020 devotes Innovation in SMEs to fund SME innovation actions, attract SME Innovation Associates and provide intermediate support for EEN and Eurostars. ESI Funds are also SME-oriented, devoting TO3 towards enhancing the competitiveness of SMEs.

Horizon 2020 also aims to deepen the relationship between science and society and reinforce public confidence by fostering informed engagement of citizens and civil society. Horizon 2020 and ESIF support communication activities towards the public to raise awareness of EU-funded projects. Governments are often strongly involved in public-public partnerships (JPIs), represented through public sector bodies or bodies with a public service mission. ESIF also involves governments under TO11: enhancing institutional capacity of public authorities for efficient public administration.

6.4 Synergies within Horizon 2020

Horizon 2020 is strongly focused on developing synergies, both internally and externally. Horizon 2020 will provide a seamless approach across all of its constituent parts, promoting the exchange of ideas and perspectives. The seamless implementation of the three pillars allows participants to move between different parts, fostering interactions between different instruments, while avoiding duplication of efforts and reinforce their combined impact.

Horizon 2020 allows for the combination of different instruments. An example is COST receiving EU funding from two different WP parts (SC6 and SEWP), which are being implemented and managed in an integrated manner. SC6: Inclusive Societies funds the reinforcement of existing COST networking activities, whereas SEWP focuses on funding COST widening activities that foster inclusive R&I by bringing together outstanding, but not well-integrated researchers. SC6 also funds the setting-up of the PSF and part of its activities together with SEWP.

The SME instrument illustrates how to an EU integrated approach can strengthen internal synergies towards the objective of increased SME participation. The SME instrument is initially implemented under ‘Innovation in SMEs’, but applied and funded by the combined budget of LEIT and SCs, whose

target is to allocate a minimum of 20% of their total budget towards SMEs. The SME instrument shall therefore also take LEIT and SC objectives into account. Horizon 2020 regulations also emphasise that the Commission should ensure sufficient complementarities between the third phase of SME instrument and the financial instruments under ‘Access to risk finance’. Business acceleration services provided by the SME instrument can increase investment readiness and provide assistance in applying for further EU risk finance, which are needed to reinforce the initiatives provided under the SME-instrument. Both the Equity facility and SME-related component of the Debt facility of ‘Access to risk finance’ are implemented as part of two financial instruments that provide support to those SMEs in conjunction with equity and debt facilities under the EU programme for the Competitiveness of Small and Medium-sized Enterprises (COSME).

Other mechanisms also exist in order to strengthen internal synergies and ensure an integrated Horizon 2020 approach. So does FET provide support to LEIT-KETs at lower Technology Readiness Levels (TRLs³⁹), which in turn provide financial support for the application of these enabling technologies in line with Societal Challenges. A more specific example is FET Proactive on High Performance Computing (HPC) being developed in synergies with LEIT-ICT and RI-EDI. To improve coordination and governance of European research training, mobility and career development, MSCA actions are developed in close synergy with the ERASMUS+ programme, RI-instrument and EIT. Even ‘Innovation in SMEs’ complements MSCA through its enterprise-led Innovation Associate pilot, providing additional work opportunities for experienced researchers in SMEs. The Widening Fellowship strengthens internal synergies by automatically resubmitting non-competitive MSCA-IF proposals from widening institutions under SEWP calls. Proposals under the Widening Fellowships must fulfil all the admissibility and eligibility conditions of MSCA-IF and pass all thresholds⁴⁰ for that call. Proposals are ranked according to the scores received in the MSCA-IF evaluation.

The internal Horizon 2020 interactions have been summarised and categorised according to the classification provided by Flanagan et.al. (2011), in table 14

³⁹ TRLs are a method of estimating a technological maturity.

⁴⁰ A score of 70% or higher, yet failing to reach an adequate place in the ranking to be funded under MSCA.

Policy instruments involved		Types of interaction
ERC	ERC Fellowships	(1) Similar instruments
SC6	COST	(3) Different instruments targeting different actors
Innovation in SMEs & LEIT & SCs	Access to Risk Finance & COSME	(2) Different instruments targeting the same actors
FET Proactive	LEIT & SCs	(3) Different instruments targeting different actors
FET Proactive HPC	LEIT-ICT & RI-EDI	(3) Different instruments targeting different actors
MSCA	EIT & RIs & Innovation in SMEs & ERASMUS+	(3) Different instruments targeting different actors
MSCA-IF	Widening Fellowships	(1) Similar instruments
SoE	SME Instrument	(2) Different instruments targeting the same actors

Table 14: Categorisation of interactions within Horizon 2020

Source: (Flanagan et al., 2011)

6.5 Focus on excellence and widening

Despite Horizon 2020 instruments traditionally having a stronger focus on excellence, widening elements have started to find their way into the programme. This is not only indicated by the establishment of SEWP-instruments, but also other small initiatives introduced in later stages of the programming period, like SoE and ERC Visiting Fellowships.

6.3.1 Excellence

As Horizon 2020 contributes to the Europe 2020 objectives, the programme strongly focuses on strengthening the external global competitiveness of the European economy and industry, through the promotion of world-class excellence in European R&I. While key terms of excellence, world-class and quality are most prevalent amongst policy instruments under Pillar I of ‘Excellent Science’, they can also be found under other Horizon 2020 instruments, referring to excellent, world-class or high quality R&I, S&T, proposals, researchers, investigators, innovators, enterprises, companies, industry, institutions, infrastructures, roadmaps, networks, ecosystems, cooperation, collaboration, education and training.

These key terms best fit under the interpretation of Threshold excellence, yet key terms for Zero-sum excellence (e.g. ‘the best’) have also been prevalent in Horizon 2020 in the context of attracting and the best researchers or other players to Horizon 2020 participation. Zero-sum excellence is reflected in Horizon 2020 through internally competitive calls for proposals, in which each proposal under is evaluated by independent experts appointed by the Commission or funding body, following which proposals are ranked according to the evaluation results, in which only the best proposals are selected based on that ranking without any consideration of geographical distribution. While SEWP-instruments require specific geographical eligibility conditions, they are still evaluated according to a similar process of evaluation, ranking and priority order.

The evaluation and selection process of proposals is based on three award criteria, being: 1) Excellence, 2) Impact and, 3) Quality and efficiency of implementation. Award criteria seem to differ for each type of action, depicted in Annex III. Evaluation scores will be awarded out of 5 for each criteria. The thresholds for individual criteria is 3, whereas the overall threshold applying the sum of the three individual scores, will be 10. For proposals awarded the same score within a ranked list, a priority order is determined. Starting with the highest-scored group and continuing in descending order, proposals that address (sub-)topics not covered by more highly-ranked proposals, will have highest priority. If both proposals have (sub-)topic not covered by higher-ranked proposals, proposals shall be prioritised according to the scores for the excellence criterion, followed by impact scores if excellence scores are equal.

Some Horizon 2020 policy instruments contain exceptions to the standard application of the award criteria, using different weighting and thresholds. So may Impact be given a stronger weighting of 1,5 in proposals for Innovation Actions, whereas the excellence criterion is given a stronger weighting and higher threshold under FET R&I Actions. MSCA actions seem to have a threshold of 70% for all award criteria, giving the strongest weighting to excellence. However, one the most stand-out exception is excellence as sole evaluation criterion for ERC grants⁴¹, in which only the most exceptional proposals are funded after extremely competitive calls. Additionally, ERC applicants should be able to demonstrate a track record of past achievements, which include indicators for research excellence like publications in leading peer-reviewed international journals, granted patents, awards or prizes. Due to the high competitiveness of ERC calls, the Scientific Council has also put restrictions on applications by excluding applicant proposals which were of insufficient quality to fully meet the ERC's excellence criterion in the previous year.

6.3.2 Widening

Horizon 2020 plays a central role in the delivery of the Europe 2020 strategy, not only by boosting competitiveness, but also by strengthening economic, social and territorial cohesion. Horizon 2020 acknowledges the persisting R&I divide between innovation leaders and modest innovators within the Union. Widening participation is identified as a cross-cutting issue within Horizon 2020 regulations⁴² and policy documents, repeatedly emphasising the programme should be open to a wide range of participants from across Europe and beyond, in particular first-time applicants. The RI-instrument ensures wider access for all European researchers to research infrastructures and data, while Access to Risk Finance contains the Innovfin Emerging Innovators facility, providing risk finance for

⁴¹ Except for ERC Proof of Concept grants.

⁴² Art. 14(i) Reg. 1291/2013.

beneficiaries from modest and moderate innovator countries⁴³ that received limited support under Innovfin thus far.

So while claiming to have a strong focus on excellence without any consideration of geographical distribution, Horizon 2020 still enables widening elements to exist within the programme. Due to their specific policy requirements, scope and perspective, SEWP-instruments necessitate specific geographical eligibility conditions in order to maximise their value and impact. SEWP-instruments solely target those applicant organisations which are low performing in terms of research excellence⁴⁴. When given the same score, Teaming prioritises proposals with coordinators from Widening Countries, whereas JPI Urban Europe expects a relevant geographical spread of European R&I resources. By allowing these specific geographical eligibility conditions to exist, the EU contradicts itself by making SEWP-instruments an exception to the focus on excellence without geographical considerations.

Geographical distribution of SEWP resources is similar to the geographical distribution of ESIF, as the territory of Widening Countries identified by SEWP largely overlaps with the territory of less-developed regions, which receive 50% of ERDF, ESF and CF resources. Transition regions and more-developed regions only receive 10% and 15% respectively, despite containing the majority of the population. As all ESI Funds contain many references towards supporting disadvantaged groups to exploit their potential, reducing disparities, tackling exclusion and strengthening territorial cohesion, there is strong evidence that all ESI Funds are heavily widening oriented.

Horizon 2020 pursues widening through three broad initiatives implemented throughout the programme. Firstly, Horizon 2020 aims to enhance accessibility for all participants by making simplification a central aim, being fully reflected in its design, implementation and its rules for participation, exploitation, dissemination and financial management. Simplification efforts reduce administrative costs and simplify financial requirements, which act as barriers for participation. This will mainly benefit participants like EU-13 institutions and SMEs, who lack resources and experience to cope with the high administrative burden.

Secondly, Horizon 2020 aims to enhance participation of EU-13 institutions by ensuring an appropriate balance between smaller and larger collaborative projects, especially under LEIT and Societal Challenges. As newcomers are less likely to participate in large actions or coordinate them

⁴³ Based on position European Innovation Scoreboard (EIS).

⁴⁴ Widening Countries ranking below the corrective threshold of 70% of the EU-27 average of the Composite Indicator for Research Excellence.

due to lack of experience, an increase in smaller collaborative projects will better facilitate access for newer EU-13 institutions with less experience.

Thirdly, the EU most concretely pursues widening and the reduction of the R&I divide through small measures to facilitate access to Horizon 2020 funding for low-performing R&D Member States and regions. Under Horizon 2020, widening is primarily pursued through dispersed soft policy instruments. The SEWP initiatives, the ERC Visiting Fellowships and SoE are considered to be the policy instruments most strongly oriented towards widening. Each of these measures has been identified as soft policy instrument and/or CSA, following systemic policy rationales of transnational cooperation, coordination and information exchange, contributing towards the realisation of the ERA. These results indicate a possible correlation between the introduction of softer policy instruments, systemic rationales and the level of commitment towards widening within Horizon 2020.

Specific *market failures* or *systemic problems* in Europe act as barriers preventing EU-13 institutions from participating, successfully competing and obtaining competitive funding within Horizon 2020. To successfully realise widening, all different type of barriers need to be collectively addressed. Analysing the analytical framework matrix, a pattern becomes apparent where small widening-oriented instruments under Horizon 2020 primarily address *systemic problems*, whereas ESIF instruments are more focused on addressing *market failures*:

- 1) *Lack of R&I capacity*: The RI-instrument contributes to widening by addressing capacity barriers, supporting the development of Regional Partner Facilities⁴⁵ and ensuring their wide accessibility. However only ERDF resources are allowed to be used for the construction of national and regional research infrastructures, thereby building R&I capacity.
- 2) *Networking deficiencies*: Horizon 2020 participation is increasingly dependent on networking and staying connected with partners across the EU. Teaming, Twinning, COST and JPI Europe primarily address collaboration and networking deficiencies by facilitating access for EU-13 institutions to previously closed networks, thus improving their R&I culture and raising their research profile. COST is most strongly widening oriented, spending half its budget to the benefit of participants from Widening Countries and containing eligibility conditions demanding at least half of participants reside in Widening Countries. Whereas Teaming and Twinning often support pre-existing partnerships between already well-networked EU-13 institutions and internationally leading counterparts, COST encourages the development of entirely new partnerships involving researchers and innovators outside existing European and international networks. Through its

⁴⁵ A Regional Partner Facility is a research infrastructure of national or regional importance in terms of socio-economic returns, training and potential for attracting researchers, that is recognised as a partner to a pan-European ESFRI or other world-class research infrastructures.

openness and inclusiveness policies, COST plays a significant role in bringing new partners from less research-intensive countries into contact with excellent researchers elsewhere in Europe.

- 3) *Lack of quality human resources*: Widening fellowships and ERA-Chairs primarily address human resource barriers through the promotion of mobility, but also training. So do Widening fellowships provide EU-13 institutions under MSCA-IF additional opportunities to attract human resources from abroad to boost R&I capabilities, in particular encouraging the return and reintegration of established European researchers to their country of origin. ERA-Chairs also support EU-13 institutions with insufficient financial resources to attract and maintain high quality human resources. ESF supports EU-13 institutions through the development and improvement of higher education, post-graduate studies and entrepreneurial skills, the training of researchers and labour mobility.
- 4) *Inefficient national or regional R&I systems and governance*: PSF has been introduced to provide tailored support and high-level expertise to national and regional authorities in low-performing Member States, to improve the design, implementation and evaluation of their R&I systems, policies, programmes and institutions.
- 5) *Lack of experience*: By providing technical assistance and practical guidance to all entities under Horizon 2020, NCPs lower the entry barriers faced by newcomers. NCPs are therefore in particularly important for the EU-13. Facilitating transnational cooperation between national NCPs and strengthening the network helps less-experienced NCPs from EU-13 countries to accumulate knowledge from other countries to bridge the knowledge gap. This leads to improved and professionalised services to EU-13 applicants with less experience, in turn contributing to the widening of access to Horizon 2020 funding opportunities. The RI-instrument also fosters cooperation between NCPs for research infrastructures, to which a substantial component of activities is devoted to helping NCPs in countries with low levels of participation. ESIF can also be used to expand advisory services for potential Horizon 2020 participants.

Despite their value for widening, the Commission is cautious in its commitment towards SEWP, allowing itself the possibility to revise budget allocations towards SEWP to respond to unforeseen situations or new developments⁴⁶. Widening under Horizon 2020 is mostly pursued through smaller, softer policy instruments that follow systemic rationales and do not put too much pressure on the budget intended for excellent R&I. The EU emphasises that a greater commitment by low-performing Member States is instrumental to exploit their R&I potential and close the R&I divide.

So are the implementation costs of widening oriented ERC Visiting Fellowships expected to be fully covered by national and/or regional authorities, thereby protecting ERC budget. SoE protects the

⁴⁶ Art. 6.5 Regulation 1291/2013.

Horizon 2020 budget by increasing access to alternative funding sources for those proposals not considered among the best, thereby ensuring focus on Zero-sum Excellence. Yet, the ‘Seal’ also acknowledges the value of other promising proposals and participants that passed a certain quality threshold and their right to be funded. SoE thereby contains a widening element, implying Horizon 2020 should fund less-competitive, participants and proposals in the situation sufficient budget is present. By providing alternative and additional chances to be funded, SoE also acts as an incentive to participate, in particular for weaker participants discouraged by the low success rates. In Horizon 2020, there should be a reasonable chance of success to ensure researchers time spent on proposals is not wasted or perceived as such.

Whereas Horizon 2020 emphasises increased national R&I commitment towards widening, ESIF puts more emphasis on EU support for disadvantaged regions in line with strengthening economic, social and territorial cohesion. ESI Funds believe territorial cohesion cannot be achieved by Member States alone due to disparities between development levels of various regions and limits on national or regional financial resources. EU action is therefore necessary in accordance with the principle of subsidiarity. The ERDF and ESF focus on disadvantaged groups is illustrated by their differentiated approach to maximum co-funding rates. Whereas maximum co-funding of eligible costs in less-developed regions lies between 80-85%, transition regions receive maximum co-funding between 60-80% and more-developed regions are only entitled to 50% co-funding. Less-developed regions, already receiving the largest ESIF share, can receive an even larger amount if they are located within a Member State with lower relative prosperity⁴⁷. However, the principle of additionality stipulates that ESIF financial allocations may not result in a reduction of national structural expenditure in regions concerned, but should be in addition to national spending. The Commission may carry out a financial correction in cases of non-compliance where a Member State has not maintained the reference level of equivalent structural expenditure.

Many widening elements within Horizon 2020 are not solely aimed at new EU-13 participants as disadvantaged group. So is Horizon 2020 concerned with the engagement of civil society, integrating the gender dimension, combating discrimination and ensuring adequate participation and inclusion of several (disadvantaged) groups, including researchers with disabilities, the private sector (in particular SMEs), young researchers, third countries and international organisations. Societal Challenge 6: ‘Inclusive, Innovative and Reflective societies’ is solely devoted towards addressing social exclusion of specific social groups and communities within civil society, acknowledging European diversity in

⁴⁷ Regulation 1303/2013 Annex VII: Allocation method of less-developed regions is determined through an absolute amount calculated by multiplying the population of the region concerned with the difference between that regions GDP per capita compared to the EU-27 average. This is followed by the application of a percentage to that absolute amount graduated to reflect the relative prosperity of the Member State in which the eligible regions is situated compared to the EU-27 average.

culture, regions and socio-economic settings as strength and source for innovation to address challenges. All ESI Funds, ESF in particular, also strengthen social inclusion of marginalised groups, promote equal opportunities, combat poverty, promote gender equality and take appropriate steps to prevent discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation throughout the preparation, design and implementation and evaluation of its programmes, in particular in relation to access to funding.

7. Conclusions and Recommendations

Based on the findings from the analytical framework matrixes, this chapter concludes by summarising the most important findings to answer each of the three sub-questions and thereby the main research question. The chapter concludes with a reflection on the strengths and weaknesses of this research, providing guidelines for future research.

7.1 Answering sub-questions

Based on academic and policy literature, this research developed broad conceptualisations for excellence and widening applicable to the EU R&I policy context to measure the extent in which each policy instrument is dedicated towards both objectives. These policy instruments are further analysed within an analytical framework, developed based on ‘policy mix’ literature. The framework analyses each policy instrument by categorising them under different types, examining to which policy rationales they primarily respond, towards which actors they are targeted and with which other instruments they interact. The results summarised three analytical framework matrixes help to better understand EU R&I policy.

7.1.1 Which conceptualisations and operationalisations of ‘excellence’ and ‘widening’ are applicable within the EU R&I policy context?

Both concepts of excellence and widening are surrounded by ambiguity in the EU R&I policy context. Whereas excellence is subjectively interpreted by different stakeholders, widening has only recently been imported from education policy into EU R&I policy without being fully fleshed out. To deal with this ambiguity, this research developed broad, multidimensional conceptualisations, covering as many characteristics as possible when measuring them.

The conceptualisation of excellence covers multiple dimensions, considering both intrinsic quality (*Threshold excellence*) emphasised by EU-13 stakeholders and comparative superiority (*Zero-sum excellence*) emphasised by EU-15 stakeholders and the majority of EU institutions. Inspired by interpretations from education policy, the widening concept is based on principles of equity and social justice, aiming to promote more diverse participation by increasing openness, accessibility and inclusion, supporting disadvantaged groups with potential to catch-up by breaking down barriers, thereby reducing disparities and strengthening cohesion. To keep focus on our research questions, the widening concept is only applied to contexts with EU-13 participants being the disadvantaged group, thereby excluding widening interpretations that consider SMEs, young or female researchers and third country participants as disadvantaged groups.

The EU is partly responsible for the ambiguity surrounding the widening and excellence concepts. With strong conceptual consensus lacking among EU institutions, stakeholders are provided the possibility to adopt subjective interpretations which best serve their interest. While the EU seems to favour the Zero-sum interpretation of excellence, it also allows small elements of Threshold excellence to exist under Horizon 2020 to justify the small widening elements within the programme. This research suggests the EU should develop a more comprehensive and concrete conceptualisation of both concepts. Whereas widening needs to be developed in more detail for the EU R&I policy context, the EU needs to consider whether to fully commit to the Zero-sum interpretation of excellence or develop a more comprehensive conceptualisation if it wants to make room for widening elements.

7.1.2 How can the EU R&I policy system be defined in terms of policy domains, policy instruments, policy rationales and target actors in regards to achieving ‘excellence’ and ‘widening’?

Over the years, R&I policy has undergone heavy growth and evolution, going beyond traditional goals to tackle broader policy objectives. To realise these objectives, R&I policy has become increasingly complex, developing multi-level governance and becoming more interconnected with other policy domains. Different policy instruments from different policy levels and domains, following different policy rationales and targeted at different actors now increasingly interact with each other to achieve similar objectives. The increasing complexity and interconnectivity of R&I policy is illustrated by the widening issue. The desire of the EU to address increasingly broad policy objectives led to the development of the Europe 2020 Strategy, simultaneously pursuing both smart and inclusive economic growth. To achieve this goal, the EU needs to enhance both global competitiveness through increased R&I excellence, as well as strengthen territorial cohesion through widening participation. This has led to increased interactions between the EU policy domains of R&I and cohesion policy, illustrated by the introduction of SEWP in Horizon 2020 and the development of ESIF TO1: strengthening RTDI.

The analytical framework matrixes illustrate that despite the introduction of SEWP-instruments, the majority of Horizon 2020 instruments are still primarily excellence oriented. Most if these policy instruments can be categorised as economic instruments, primarily following neoclassical rationales by investing in R&I or research infrastructures, thereby leveraging and pooling resources from other public or private sources. Widening on the other hand, is primarily pursued under Horizon 2020 through small-scale, soft policy instruments, like SEWP-instruments, the Seal of Excellence and ERC Visiting Fellowships, which do not or barely affect the budget intended for excellent R&I. This might indicate that the EU is not fully committed to pursue widening participation under the EU R&I policy domain due to its controversial nature, strongly emphasising the necessity of increased national R&I investments and stronger commitment from the EU-13 to fully realise widening.

In addition to being soft rather than economic, widening-oriented instruments under Horizon 2020 also deviate from most other Horizon 2020 instruments by following systemic rather than neoclassical rationales, focussing on improving regional governance, strengthening transnational cooperation and developing human resources. A diverse set of barriers⁴⁸ prevent EU-13 institutions to successfully participate in Horizon 2020 calls, which need to be addressed through a comprehensive and diverse set of policy instruments following different policy rationales. The analytical framework indicates that the newly introduced SEWP-instruments, SoE and ERC Fellowships fill gaps in the EU R&I policy mix towards achieving widening by addressing barriers to EU-13 participation related to human resources⁴⁹, networking⁵⁰, governance⁵¹ and experience⁵², which have been not addressed before on EU level, introducing systemic policy rationales into the Horizon 2020 programme.

While economic ESIF instruments are also strongly widening-oriented, they primarily follow neoclassical rationales, addressing *market failures* requiring large amounts of resources. So can ERDF funds be used to finance otherwise unaffordable research infrastructures. ESIF addresses capacity barriers for EU-13 institutions, which are unable to be addressed by small-scale widening instruments under the R&I policy domain due to a lack of budget commitment. Using ESIF as alternative funding source ensures committed R&I investments on the long-term amongst the EU-13. While increased national investment from the EU-13 to close the R&I divide are recommended, the inefficiency of those investments might not lead to higher participation, while potential economic crises might abolish all progress made in years prior. However, EU-13 countries using ESIF as main source for R&I have suffered less from national austerity measures following the financial crisis (Izsak & Radosevic, 2017). ESIF also helps increase the efficiency of national investments, requiring national authorities to set out a comprehensive, coherent strategy for its implementation through the Common Strategic Framework, Partnership Agreements, Operational Programmes and most importantly: RIS3.

The analysis of the EU R&I policy mix indicates that a comprehensive EU approach exists towards achieving widening. The soft, systemic, policy instruments under Horizon 2020 strongly complement the economic, neoclassical policy instruments under ESIF in their pursuit of widening, each addressing a different set of barriers for EU-13 participation. To maintain this comprehensive package, continuation of small widening initiatives under Horizon 2020 is therefore advised despite their controversy.

⁴⁸ 1) Lack of R&I capacity, 2) Networking deficiencies, 3) Lack of quality human resources, 4) Inefficient national or regional R&I systems and governance, 5) Lack of experience.

⁴⁹ ERC Visiting Fellowships, ERA-Chairs, Widening Fellowships.

⁵⁰ Teaming, Twinning, COST, JPI Urban Europe.

⁵¹ Seal of Excellence and PSF.

⁵² Seal of Excellence, NCPs.

7.1.3 Which gaps, overlaps, complementarities and tensions exist within the interactions between different policy instruments under the current EU R&I policy mix in regards to achieving ‘excellence’ and ‘widening’?

The identified interactions within Horizon 2020 provide a negative message towards the position of widening elements in the programme. Interactions between SEWP-instruments and the rest of the programme illustrate tensions in the Horizon 2020 policy mix in regards to achieving widening and excellence. Tensions between conflicting policy goals are visible in COST, where the SC budget is strictly separated from COST widening activities, which are to be solely funded by SEWP budget. This illustrates the EU being reluctant to spend any Horizon 2020 budget on widening activities that is not from SEWP.

Interactions between Widening Fellowships and MSCA also indicate tensions between the SEWP-instruments and the rest of Horizon 2020. Non-competitive MSCA-IF proposals from Widening Countries unable to attract funding are automatically resubmitted to Widening Fellowship calls, thereby providing participants from these countries additional opportunities to benefit from Horizon 2020 funding. While Widening Fellowships respect the admissibility conditions, eligibility conditions and thresholds under MSCA, it does not consider its ranking. Widening Fellowships can be interpreted as an alternative method to pursue widening under Horizon 2020 without dedicating funds other than SEWP. Rejected Horizon 2020 proposals not considered among ‘the best’ (Zero-sum excellence), are funded by the programme regardless, indirectly applying unauthorised geographical considerations under SEWP which hurt the principle of excellence. Therefore, widening instruments need to remain small-scaled and should be clearly separated from other Horizon 2020 instruments to protect the principle of excellence.

While internal interactions between Horizon 2020 policy instruments are often in tension regarding excellence and widening, external interactions between Horizon 2020 and ESIF appear to be more complementary. The Horizon 2020 policy mix exhibits gaps towards achieving widening, with the programme unable to support EU-13 institutions though neoclassical policy rationales due to budget restraints caused by the programme’s commitment to excellence. This gap is supplemented by ESI Funds, which provide large amounts of resources at national level for EU-13 Member States to build R&I capacities. This shows how Horizon 2020 and ESIF are complementary towards each other in regard to achieving widening. For this reason, stronger synergies between ESIF and the widening oriented instruments under Horizon 2020 must be explored and encouraged in the future.

7.2 Answering the main research question

The previous sub-questions help answer our main research question: *‘How can the EU R&I policy mix better address the challenge of ‘Spreading Excellence and Widening Participation’ towards institutions from less-performing Member States (EU-13) without compromising the principle of excellence in Horizon 2020?’*.

7.2.1 A comprehensive EU approach to widening

Due to the tensions within interactions between SEWP- and other Horizon 2020 instruments, this research recommends to strictly separate both sets of instruments, while not expanding the budget for SEWP more than necessary in order to protect the excellence principle. Nevertheless, the added-value of the widening-oriented instruments under Horizon 2020 is still recognised as small-scaled measures following systemic policy rationales, addressing barriers for EU-13 participation not previously addressed at EU level. For these reasons, it is recommended to continue supporting widening instruments under Horizon 2020. However, it is essential to address widening in a comprehensive manner, which also encompasses neoclassical policy rationales. As the Horizon 2020 budget is limited and national EU-13 R&I investments are deemed inconsistent and inefficient, ESIF is considered an important alternative funding source to build R&I capacity in EU-13 Member States thereby contributing to widening without compromising the excellence principle within Horizon 2020.

7.2.2 Synergies between Horizon 2020 and ESIF

To achieve maximum impact of EU R&I investments, the EU states Horizon 2020 should develop close synergies and complementarities with other Union programmes from different policy fields (e.g. education, energy, environment and cohesion policy). As both R&I and cohesion policy seek comprehensive alignment with the objectives of the Europe 2020 strategy, synergies and complementarities between Horizon 2020 and ESIF in particular should be strengthened towards closing the R&I divide⁵³. Horizon 2020 programmes should be implemented in a synergy-friendly manner, for example by connecting NCPs to national/regional ESIF policy makers and managing authorities. However translating synergies into policy reality is a long-term challenge and a learning process, made more difficult by the fact that ESIF implementation falls under the authority of Member States, while Horizon 2020 support is provided at EU level (European Commission, 2014a).

Synergies between ESIF and Horizon 2020 can exist in several forms. In regards to achieving widening, *sequential funding* (figure 7) is most important, where successive projects that build on each other are financed by different funds. Particularly important for increasing EU-13 participation in Horizon 2020 is the development of a ‘Stairway to Excellence’, an example of *upstream sequential*

⁵³ Art. 21 Regulation 1291/2013 EU & Art. 4.6 Regulation 1303/2013

funding which builds R&I capacities of actors in low-performing RDI Member States and regions by investing in R&I infrastructures (ERDF) and the development of skills (ESF), thereby contributing in closing the R&I divide and ensuring stronger FP participation in the future (figure 8) (European Commission, 2014a). Flanagan et. al. (2011) would categorise sequential funding as interactions between different instruments targeting different actors involved in the same process, taking place within the policy, governance and geographical space.

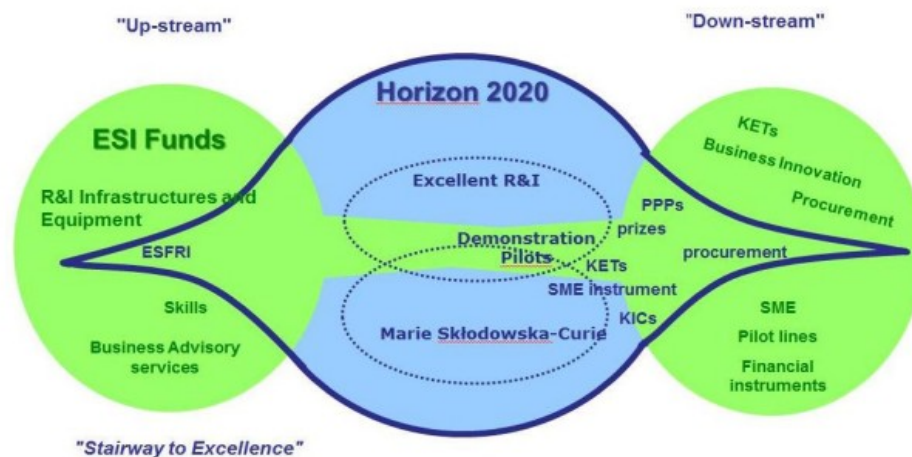


Figure 7: Sequential funding, upstream and downstream
Source: (European Commission, 2014a)

An example of synergies through sequential funding can be found between Teaming, the RI-instrument and ESIF. While the RI-instrument supports the development of European research infrastructures, it does not provide funding for the purchase or construction of those infrastructures, following a systemic rationale of transnational cooperation. It is also impossible for Twinning to support infrastructure costs for the CoE. Therefore, ESI Funds are able build R&I capacities through the construction of research infrastructures for Regional Partner Facilities under the RI-instrument or the CoE under Teaming in line with smart specialisation strategies. In turn, the Integrated Activities under the RI-instrument can also enhance the socio-economic impact of ESIF investments in research infrastructures.

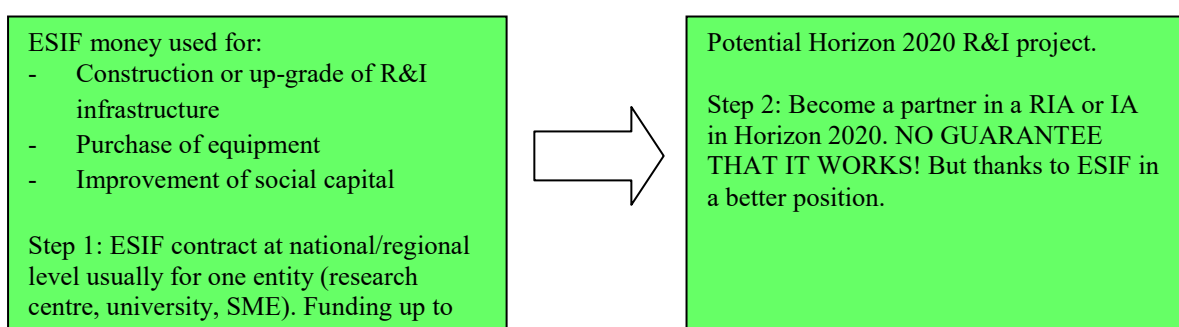


Figure 8: Upstream sequential funding (Stairway to Excellence)
Source: (European Commission, 2014a)

Another way in which synergies between ESIF and Horizon 2020 can contribute to widening is through *alternative funding*, in which funding for promising and positively evaluated Horizon 2020 proposals that did not receive funding due to limited budget are reoriented towards ESIF. SoE can play a pivotal role in accommodating alternative funding, while simultaneously protecting Horizon 2020 budget intended for excellence (European Commission, 2014a). However, its applicability is limited as it can only be applied to single participants. Proposals with multiple participants would find it difficult to use ESIF funding, as each participant resonates in different regions with different RIS3 strategies. As most Horizon 2020 calls require multiple participants from different Member States, broader SoE implementation proves to be difficult in the future.

Finally, synergies can be sought through *simultaneous funding* that bring Horizon 2020 and ESIF funding together in the same project, such as using ESI Funds for costs that are non-eligible under Horizon 2020. While seeking synergies, it is pivotal to uphold a clear division of activities between both programmes at the same time, respecting their distinct objectives. Where possible, cumulative funding in the same action or operation is possible between Horizon 2020 and ESIF, provided grants do not cover the same cost items, avoiding double funding⁵⁴ (European Commission, 2014a).

Alternative and simultaneous funding are interactions between different policy instruments targeting the same actors (Flanagan et al., 2011).

7.2.3 The importance of RIS3 for achieving synergies

RIS3 is a key tool of the Europe 2020 strategy to successfully realise synergies between Horizon 2020 and ESIF towards pursuing widening in the future, without compromising the excellence principle. It is a solution for avoiding dissipation of EU research funds by focussing R&I resources on those sectors which are high-performing (Rusu, 2013). Strengthening focus towards competitive strengths in a few R&I priorities and setting-up an entrepreneurial discovery process, RIS3 sets out the national and regional investments frameworks for R&I, not only from ESIF, but from all funding sources. Horizon 2020 actors should therefore be involved in the RIS3 development process (European Commission, 2014a). RIS3 thereby allows for a more efficient R&I investments of both ESIF and Horizon 2020 through *upstream sequential and simultaneous funding*. RIS3 can also enhance transnational cooperation between less-performing and better-performing Member States and regions, who share the same thematic R&I priorities, thus also addressing networking deficiencies of EU-13 Member States.

SEWP-instruments in particular consider smart specialisation strategies as helping tool to develop synergies. So are Teaming (phase 1) and Twinning proposals encouraged to identify broad alignment and complementarity with the smart specialisation strategies of the Member State where the applicant

⁵⁴ Art. 37 Regulation 1290/2013 EU & Art. 65.11 Regulation 1303/2013

is established. In Teaming phase 2 this will help in acquiring a letter of commitment from interested national/regional authorities for complementary ESIF funding regarding investments in infrastructure and equipment for the implementation of the future CoE. ERA-Chair proposals must include a description of how necessary investments in research projects, facilities and especially infrastructures will be achieved as ERA-Chair grants solely cover costs related to the appointment of the ERA-Chair holder and measures to facilitate structural change. ESIF is again suggested as alternative funding, expecting ERA-Chair proposals to be in line with the objectives of relevant national or regional smart specialisation strategies.

7.3 Reflection

This research has developed a clear overview of the EU R&I policy mix and landscape, while highlighting significant overlaps, gaps, complementarities and tensions within that mix towards achieving widening. This has led to several recommendations to better achieve widening in R&I without compromising the excellence principle in Horizon 2020.

However this research also contains some limitations which need to be considered. Due to the size and complexity of both programmes, the analytical framework matrixes only allows for a simplified overview of reality, ignoring smaller instruments and interactions. Another limitation in this research is that the EU-13 are considered to be homogenous group, consisting primarily of CEE countries who recently joined the EU. This group is much heterogeneous in reality with, with each Member State facing its own specific country-specific strengths and barriers.

This research mainly identified limitations and possibilities of the current EU R&I policy mix, with the primary advice to more strongly protect the Horizon 2020 budget intended for widening, while simultaneously strengthening synergies between Horizon 2020 and ESIF. Future research should focus how to improve synergies between Horizon 2020 and ESIF, giving specific attention to the role of RIS3 strategies.

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Annex I: Abbreviations

Commission:	<i>European Commission</i>
CEE:	<i>Central and Eastern Europe</i>
CISTRE:	<i>Composite Indicator for Scientific and Technological Research Excellence</i>
COSME:	<i>Competitiveness of Small and Medium-sized Enterprises</i>
COST:	<i>European Cooperation in Science and Technology</i>
CoE:	<i>Centre of Excellence</i>
CPR:	<i>Common Provision Regulation</i>
CSA:	<i>Coordination and Support Actions</i>
CSF:	<i>Common Strategic Framework</i>
EAFRD:	<i>European Agricultural Fund for Rural Development</i>
EDI:	<i>European Data Infrastructure</i>
EEN:	<i>European Enterprise Network</i>
EFSI:	<i>European Fund for Strategic Investments</i>
EIC:	<i>European Innovation Council</i>
EIS:	<i>European Innovation Scoreboard</i>
EIT:	<i>European Institute of Innovation and Technology</i>
EMFF:	<i>European Maritime and Fisheries Fund</i>
EMU:	<i>European Economic and Monetary Union</i>
EOSC:	<i>European Open Science Cloud</i>
ERA:	<i>European Research Area</i>
ERC:	<i>European Research Council</i>
ERDF:	<i>European Regional Development Fund</i>
ESFRI:	<i>European Strategic Forum for Research Infrastructures</i>
ESIF:	<i>European Structural and Investment Funds</i>
ESF:	<i>European Social Fund</i>
ETC:	<i>European Territorial Cooperation</i>
EU:	<i>European Union</i>
EU-13:	<i>BG, CY, CZ, EE, HR, HU, LV, LT, MT, PO, RO, SI, SK</i>
EU-15:	<i>AT, BE, DE, DK, EL, ES, FI, FR, IR, IT, LU, NL, PT, SE, UK</i>
FET:	<i>Future and Emerging Technologies</i>
FP:	<i>Framework Programme</i>
FTI:	<i>Fast Track to Innovation</i>
GDP:	<i>Gross Domestic Product</i>
GERD:	<i>Gross Expenditure in Research and Development</i>
HE:	<i>Higher Education</i>

HPC:	<i>High Performance Computing</i>
IA:	<i>Innovation Activities</i>
IPR:	<i>Intellectual Property Rights</i>
JPI:	<i>Joint Programme Initiative</i>
JRC:	<i>Joint Research Centre</i>
JTI:	<i>Joint Technology Initiative</i>
JU:	<i>Joint Undertakings</i>
KIC:	<i>Knowledge and Innovation Community</i>
LEIT:	<i>Leadership in Enabling and Industrial Technologies</i>
MSCA:	<i>Marie Skłodowska Curie Actions</i>
MSCA-ITN:	<i>International Training Networks</i>
MSCA-IF:	<i>International Fellowships</i>
MSCA-RISE:	<i>Research and Innovation Staff Exchange</i>
NCP:	<i>National Contact Point</i>
NPM:	<i>New Public Management</i>
Parliament:	<i>European Parliament</i>
PPP:	<i>Public-Private Partnerships</i>
PSF:	<i>Policy Support Facility</i>
RI:	<i>Research Infrastructure</i>
RIA:	<i>Research and Innovation Activities</i>
RIS3:	<i>Research and Innovation Strategies for Smart Specialisation</i>
R&D:	<i>Research and Development</i>
R&I:	<i>Research and Innovation</i>
RTD:	<i>Research, Technology and Development</i>
SC:	<i>Societal Challenges</i>
SEWP:	<i>Spreading Excellence and Widening Participation</i>
SME:	<i>Small and Medium-sized Enterprise</i>
SWAFS:	<i>Science with and for Society</i>
S&T:	<i>Science and Technology</i>
TO:	<i>Thematic Objective</i>
TRL:	<i>Technology Readiness Level</i>
WP:	<i>Work Programme</i>

Annex II: Award criteria for each type of Horizon 2020 Action

	Excellence	Impact	Quality and efficiency of implementation⁵⁵
All type of Actions	1) Clarity and pertinence of the objectives. 2) Soundness of the concept and credibility of proposed methodology.	1) Extent to which outputs of the project contribute to the expected impacts mentioned in the WP under the relevant topic.	1) Quality and efficiency of the work plan, including extent to which resources are assigned are in line with their objectives. 2) Appropriateness of management structures and procedures. 3) Complementarity of participants and extent to which consortium brings together necessary expertise. 4) Appropriateness allocation of tasks, ensuring all participants have a valid role and resources to fulfil that role.
R&I Actions (RIA) & Innovation Actions (IA)	1) Extent that proposed work is beyond the state-of-the-art and demonstrates innovation potential. 2) Appropriate consideration of interdisciplinary approaches and gender dimension.	1) Any substantial impacts not mentioned in the WP that would enhance innovation capacity, create new market opportunities, strengthen competitiveness, ensure growth for companies or bring benefits to society. 2) Quality of proposed measures to exploit and disseminate project results and communicate project activities to target audiences.	
Coordination and Support Action (CSA)	1) Quality of the proposed coordination and/or support measures.	1) Quality of proposed measures to exploit and disseminate project results and communicate project activities to target audiences.	
ERA-NET Cofund Actions	1) Level of ambition in the collaboration and commitment of participants to pool national resources in terms of budget and number of partners and coordinate national R&I programmes.	1) Contribution to better alignment of national policies. 2) Establishing and strengthening a durable cooperation between partners and national R&I programmes. 3) Quality of proposed measures to exploit and disseminate project results and communicate project activities to target audiences.	
EJP Cofund Actions	1) Level of ambition in the collaboration and commitment of participants to pool national resources in terms of budget and number of partners and coordinate national R&I programmes.	1) Contribution to better alignment of national policies. 2) Effectiveness of proposed measures to exploit and disseminate project results and communicate the programme.	
Pre-commercial procurement (PCP) & Public procurement of innovative solutions (PPI)	1) Progress beyond the state-of-the-art in terms of the degree of innovation to satisfy the innovation need.	1) Strengthening competitiveness and growth of companies by developing innovations meeting the needs of the market. 2) Quality of proposed measures to exploit and disseminate project results and communicate project activities to target audiences. 3) More forward-looking procurement approaches.	

⁵⁵ The 3rd award criteria: Quality and efficiency of implementation, is the same for each type of action.