

JRC TECHNICAL REPORTS

Exploring Synergies between EU Cohesion Policy and Horizon 2020 Funding across European Regions

An analysis of regional funding concentration on key enabling technologies and societal grand challenges

Mathieu Doussineau,

Julia Bachtrögler-Unger

2021



This publication is a Science for Policy report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication. For information on the methodology and quality underlying the data used in this publication for which the source is neither Eurostat nor other Commission services, users should contact the referenced source. The designations employed and the presentation of material on the maps do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Contacts:

Name: Mathieu Doussineau
Address: Edificio Expo, c. Inca Garcilaso 3, 41092, Seville, Spain
Email: mathieu.doussineau@ec.europa.eu / mathieu.doussineau@gmail.com
Tel.: +34 954 487 172

Name: Julia Bachtrögler-Unger
Address: Arsenal Objekt 20, 1030 Wien, Austria
Email: julia.bachtroegler-unger@wifo.ac.at
Tel.: +43 1 798 26 01-473

EU Science Hub

<https://ec.europa.eu/jrc>

JRC123485

EUR 30678 EN

PDF ISBN 978-92-76-36247-0 ISSN 1831-9424 doi:10.2760/218779

Luxembourg: Publications Office of the European Union, 2021

© European Union, 2021



The reuse policy of the European Commission is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

All content © European Union, 2021 (unless otherwise specified)

How to cite this report: Doussineau, M., Bachtrögler-Unger, J., Exploring synergies between the EU Cohesion policy and Horizon 2020 funding across European Regions, EUR 30678 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-36247-0, doi:10.2760/218779, JRC123485.

Contents

Abstract..... 2

Acknowledgements 3

Executive summary..... 4

1 Introduction 5

2 Data and methodology..... 8

 2.1 R&I funding datasets at the project level 9

 2.2 Taxonomy used to link Horizon 2020 and ERDF project datasets 10

 2.3 Measuring funding concentration 10

 2.4 R&I viewer: a tool to monitor the allocation and the concentration of funding 11

3 Synergies between EU’s R&I funding in EU regions..... 15

 3.1 Is there a concentration of funding and synergies among the EU’s two main funding instruments for R&I activities?..... 15

 3.2 What are the most synergetic EU regions for KETs and SGCs? 16

 3.3 Which technological and policy domains are the most suitable for funding concentration and synergies?..... 19

 3.4 In which regions is R&I funding concentrated on specific KET and SGC? 21

4 Discussion and conclusions..... 26

References..... 28

Abstract

Over the course of the 2014-2020 period, the European Union has invested more than €125bn into support to research and innovation through two main channels: the excellence-based Horizon 2020 programme and its cohesion policy implemented through the European Structural and investment funds (ESIF) and in particular the European Regional Development fund (ERDF). While projects funded by ESIF are selected in the context of place-based operational programmes and smart specialisation strategies (S3), Horizon 2020 grants are assigned based on the quality of the project proposals and consortia without any geographical criteria. A concentration of R&I funding from both funding schemes in the same technological or policy area could point to the creation of a synergy between EU funding as suggested by the concept of smart specialisation and encouraged by the European Commission. This report uses project data to analyse the regional distribution of Horizon 2020 and ESIF funding among key enabling technologies and societal grand challenges and to map potential synergies between different EU funding policies.

Acknowledgements

The authors of this report would like to thank Nicholas Harrap, Michaela Batorova and Filipe Batista e Silva for their valuable comments and suggestions.

Authors

Mathieu Doussineau*, Julia Bachtrögler-Unger**

*European Commission Joint Research Centre, Territorial development unit

**Austrian Institute of Economic Research (WIFO)

Executive summary

The European Union dedicates an increasing share of its financial resources to support research, technological development and innovation. In line with the concept of smart specialisation, regions are encouraged to direct European (R&I) funding towards technological, industrial or policy areas that fit or are related to regional strengths, challenges and growth potentials.

The two most important EU R&I funding instruments - Horizon 2020 and the European Regional Development Fund (ERDF) – follow different funding principles and procedures. In line with their smart specialisation strategies, regions shall focus (ERDF) funding on specific thematic and sectoral priority areas. Moreover, regions are encouraged to exploit complementarities between the ERDF, Horizon 2020 and other funds in order to achieve a critical mass of funding in the priority areas. Until now there is little research on the regions' use of European R&I funding in the multi-annual financial framework (MFF) 2014-2020.

Therefore, this report explores the distribution of ERDF co-funding for R&I activities as well as Horizon 2020 grants among European NUTS-2 regions and thematic areas. It investigates the occurrence of potential synergies in regions stemming from a concentration of funding from both schemes in the same field. This is done by using a new dataset including detailed information on projects co-funded by the ERDF in 2014-2020 that is enriched by assigning key enabling technologies (KET) and societal grand challenges (SGC) in order to bridge ERDF funding data with the CORDIS database of Horizon 2020 projects.

The analysis covers Horizon 2020 and ERDF grants allocated between 2014 and 2019 to thousands of organisations located in the 281 European NUTS-2 regions. In terms of funding, the range of projects considered in the analysis represents more than €60bn of R&I funding provided. Using the average thematic distribution of funding in EU regions as a benchmark, the analysis reveals substantial differences among regional funding concentration profiles concerning technology and policy areas. Comparing the two funding instruments, a larger share of regions concentrates Horizon 2020 funding in specific key enabling technologies, while ERDF funding is more often concentrated on projects addressing certain societal grand challenges.

However, the findings indicate substantial differences among the frequency of regional funding concentrations in specific technology and policy areas. Characteristics of the technology or policy areas, such as distance to the market the relatedness to a certain industry or the need for the presence of an industrial ecosystem (e.g. transport or security), seem to play an important role.

The analysis shows that the KET for which the most synergies are observed across EU regions are those closest to the market (advanced manufacturing and processing, advanced materials and ICT). With regards to SGC, the areas related to Clean Energy, Food Security and Environment are the most implemented across EU regions. By contrast, it seems that only a limited number of EU regions concentrate the R&I funding available to them on technological and policy areas linked to traditional industries and requiring more pre-existing industrial assets, such as Clean Transport and Security. The mapping of synergies between ESIF and Horizon 2020 proposed in this report suggests that some KET and SGC not only fit well the funding logic of Horizon 2020 but also the funding requirements and priorities of EU cohesion policy (ERDF), particularly, the increase of R&I capacities or the support to SMEs.

Creating synergies between EU funding and policies also is an objective in the new programming period 2021-27. In the Conclusions of a special meeting of the Council in July 2020¹, it is stated for the Horizon Europe programme that “particular attention will be paid to the coordination of activities through Horizon Europe with those supported under other Union programmes, including through cohesion policy. In this context, important synergies will be needed between Horizon Europe and the structural funds for the purpose of ‘sharing excellence’, thereby enhancing regional R&I capacity and the ability of all regions to develop clusters of excellence”. The beginning of the new MFF 2021-2027 is an opportune moment to learn from past experiences and to improve and adapt public intervention in the field of R&I for better addressing future needs.

¹ <https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf>

1 Introduction

The combination of funding and financing sources aimed at creating synergies is a challenge that the European Commission is encouraging and supporting through the provision of guidelines and various initiatives. Following an initiative of the European Parliament, the Joint Research Centre (JRC) and the Directorate General for Regional and Urban Policy (DG REGIO) launched the Stairway to Excellence (S2E) Pilot Project in 2014. Throughout the project duration which ended in 2020, S2E was centred on the provision of assistance to EU Member States and regions with the aim of contributing to closing the innovation gap through the creation of synergies between EU funding. This report aims at providing an overview of potential synergies between EU funding by exploring the allocation of research and innovation (R&I) grants across EU regions.

The “Lamy” report published in 2017 argued that the numerous EU funding schemes illustrate the lack of a systemic and coordinated R&I policy at the EU level. It is crucial, according to the report, that the post-2020 EU R&I programme and future structural funds are designed from the beginning with complementary, mutually reinforcing and inter-operable intervention logics. However, some academics argue that EU R&I policy and EU cohesion policy follow distinct goals and can hardly coexist harmoniously. The conventional objective of R&I excellence needs to be complemented by a broader and more complex approach to generate place-based innovation ecosystems: the concept of European 'excellence' supported by the Horizon framework programme should be complemented with regional 'relevance' (Foray, Morgan & Radosevic, 2018).

The support of research and innovation (R&I) has been an important priority of EU policies in the multi-annual financial framework (MFF) 2014-2020 - and will become even more relevant in the future. The largest amounts of funding for R&I activities were allocated through the Horizon 2020 programme, which provides €80bn for excellence-based projects in specific thematic areas, and through the European Structural and Investment Funds (ESIF), of which €43.2bn² have been allocated to EU regions to support strengthening research, technological development and innovation in order to foster smart and sustainable growth. The European Regional Development Fund (ERDF) is the major funding instrument of R&I activities in the context of EU cohesion policy (ERDF represents 95% of ESIF R&I funding allocations). Given the design of these main R&I funding schemes, the objective of the EU is twofold: First, to strengthen European excellence in science and technology by improving cross-border collaboration between the most appropriate European organisations, and second, to support the competitiveness of EU regions by promoting intelligent, inclusive and sustainable growth.

European R&I funding distributed across European regions should be targeted to relevant technological fields and socio-economic challenges and, especially concerning the ERDF, tailored to region-specific needs, existing local strengths and identified opportunities in R&I. The excellence-based rationale of Horizon 2020 supporting European “champions” and the purpose of the ERDF as part of EU cohesion policy, which aims to support EU regions in closing the R&I gap between them and more advanced regions, should ideally complement each other. However, the differences in funding principles and objectives, considering the excellence of project proposals and consortia in the case of Horizon 2020 granting and regional priorities in the case of ERDF project selection, could also lead to unintended discrepancies in achieving the overall objective of increasing innovation activities and output (see e.g. Foray et al. 2018B).³

With the aim to address socio-economic challenges and opportunities faced by EU regions, the concept of smart specialisation strategies (RIS3) is based on identifying specific priority areas in which regional competitive advantage can be exploited and further developed, considering local conditions, economic activity

² Open Data Portal for the ESIF, DG REGIO (accessed: 23 January 2021).

³ Refer to Foray et al. (2018A, 2018B) for a discussion on the embeddedness of R&I policy within the framework of cohesion policy.

and knowledge. In practice, specialisation areas selected by regions in their RIS3 cover a wide range of technology and policy areas corresponding to place-based assets and needs (McCann and Ortega-Argilés 2016). Though, there is also evidence that priorities set in RIS3 often do not sufficiently consider local conditions but mimic those from other regions (Di Cataldo et al. 2020).

In order to achieve a critical mass of financial support targeted at selected priorities and corresponding actors, the implementation of RIS3 should target complementarities among different funding instruments, such as Horizon 2020 and ERDF, despite different funding principles, rules and legal frameworks (European Commission 2014). The successful combination of different funding sources is expected to contribute to enhancing innovation in specific priority areas as well as the overall success of the EU's (regional) R&I policy. Therefore, the European Commission encourages regions to develop strategies for combining funding instruments to possibly exploit synergies already at the beginning of a funding period (Foray et al, 2012). Ideally, strategic funding synergies should be planned or at least envisaged at the design phase of the RIS3 strategies by involving and informing relevant actors about Horizon 2020 and ERDF funding opportunities and e.g. by supporting innovative firms in their applications for certain Horizon 2020 calls. In accordance with the place-based approach of smart specialisation, there is no universal concept for combining different EU R&I funding schemes in an optimal way, as differential funding profiles of EU regions concerning the individual funding schemes as well as the diversity of EU regions in terms of economic development and institutional settings need to be taken into account.⁴

Since 2014, thousands of projects and R&I activities have been supported through both the Horizon 2020 framework programme and cohesion policy. A comprehensive monitoring system of RIS3 as well as detailed information on the usage of EU (R&I) funding, in their own but also in other European regions, would help managing authorities to monitor the allocation of funding to thematic areas fuelling their respective RIS3, and to better evaluate and update their strategies in view of the upcoming next programming period.

This report uses a novel dataset of R&I-related projects co-funded by the ERDF as well as data on Horizon 2020 projects in 281 European NUTS-2 regions to explore synergies between EU R&I funding schemes.⁵ Therefore, in a first step, the distribution of ERDF and H2020 funding among thematic areas, depicted by key enabling technologies and societal grand challenges, is analysed. Within the Horizon 2020 programme framework, calls for project proposals are organised around the key enabling technologies (KET) and societal grand challenges (SGC) to be addressed. KETs are expected to play a major role in facing societal grand challenges such as climate change (Montresor and Quatraro 2015), and allow recombining given technological capabilities for innovation (see e.g. Frenken et al. 2012). Therefore, regions are encouraged to focus on them in their RIS3 and thus also in the distribution of ESIF⁶, which encourages the use of KETs and SGCs as an analytical framework for the thematic analysis of R&I activities co-financed by ERDF and Horizon 2020 (see also European Commission 2012, Sörvik & Kleibrink 2015). Although European R&I funding only mirrors a part of financial support for R&I activities in the Member States, a concentration of ERDF or Horizon 2020 funding in (a few) specific areas would be in line with the rationale of smart specialisation.

In a second step, it is investigated whether potential synergies between ERDF and Horizon 2020 funding exist by focusing on the same specific areas occur in NUTS-2 regions. A synergy between funding is considered when a concentration of funding is observed for both sources in the same area. From a policy

⁴ The European Commission provides methodological guidelines to public authorities and to final beneficiaries (European Commission 2015) that are either generic (European Commission, 2014) or relate to specific thematic areas. Moreover, the Stairway to Excellence (S2E) pilot project initiated by the European Parliament and co-implemented by the JRC and DG for Regional and Urban Policy in 2014 assists regional and national authorities in the implementation of synergies between funding (Doussineau et al 2018, Perez et al 2014, Ozbolat et al, 2018, Haegeman et al 2018).

⁵ In the following, the Nomenclature of territorial units for statistics (NUTS) 2016 is considered.

⁶ Indeed, according to information provided by the smart specialisation platform, 60% of regions registered in the platform have specified at least one KET as area of specialisation (Sörvik et al 2013).

perspective, this may either confirm the selection of a (related) priority area or inform policy makers about a potential new priority to be considered in the S3 strategy. Moreover, detecting potential synergetic areas allows to identify innovative and competitive actors that successfully applied for Horizon 2020 grants and are also benefiting from ERDF support.

This report does neither aim at evaluating the success of regional R&I funding strategies (relative to other regions) nor at its alignment with the content of RIS3. Its objective is to analyse – and map results – whether regions, relative to the EU average distribution, concentrate their ERDF funding on projects in the field of specific technological and policy areas, as the smart specialisation concept suggests, and whether potential synergies with Horizon 2020 in supporting R&I activities in the same thematic area occur. This exercise hopes to feed future research on how synergies and the concentration of EU funding influence EU policy effects and whether they promote regional growth and development.

The remainder of this report is structured as follows: Section 2 introduces the methodological approach applied in order to create a link between a newly created dataset of ERDF beneficiaries and Horizon 2020 beneficiaries. More specifically, Section 2.1 briefly introduces the R&I funding project-level datasets used, and Section 2.2. outlines the taxonomy based on which KET and SGC were assigned to ERDF projects. Section 2.3 describes the calculation of the location quotient which is used to identify specialization patterns. Section 2.4 presents descriptive statistics of the data and introduces the R&I viewer available online at the Smart Specialization platform. Section 3 shows the results of the analysis of synergies in European NUTS-2 regions and Section 4 concludes.

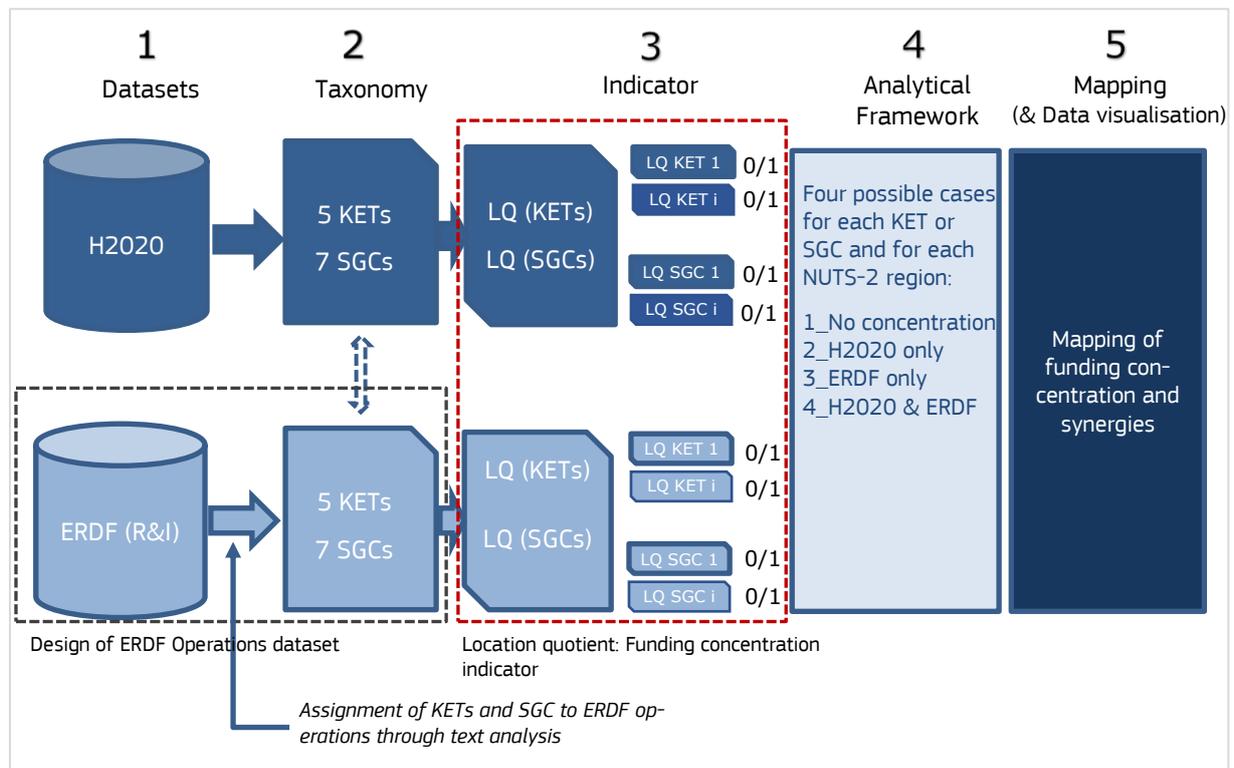
2 Data and methodology

Three main components are necessary to analyse the concentration of European R&I funding and synergies: First, a Horizon 2020 and an ERDF dataset gathering information about funded projects. Second, a common taxonomy describing technological and policy areas linking the two datasets, and third, an indicator depicting concentration of funding and therefore usable to identify synergies across funding schemes.

Figure 1 shows the steps taken from raw project datasets to the mapping of synergies, including the design of a data visualisation web-platform⁷ to better understand the use of EU funding by regions:

1. Collect and/or design datasets of ERDF and H2020 funding (Section 2.1)
2. Choose of a common taxonomy to link dataset (Section 2.2)
3. Define an indicator to measure the concentration of funding (Section 2.3)
4. Design an analytical framework to visualize the data (Section 2.3)
5. Visualize and map results (Sections 3 & 4)

Figure 1 Synoptic overview of the methodological approach



Source: Own elaboration.

⁷ R&I Regional Viewer: <https://s3platform.jrc.ec.europa.eu/synergies-tool>.

2.1 R&I funding datasets at the project level

In order to explore synergies between the Horizon 2020 framework programme and the ERDF, detailed thematic and geographical information on funded projects is required.

The Horizon 2020 programme is centrally managed by the DG Research & Innovation of the European Commission. Information concerning projects and beneficiaries is gathered in a structured dataset, the CORDIS database.⁸ Regarding ERDF, data on projects and beneficiaries is collected and published by individual national or regional managing authorities in EU member States. Therefore, a recently compiled structured database by the JRC Seville based on lists of operations co-funded by the ERDF is used⁹. Information on ERDF operations is provided by regional or national public authorities managing operational programmes, as required by Article 115(2) of the common provisions regulation in Regulation (EU) No. 1303/2013), by June 2019. INTERREG projects centrally reported in the KEEP database¹⁰ are also considered. In order to standardise and enrich the data, project names and descriptions are translated into English and beneficiary names linked with business data. Based on the ESIF categories of intervention¹¹ (intervention field), projects are defined as related to R&I or not (see Bachtrögler et al. 2020 for a detailed documentation of the dataset).¹²

To create a thematic link with Horizon 2020 project data, key enabling technologies (KET) and societal grand challenges (SGC) are assigned to R&I projects co-funded by the ERDF based on project descriptions (refer to Section 2.2 for more details). As an additional link, name matching of ERDF and Horizon 2020 beneficiaries allows for the identification of organisations profiting from both schemes, which could be important for further analyses on the usage of different funding instruments within the same beneficiary firm or institution. The dataset of R&I-related projects co-financed by the ERDF as well as the dataset of Horizon 2020 projects, together with descriptive analysis, can be explored in the R&I regional viewer provided by the S3 Platform which is introduced in Section 2.4 of this report.

For beneficiaries supported by both schemes, information on the project location (NUTS regions), the amount of allocated EU support (for some ERDF projects, total eligible expenditure and EU co-financing rates) as well as thematic information (KET and SGC in the case of Horizon 2020, categories of intervention for the ERDF) is reported. To link the two datasets at the level of beneficiaries, beneficiary names of ERDF projects are matched with those of Horizon 2020 beneficiaries. This allows to get first insights on the frequency of firms or organisations successfully applying for research funding from both schemes.

In total, the Horizon 2020 dataset analysed consists of 8,393 projects gathering 73,749 participations (grants) from 2014 to October 2019. For the analysis, only projects that relate to the five key enabling technologies and the seven societal grand challenges are considered. In terms of funding, this selection covers 56% of the total Horizon 2020 funding amount¹³ (€26.4bn). The ERDF dataset includes more than 84,000 projects that were classified as R&I-related based on the categories of intervention as reported

⁸ Source: CORDIS Horizon 2020 dataset, EC DG Research & Innovation.

Note: Other measures than project grants funded by Horizon 2020, such as ERC grants or Marie S. Curie Actions, are not considered in the analysis.

⁹ Bachtrögler, J., Doussineau, M., Reschenhofer, P., Dataset of projects co-funded by the ERDF during the multi-annual financial framework 2014-2020, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18860-5, doi:10.2760/491487, JRC120637.

¹⁰ See website <https://keep.eu/>.

¹¹ Commission Implementing Regulation (EU) No 215/2014 of 7 March 2014.

¹² Categories of intervention defined as R&I related comprise R&I processes in large enterprises and SMEs, Investment in infrastructure, capacities and equipment in small and medium-sized enterprises (SME) and large enterprises directly linked to R&I activities, Public and private R&I infrastructure, R&I activities in research centres, Technology transfer and university-enterprise cooperation as well as cluster support and business networks primarily benefiting SMEs, Cluster support and business networks, etc. (Bachtrögler et al. 2020, pp. 7 f.).

¹³ The other share of the H2020 budget mostly comprises ERC grants (20%) and Marie Skłodowska-Curie Actions (10%),

by regional (or national) managing authorities from 2014 to June 2019. This corresponds to a total ERDF amount of €35.3bn and represents a share of 86% of ERDF funding dedicated to the thematic objective Research & innovation¹⁴. As this analysis can only take into account projects that could be assigned a KET or SGC, the amount of funding considered in the analysis is slightly reduced (€30.1bn).

2.2 Taxonomy used to link Horizon 2020 and ERDF project datasets

A same technology and a policy taxonomy are used to analyse the concentration of both sources of funding in order to bridge the two datasets and identify synergies. KETs and SGCs areas are assigned, when possible, to ERDF projects through text analysis of project titles and descriptions. With regards to the technology taxonomy, the list of keywords adopted by the *Knowmak platform* (<https://www.knowmak.eu/>) and based on an ontological approach serves as basis for the assignation of KETs and SGCs to ERDF operations. There can be one or more KET or SGC or none assigned to a single project. In this analysis, we consider five KETs representing an important component of Horizon 2020 through the 'Leadership in Enabling and Industrial Technologies' (LEIT)¹⁵. Concerning the policy taxonomy, the seven societal grand challenges as defined in the Horizon 2020 programme constitute a cross-cutting policy dimension completing the technological one. The challenges reflect the policy priorities of the Europe 2020 strategy and cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake¹⁶. In total, 44.7% of ERDF operations are found to be related to at least one key enabling technology and 72.8% to at least one societal grand challenge. The technological areas considered are the following:

- EU.2.1.1 Information and Communication Technologies (ICT)
- EU.2.1.2 Nanotechnologies
- EU.2.1.3 Advanced materials
- EU.2.1.4 Industrial biotechnologies
- EU.2.1.5 Advanced manufacturing and processing

The policy taxonomy (SGC) is structured as follows:

- EU.3.1 Health, demographic change and wellbeing
- EU.3.2 Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy
- EU.3.3 Secure, clean and efficient energy
- EU.3.4 Smart, green and integrated transport
- EU.3.5 Climate action, environment, resource efficiency and raw materials
- EU.3.6 Europe in a changing world - inclusive, innovative and reflective societies
- EU.3.7 Secure societies - protecting freedom and security of Europe and its citizens

2.3 Measuring funding concentration

In this report the location quotient (LQ) is used to quantify differences in the regional distribution of European R&I funding to specific technological or policy areas relative to the EU average distribution.¹⁷ Thus, it allows to i

¹⁴ Open Data Portal for the ESIF, DG REGIO (accessed: 13 April 2021). The usage of the remaining share of ERDF funding is expected to be reported by managing authorities in future lists of operations.

¹⁵ A European strategy for Key Enabling Technologies – A bridge to growth and jobs' European Commission, 2012, 341 final <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges>.

¹⁷ The location quotient (Florence 1939) was introduced by Sargent Florence (1939) in his "Theory of Location" and has been developed by Billing and Johnson (2012) as an estimator of industrial concentration. Location quotient is equivalent to the revealed comparative advantage which is an index used in international economics for calculating the relative advantage or disadvantage of a certain country in a certain class of goods or services as evidenced by trade flows. It is based on the Ricardian comparative advantage concept.

investigate whether a region concentrates relatively large amounts of funds on a certain area as compared to the EU average.

For the purpose of this analysis, we consider it as a specialisation of (European R&I) funding if a region dedicates a larger share of Horizon 2020 and ERDF funding, respectively, on a specific technological or policy field than this is the case at the European level. In case project funding under both funding schemes is concentrated in the same area, we assume this to potentially generate a synergy between Horizon 2020 and ERDF funding.¹⁸

The location quotient is calculated as follows:

$$LQ_i = (X_{i,j}/\sum X_j) / (X_{i,EU}/\sum X_{EU})$$

Where:

-LQ_i= Location quotient for area I (KET or SGC)

-X_{i,j} = total funding allocated to area i by region j

-ΣX_j = total funding allocated in region j

-X_{i,EU} = total funding allocated to area i in the EU

-ΣX_{EU} = total funding allocated in the EU

To investigate the degree of specialisation in European R&I support in the 281 NUTS-2 regions of the EU, the LQ is calculated for each KET and SGC, and each source of funding, considering the corresponding EU-wide distribution as a benchmark, i.e. a threshold value of 1.¹⁹ For the purpose of this analysis, a concentration of funding is defined according to the following criteria:

- A LQ greater than 1 implies a concentration of funding in a given area (the relevant share of funding in the region is higher than the EU reference).
- An LQ equal to 1 means that the share of funding in the given area is equal to the share at the EU level.
- An LQ smaller than 1 means that the share of funding in the region is lower than at the EU reference level.

Based on calculated location quotients, Table 1 summarises four cases which characterise the distribution of R&I support available within EU regions. Case number 4 is particularly interesting as it flags a concentration of funding in both Horizon 2020 and ERDF, thereby pointing to the possible exploitation of synergies between European R&I policy instruments.

Table 1 The 4 possible cases of concentration of funding for an Area (KET or SGC) in a given NUTS 2 region

Case	Definition	LQ H2020 >1 (concentration)	LQ ERDF>1 (concentration)
Case 1	No concentration	no	no
Case 2	Concentration of funding in H2020 and not in ERDF	yes	no
Case 3	Concentration of Funding in ERDF and not H2020	no	yes
Case 4	SYNERGY: concentration of funding in both programmes	yes	yes

2.4 R&I viewer: a tool to monitor the allocation and the concentration of funding

¹⁸ Although national R&I funding programmes are not considered in this analysis, a concentration of EU-funded R&I interventions in a certain technological or policy field can be expected to point to regional R&I funding specialisation. Note that this report does not go into detail regarding the content of R&I activities funded, and therefore cannot take into account possible overlaps or a duplication of funding.

¹⁹ Obviously, if we consider 1.05 or a larger value as a threshold value, the number of synergies found will decrease. To get a first overview of potential (thematic) synergies between the European main R&I funding schemes, this report sticks to the benchmark value of 1.

The S3 web Platform hosted by the JRC Seville assists EU countries and regions in developing, implementing and reviewing their RIS3. Established in 2011, following the Communication on "Regional Policy contributing to smart growth in Europe 2020", the role of the S3 Platform is to provide information, methodologies and advice to policy makers offering a knowledge repository of guidelines and methodologies tackling various components of the concept (ie. interregional collaboration, monitoring & evaluation), and also good practices collected since 2014. In addition, the S3 platform provides a set of web-tools allowing policy makers to better monitor and benchmark their respective territories in the EU regional context. Among the web-tools available on the S3 platform, the R&I regional viewer (available at <https://s3platform.jrc.ec.europa.eu/synergies-tool>) provides two dashboards proposing a set of indicators, maps and graphs based on dataset of projects funded by Horizon 2020, on the one hand, and by ERDF, on the other hand. The tool offers the possibility to visualise and compare investments under different funding channels of EU programmes across EU regions (at NUTS level 1, 2 and 3). Benchmarking is also possible considering any selection of regions from a scroll down menu placed on top of the dashboards or directly on the map.

This first version of the R&I viewer is composed of two distinct dashboards dedicated to respectively Horizon 2020 and ERDF. The two dashboards follow the same structure:

- 1-Territorial information (EU contribution)
- 2-Thematic & specialisation information (specialisation indicators and thematic distribution)
- 3-Project and beneficiary information (lists of projects and beneficiaries)

Information on the specialisation of funds is based on the methodological approach outlined in this report. The content within each section of the dashboard varies according to the availability of information. Information on projects supported through the Horizon 2020 programme appears to be more comprehensive than the one for ERDF projects, particularly regarding the type of beneficiaries (e.g. University, Public research centre, Private company including SME).

Figure 2 provides a synoptic overview of the three sections of the Horizon 2020 and ERDF dashboards. It provides a description of the information for each source of funding and indicates the variables bridging the two datasets for each section: Territories (NUTS regions) for first, thematic (KET and SGC) for the second, and beneficiaries for the third one. The screenshot pictured in Figure 3 shows the dashboard.

Figure 2 Synoptic view of the R&I viewer

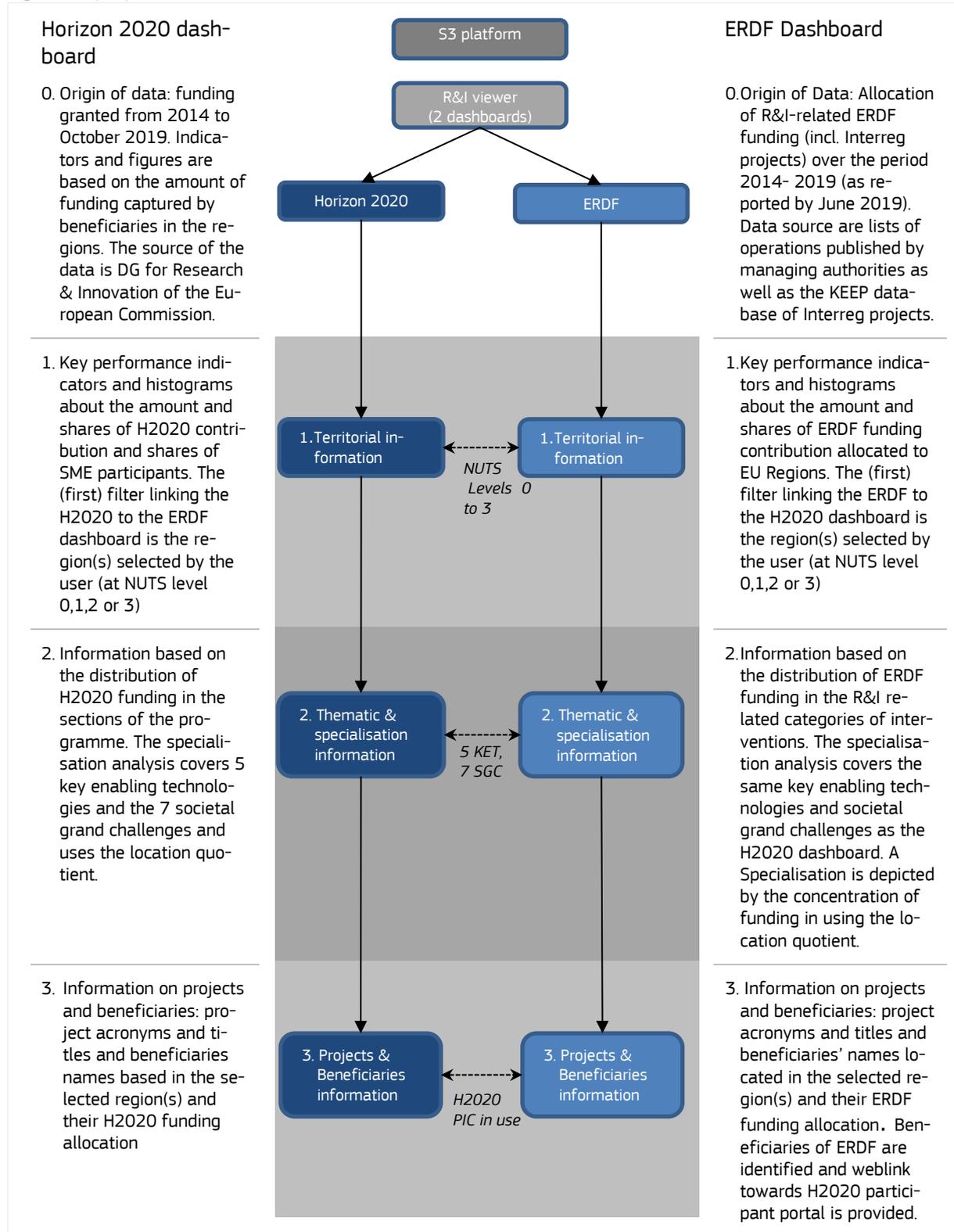
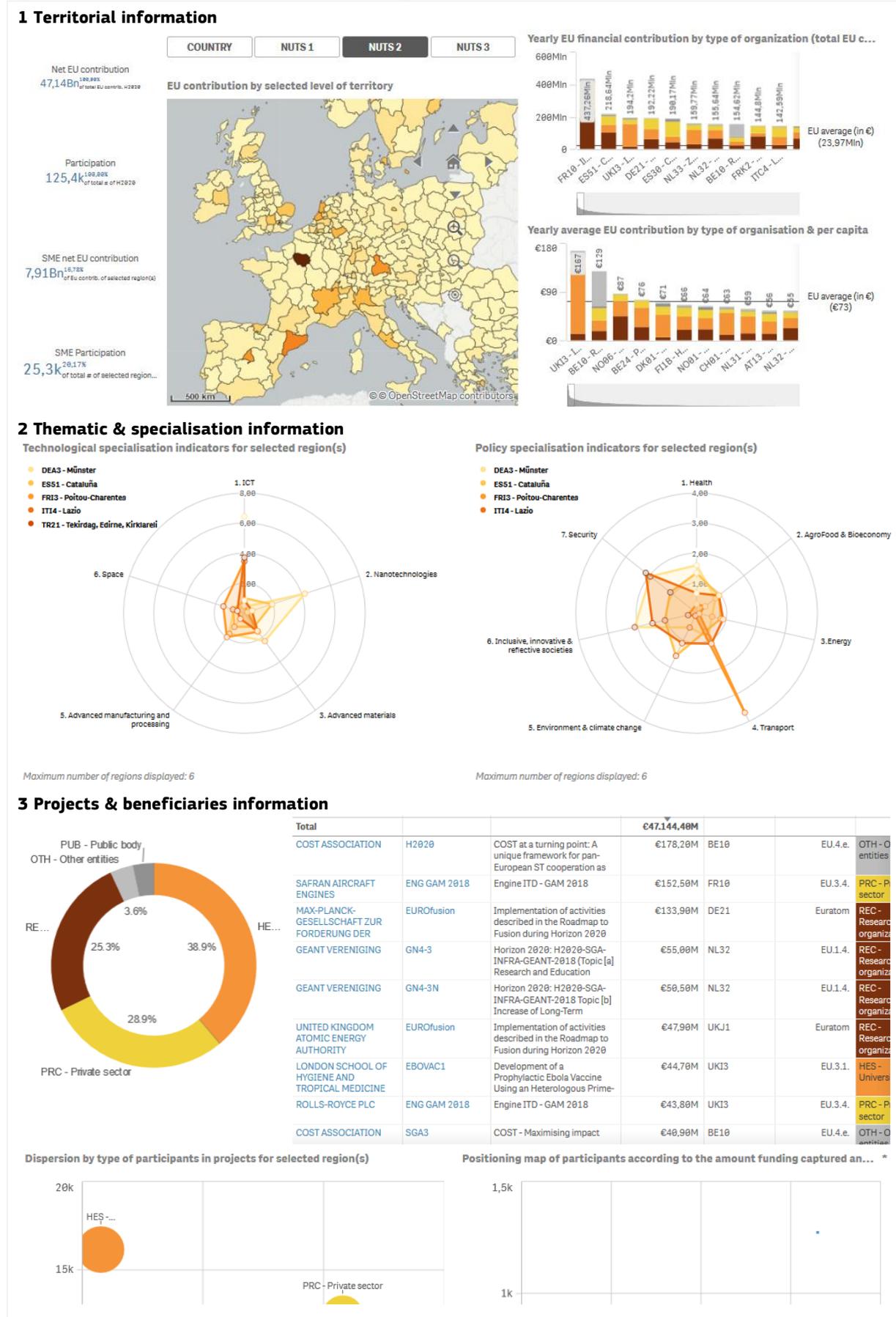


Figure 3 Screenshot of the R&I viewer (H2020 regional dashboard)



3 Synergies between EU's R&I funding in EU regions

In the following, results on EU funding synergies between Horizon 2020 and the ERDF in the support of specific thematic areas are discussed. First, we analyse the thematic distribution of EU R&I funding provided by the ERDF or Horizon 2020, in particular, whether a concentration of funding in specific areas relative to the EU average occur. This would be in line with the concept of smart specialisation and, at the same time, is a prerequisite for a synergy among both schemes (Section 3.1). Second, the number of synergies as well as thematic specialisations of either the ERDF or Horizon 2020 in technological and policy areas is visualised in a map of EU regions (Section 3.2). Third, we have a closer look at individual KET and SGC to see whether a relative concentration of funding is more likely concerning specific fields and specific funds (Section 3.3). Finally, we investigate the regional distribution of specialisations of funding in certain areas (Section 3.4).

3.1 Is there a concentration of funding and synergies among the EU's two main funding instruments for R&I activities?

Calculating location quotients for each region, technology and policy area, respectively, according to equation (1) indicates that there is a specialisation of Horizon 2020 funding relative to the EU average in at least one thematic field in almost every (up to 277 of 281) European NUTS-2 region. Likewise, also ERDF funding is concentrated on at least in one thematic area in most regions.

To give an example, Table 3 shows the LQ calculated for each KET and SGC, considering Horizon 2020 and ERDF funding, respectively, in the Austrian region of Upper Austria. Unilateral concentration of ERDF funding relative to the EU average can be observed in the technological areas of EU.2.1.3 (Advanced materials), EU.2.1.4 (industrial biotechnologies) and EU 2.1.5 (Advanced manufacturing and processing). Horizon 2020 funding in the region also focuses on advanced materials and advanced manufacturing and processes, suggesting a possible exploitation of synergies between the two funding schemes. These thematic synergies reflect the economic structure of Upper Austria, where more than a quarter of workers are employed in the manufacturing sector (Piribauer et al. 2020) and point to the implementation of a place-based R&I policy. Regarding SGC, one synergy among funding schemes is detected in the area of EU 3.3 (secure, clear and efficient energy). Furthermore, a location quotient greater than 1 is found for ERDF funding in the policy areas EU 3.2 (Food security, agriculture and forestry, marine water research and the bioeconomy) and EU 3.5 (Climate action, environment, resource efficiency and raw materials), and for Horizon 2020 funding in Upper Austria in the field of smart green and integrated transport (EU 3.4).

Table 2 Example of Location Quotients in Upper Austria (AT31)

Area codes	(shortened) Area labels	ERDF		Horizon 2020	
		LQ	Concentration (yes/no)	LQ	Concentration (yes/no)
EU.2.1.1.	ICT	0.569	No	0.722	No
EU.2.1.2.	Nanotechnologies	0.566	No	1.968	Yes
EU.2.1.3.	Advanced materials	1.177	Yes	1.599	Yes
EU.2.1.4.	Industrial biotech	1.055	Yes	0.244	No
EU.2.1.5.	Adv. Manufacturing& proc.	2.095	Yes	1.818	Yes
EU.3.1.	Health	0.637	No	0.125	No
EU.3.2.	Food	1.668	Yes	0.364	No
EU.3.3.	Energy	1.473	Yes	2.190	Yes
EU.3.4.	Transport	0.990	No	1.934	Yes
EU.3.5.	Climate	1.035	Yes	0.195	No
EU.3.6.	Society	0.866	No	0.090	No
EU.3.7.	Security	0.410	No	0.120	No

Source: ERDF dataset of R&I-related projects (Bachtrögler et al. 2020a), CORDIS database of Horizon 2020 projects, own calculation. Total # of regions: 281.

Table 2 presents descriptive statistics based on the location quotients (LQ) calculated for each technology and policy area (five KETs and seven SGCs). In 261 regions, Horizon 2020 grants are concentrated in at

least one technological area, which points to the existence of competitive actors and favourable conditions for research in the respective field. Even in 277 regions, Horizon 2020 funds are specialised in at least one societal grand challenge. Also, regarding the ERDF, there are only six (five) out of 281 NUTS-2 regions for which no relative concentration of funding on at least one KET (SGC) is found ($LQ > 1$). The mean of the location quotients is notably larger for the Horizon 2020 scheme than in the case of the ERDF, which indicates a more pronounced average concentration of Horizon 2020 funding in the regions.²⁰

The total number of specialisations in a certain KET or SGC ranges from 571 (Horizon 2020) to 610 (ERDF) for KET, from 840 to 896 for SGC. This implies that regions concentrate their R&I funds on, on average, two technological areas and on three policy areas, respectively.

Table 3 Concentration of funding in KET and SGC among Horizon 2020 and ERDF funding: Descriptive statistics of the location quotient (LQ) based on 281 NUTS-2 regions

	ERDF						Horizon 2020					
	Avg LQ	Std. Dev LQ	Min LQ	Max LQ	Σ of LQ>1	Σ of regions with at least one LQ >1	Avg LQ	Std. Dev LQ	Min LQ	Max LQ	Σ of LQ>1	Σ of regions with at least one LQ >1
KET	1.11	0.84	0	10.23	610	275	1.44	1.75	0	23.73	571	261
SGC	1.02	0.55	0	6.27	896	276	1.20	1.15	0	11.37	840	277

Source: ERDF dataset of R&I-related projects (Bachtrögler et al. 2020a), CORDIS database of Horizon 2020 projects, own calculation. Total # of regions: 281.

Having a look at location quotients reported for KET on the one hand, and SGC on the other hand, it turns out that there are more specialisations concerning the societal grand challenges. As these policy areas are formulated relatively broadly, it appears intuitive that there are more projects related to those than to more specifically defined KET. However, similar to the comparison of the extent of funding among Horizon 2020 and ERDF, the average intensity of the specialisation on a specific technological area is notably larger than the average one on a particular policy area, especially when considering Horizon 2020 funds (LQ of 1.44 as compared to 1.20 for Horizon 2020, LQ of 1.11 as compared to 1.02 for the ERDF).

If there is a funding concentration of both Horizon 2020 and the ERDF in the same area, we speak of a (potential) synergy. In total, there are 625 synergies with regard to KET and SGC across all European regions. More than 60% (382) of them refer to a policy area (SGC), 243 to a technological area. Thereby, at least one R&I funding synergy in a technological field is detected in 182 NUTS-2 regions, and at least one synergy in a policy area in 236 regions.

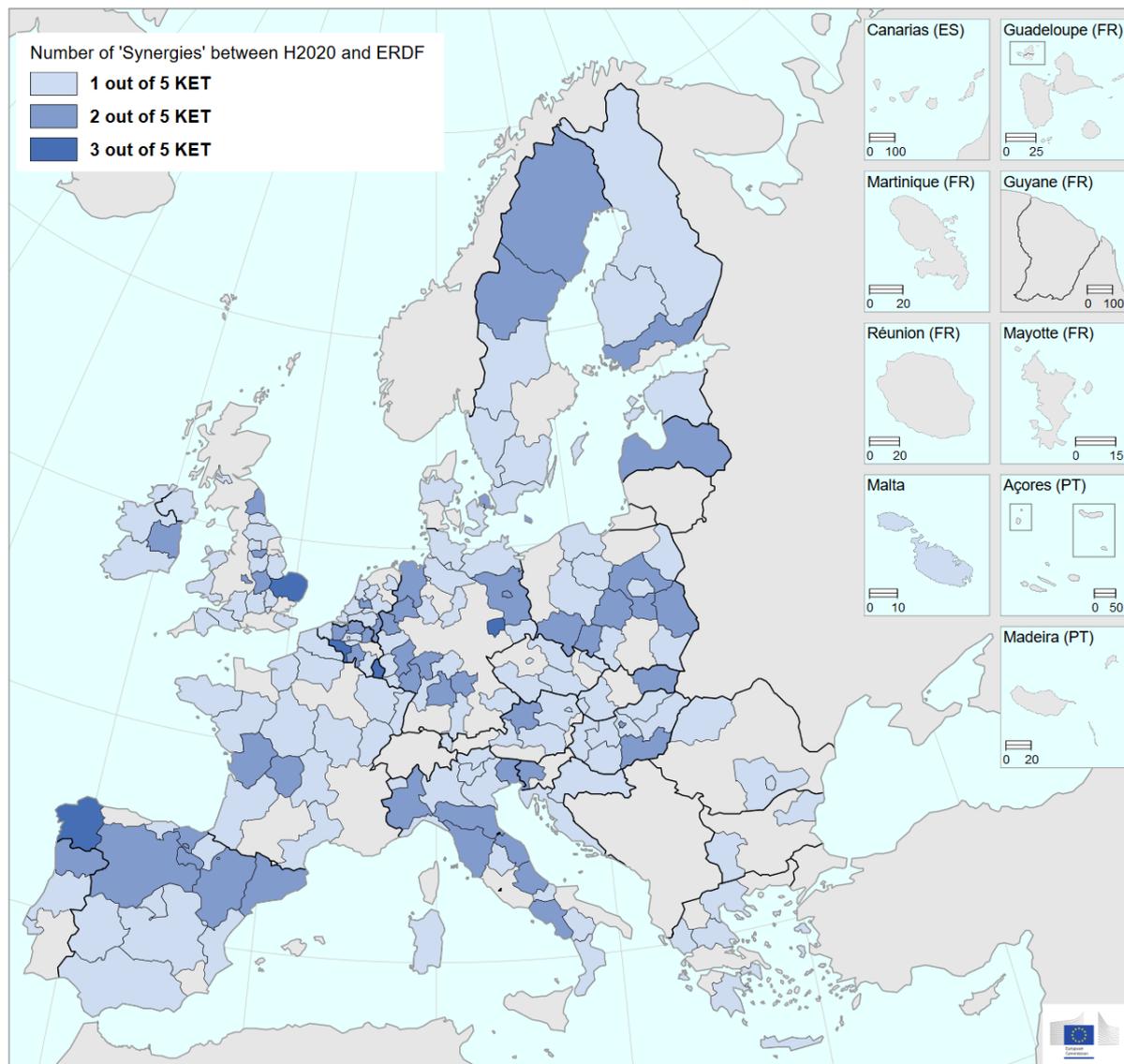
3.2 What are the most synergetic EU regions for KETs and SGCs?

In almost each European region, concentration of ERDF and Horizon 2020 funding is detected with regard to, at least, one specific technological or policy area. However, only 122 out of 281 European NUTS-2 regions focus ERDF funds available to them on R&I-related projects in at least one specific technological field(s) also supported intensely by Horizon 2020; 56 regions are found to have focused funding by both the ERDF and Horizon 2020 on two or even three technological fields (see Map 1). Furthermore, in 126 regions a possible funding synergy between ERDF and Horizon 2020 is found concerning (at least) one societal grand challenge. Referring to policy areas, also the maximum number of possible synergies arising in one region is higher (see Map 2).

Map 1 shows the distribution of the number of synergies among KET across European NUTS-2 regions, and Map 2 the same among SGC.

²⁰ When considering a location quotient of 1.05 as a benchmark value, the total number of synergies observed decreased by 13.92% compared to a location quotient of 1. The number of regions for which a relative concentration of Horizon 2020 funding is detected amounts to 277. Regarding the ERDF, it is 278 regions.

Map 1 Number of synergies per NUTS-2 region referring to Key Enabling Technologies



Source: ERDF dataset of R&I-related projects (Bachtrögler et al. 2020), CORDIS database of Horizon 2020 projects, own elaboration. Total # of regions: 281.

As discussed before, **synergies among R&I funding schemes are more frequent for societal grand challenges, which are defined more broadly**. Up to three (possible) synergies concerning KET and up to four synergies concerning SGC are found for single European NUTS-2 regions.

There is a considerable **variation in the number of synergies within Member States**. Related to this, Gianelle et al. (2020) find that around a third of ERDF R&I related calls in Poland and Czechia do not contain the alignment with RIS3 priorities as a binding eligibility criterion for project selection. In contrast, almost 90% of calls for proposals in Italy and all calls in Portugal, Lithuania and Slovenia only allow for projects targeted at pre-defined strategic priorities. Although smart specialisation strategies are not only centred around KET and SGC, it could be of interest to look at Figures 4 and 5 before that background (in future research).

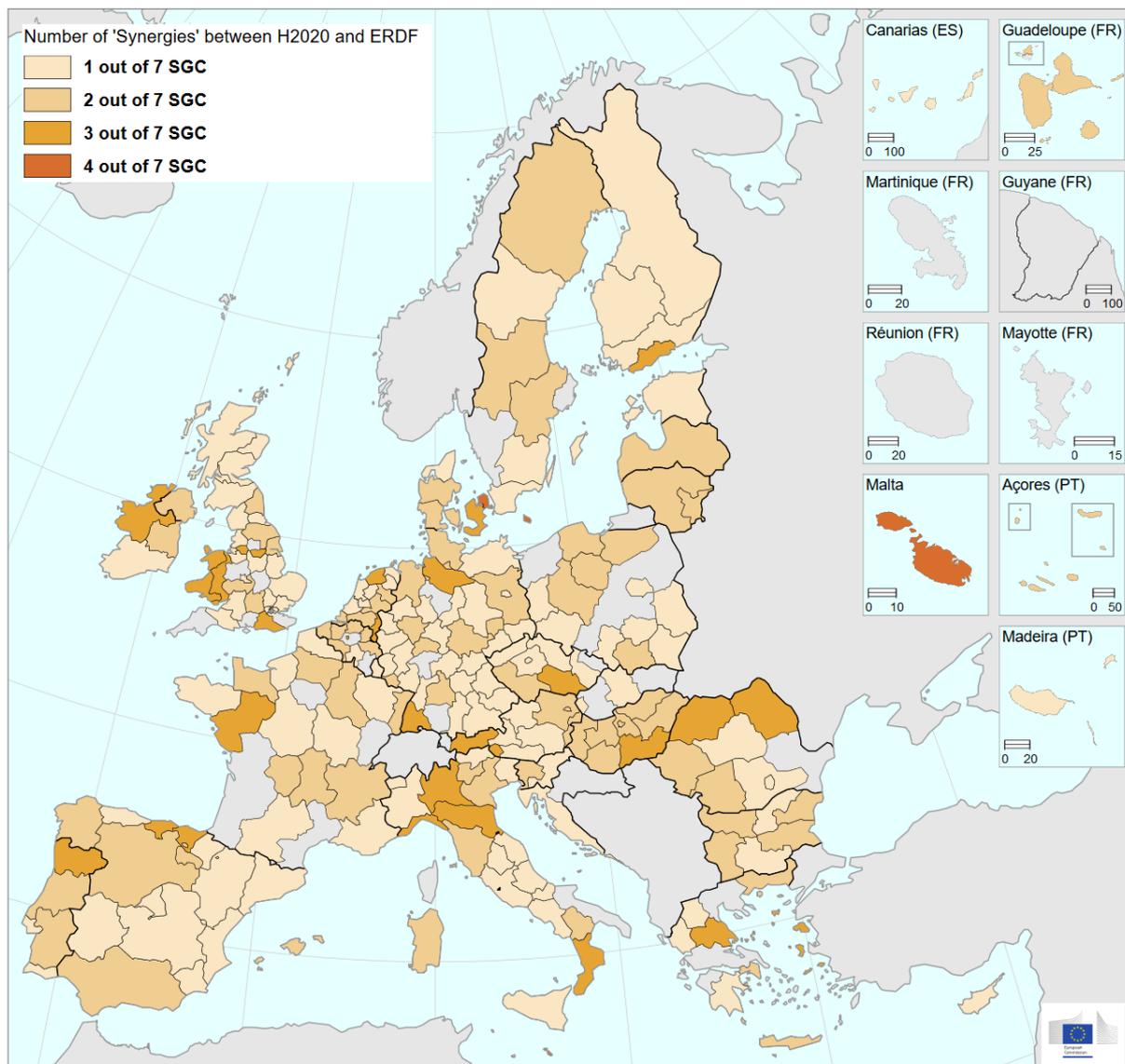
Regarding **the map of synergies in societal grand challenges, there does not appear to be an obvious pattern of the occurrence and frequency of synergies**, such as a North-South-divide or differences between EU-15 (including United Kingdom) and EU-13. Regarding potential funding synergies

in KET, though, it strikes out that only a few regions in Greece, the South of Italy, and the South of Spain, Bulgaria and Romania bundle their R&I funding in the same technological area.

It appears to be **an EU-wide pattern that there are relatively few synergies found for capital regions**. For example, in Portugal, Spain, Austria, the Netherlands, Slovakia or Poland, there is only one synergy regarding KET and only one or two synergies regarding SGC. In Lazio region in Italy, a potential synergy is found for only one societal grand challenge (inclusive, innovative and reflective societies), whereas e.g. Berlin in Germany has two synergies regarding KET (ICT and nanotechnologies) and only one regarding SGC (inclusive, innovative and reflective societies). Dublin in Ireland appears to have two synergies in KET and SGC each, while in the capital region of France or Sweden, there is neither a synergy in Horizon 2020 nor ERDF funding. In Paris, there is a relative specialisation of R&I-related ERDF spending in nanotechnologies and advanced materials and, at the same time, Horizon 2020 funds are concentrated on ICT and industrial biotechnologies.

There does **not appear to be a notable correlation between the amount of R&I-related ERDF project funding and the occurrence of (one or more) synergies in a NUTS-2 region**. However, there is a slight positive correlation with the frequency of synergies (spearman correlation coefficient of 0.18). Refer to the R&I regional viewer for a visualisation and further details on the geographical distribution of Horizon 2020 and R&I-related ERDF support.

Map 2 Number of synergies per NUTS-2 region referring to Societal Grand Challenges



Source: ERDF dataset of R&I-related projects (Bachtrögler et al. 2020), CORDIS database of Horizon 2020 projects, own elaboration. Total # of regions: 281.

3.3 Which technological and policy domains are the most suitable for funding concentration and synergies?

The presence of an ecosystem which has the capacity to trigger project ideas or is able to integrate existing networks is a key component for R&I activities. The extent of the concentration of funding in a certain field is expected to vary significantly. Variation may arise from the spectrum of R&I activities and actors a technological or policy area is linked to. For instance, among key enabling technologies, the area related to ICT concerns a wider range of industries and organisations and ecosystems than nanotechnologies or industrial biotechnologies. The same observation can be made with regard to the societal grand challenge of inclusive, innovative and reflective societies which affects a broader set of R&I activities than e.g. the challenge related to security.

Box 1 Organisations benefitting from both EU main R&I funding schemes

Another approach to analyse the interplay and potential synergies between Horizon 2020 and ERDF support for R&I activities is to investigate the existence of firms or organisations that receive funding from both schemes. In a first analysis matching the beneficiaries by their name revealed that around 15% of R&I projects co-financed by the ERDF are carried out by firms or organisations that also receive Horizon 2020

support, and that this share varies significantly across EU member states (see Bachtrögler & Doussineau, 2020).

It can be of interest in this context to investigate in which thematic area the research of organisations receiving funding from both schemes is carried out. Regarding KET, almost a half of all projects carried out by a beneficiary that also receives Horizon 2020 funding relates to industrial biotechnologies. Moreover, around a fifth of relevant projects each is carried out in the technological areas of nanotechnologies and advanced materials. Concerning societal grand challenges, around a half of R&I-related ERDF projects that were assigned a SGC and carried out by a beneficiary of Horizon 2020 funding corresponds to the – rather broadly defined – challenge of inclusive, innovative and reflective societies. More than a quarter of projects is furthermore related to challenges in the field of transport, energy and climate action, which – unlike security, health and food security – have also been main priority areas of EU cohesion policy (and thereby the ERDF) in the MFF 2014-20.

The following Figures show for each technology (Figure 4) and policy area (Figure 5) the share of the 281 regions considered for which a concentration of funding is observed for (1) Horizon 2020 funding only, (2) ERDF funding only, (3) both funding schemes and (4) none of the schemes. Comparing the profiles of concentration of funding between the individual KET and SGC suggest the following:

There are **substantial differences in concentration profiles of ERDF and Horizon 2020 funding between technology and policy areas**. In general, a larger share of regions concentrates its respective Horizon 2020 funding in key enabling technologies than in societal grand challenges. Conversely, societal grand challenges seem to be more suitable to concentrate ERDF funding. This finding corresponds to a certain extent to the rationale behind each source of funding, the Horizon 2020 programme targeting technological excellence while the ERDF within EU cohesion policy addresses the territorial divide.

When comparing concentration profiles from the perspective of the source of funding, we can observe that the share of regions concentrating ERDF funding is superior to Horizon 2020 in almost all technology areas excepting the KET EU.2.1.5 Advanced manufacturing and processing and the two societal grand challenges EU.3.4 Sustainable transports and EU.3.7 Secure society & Security. Those **three areas are most industry-oriented and may require stronger place-based assets with traditional ecosystems made of large structuring companies and SMEs than other areas**.

The concentration in both H2020 and ERDF concerns a larger share of regions in the societal grand challenges. However, significant differences are observed between areas particularly in societal grand challenges. For instance, only 5.4% of the regions are implementing synergies in the area of secure society and security and 9.3% in the sustainable transports, while more than 30% are doing so in areas related to clean energies and food security. A tentative explanation of these difference could be the preexistence of traditional industrial ecosystems based in a limited number of regions as well as the importance and current public focus on energy transition.

Another factor that could explain the difference in funding concentration profiles among certain areas is the distance from the market. The closer the area is from the research laboratory (and the further to the market), such as nanotechnologies and industrial biotechnologies, the more these technological areas are concentrated on a limited number of regions gathering the necessary ecosystems (e.g. universities, public research organisations or large companies).

Figure 4 Concentration of funding (in % of the 281 NUTS-2 regions) in each KET

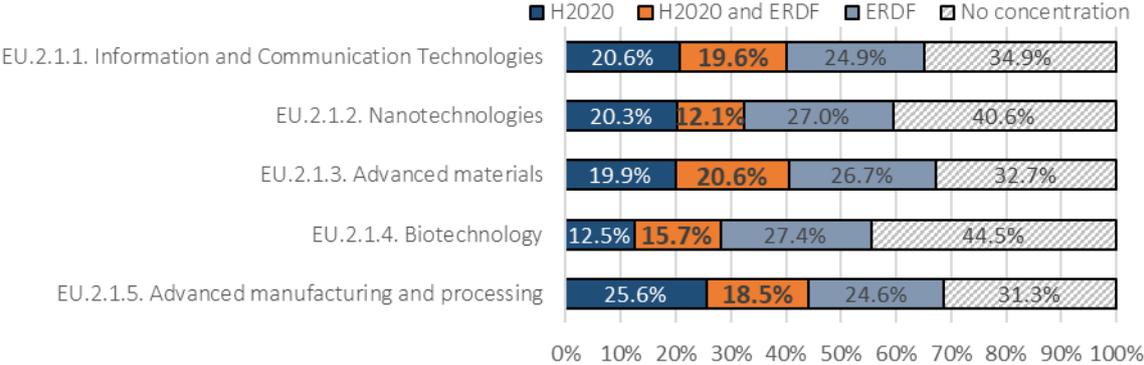
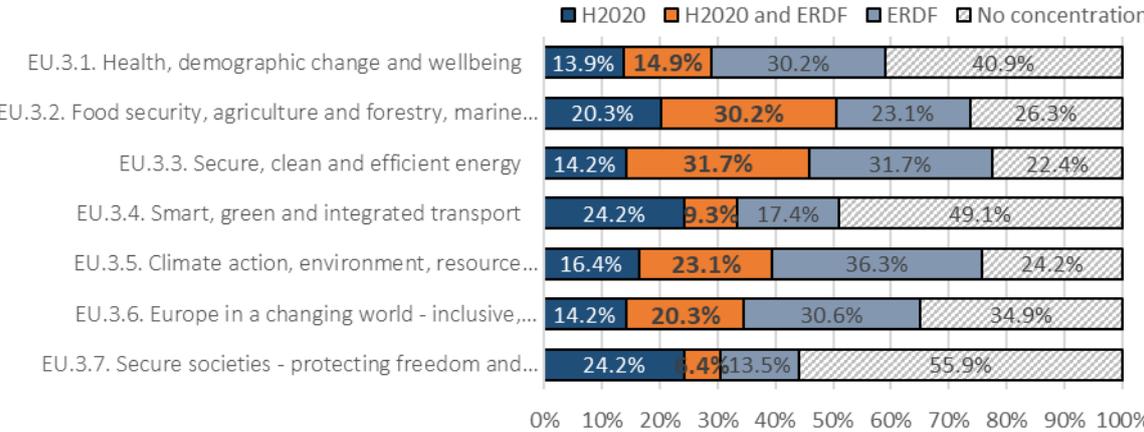


Figure 5 Concentration of funding (in % of the 281 NUTS-2 regions) in each SGC



3.4 In which regions is R&I funding concentrated on specific KET and SGC?

A technology or a policy area is linked to the R&I community it addresses. Therefore, the way to use funding varies according to the regional R&I ecosystem. The twelve following maps, five for the key enabling technologies and seven for the societal grand challenges, give an overview of the EU regions that demonstrate a concentration of funding in one or both funding schemes. Note that the analysis does not assess and rank regions according to performance indicators but maps how the two main EU R&I funding schemes are used across EU regions.

The purpose of this analysis is to deliver first insights and identify possible patterns that should be further investigated in future research:

The key enabling technologies on which the highest share of regions concentrates both Horizon 2020 and ERDF funding, are Advanced materials (58 regions) (Map 5), ICT (55 regions) (Map 3) and Advanced manufacturing and processing (52 regions) (Map 7). However, **there do not appear to be any obvious similarities among regions for which synergies of funding are detected in the same technological field.** E.g. for ICT, there are regions implementing synergies in almost every EU country, which highlights the EU-wide importance of progress in ICT and digitisation. Synergies concerning advanced materials appear to be implemented in Scandinavian regions (SE, FI), Central Europe (PL, CZ) and central Italy. A number of traditional industrial regions are found to concentrate R&I activities supported by the EU on the KET Advanced manufacturing and processing, such as the Northern part of Italy, Spain and

France as well as South Germany or, referring to the analysis in Section 3.1, Upper Austria. Nanotechnologies and Biotechnologies (Map 4 and Map 6) could be seen as more research- and less industry-oriented key enabling technologies. Ecosystems embedding public research organisations, competitive universities and SME are important factors to trigger projects funded either by the ERDF or, even more, by the Horizon 2020 framework programme. It is worth noting that we observe more concentration in those KET in the EU15 Member States (including the United Kingdom) than in the EU13 countries. However, there are some exceptions such as three regions in Poland that develop synergies of funding in Nanotechnologies. Furthermore, it should be highlighted that two thirds of Spanish regions concentrate both Horizon 2020 and ERDF funding in industrial biotechnology.

There are considerable differences in funding patterns concerning different societal grand challenges. As discussed before, in general, SGC appear to be more suitable for funding concentration than KET. In particular, the areas related to Clean Energy (Map 10) and Food & Bioeconomy (Map 9) are by far the most synergetic, with 89 and 85 regions, respectively, concentrating funding of both Horizon 2020 and ERDF in these areas. Concerning to the SGC Clean Energy regions in France, Romania, Bulgaria, Germany Denmark, Scotland, the North of Italy and Spain are implementing synergies of funding. Regarding Food and Bioeconomy, Southern regions of Spain, West of France and also Central European countries, particularly Hungary and the North of Romania, are allocation high amounts of funding (relative to the EU average) from both H2020 and ERDF in that field.

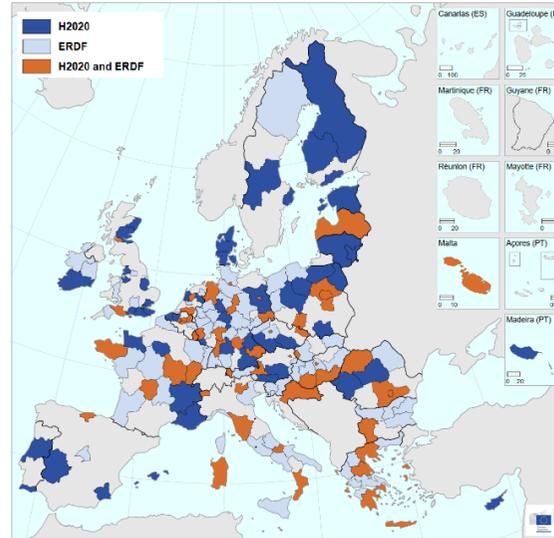
For the societal grand challenges related to sustainable transport (Map 11) and Security (Map 14), the fewest synergies are detected among EU regions. **Regarding the area related to Sustainable transport, Horizon 2020 funding concentration and synergies tend to occur more often in the EU15 countries, while a concentration of ERDF funding in EU13 countries.** As a very large share of regions does not concentrate R&I funding on the challenge of security, this suggests that this area is targeted in a limited number of specific ecosystems. Moreover, security is not one of the main priorities of EU cohesion policy and therefore the ERDF.

Concentration of funding in Key Enabling Technologies across EU regions

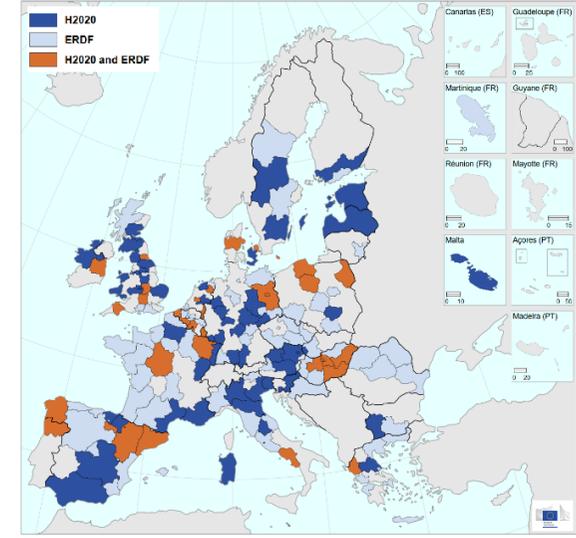
Legend:

- Regions with H2020 funding concentration only
- Regions with ERDF funding concentration only
- Regions with H2020 and ERDF funding concentration

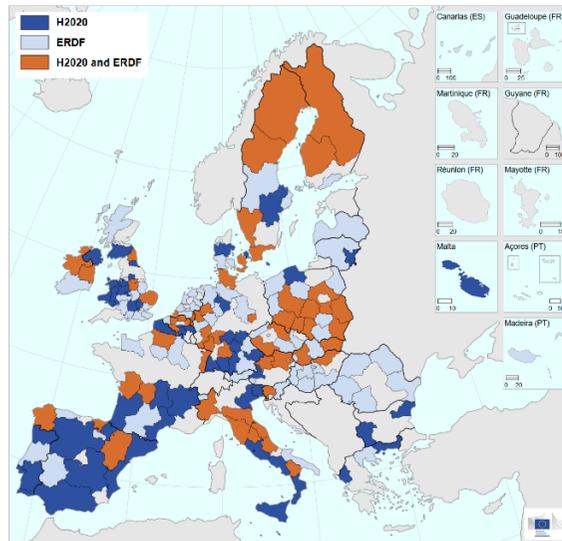
Map 3 Information and communication techno.



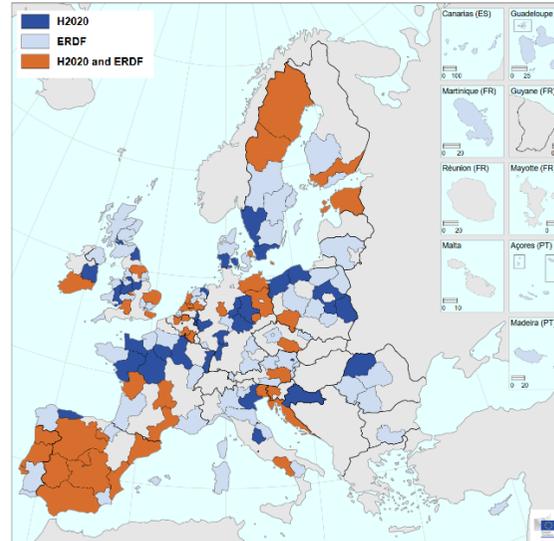
Map 4 Nanotechnologies & Nanosciences



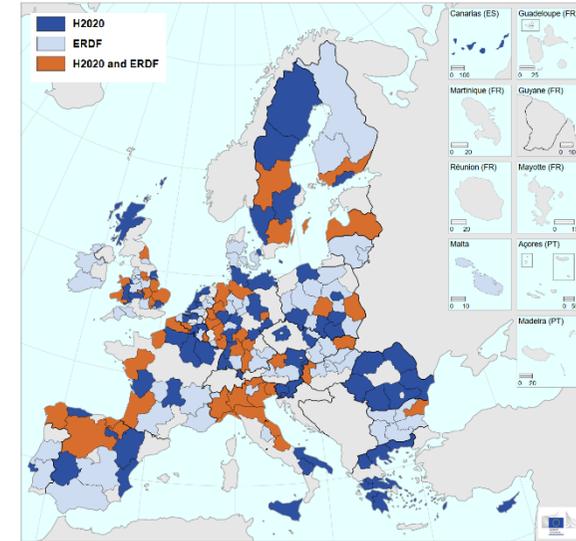
Map 5 Advanced materials



Map 6 Industrial biotechnologies



Map 7 Advanced manufacturing and processing

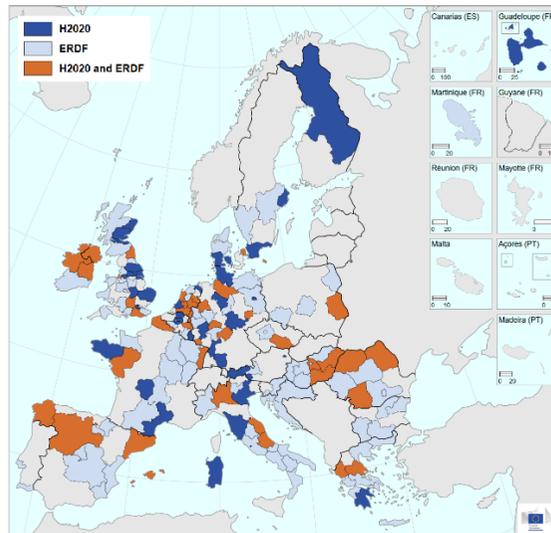


Concentration of funding in Societal Grand Challenges across EU regions

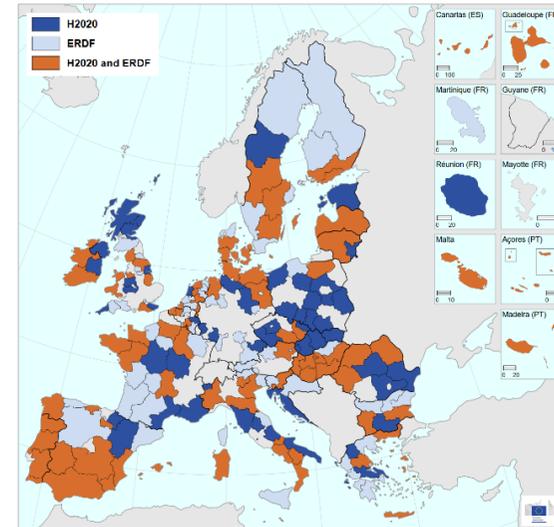
Legend:

- Regions with H2020 funding concentration only
- Regions with ERDF funding concentration only
- Regions with H2020 and ERDF funding concentration

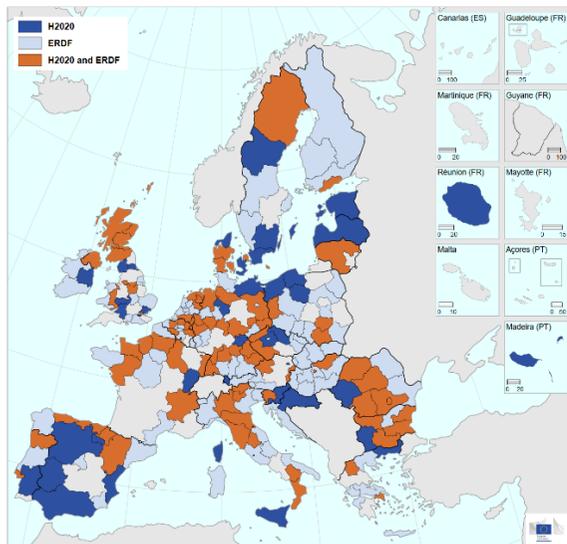
Map 8 Health, Demographic change and wellbeing



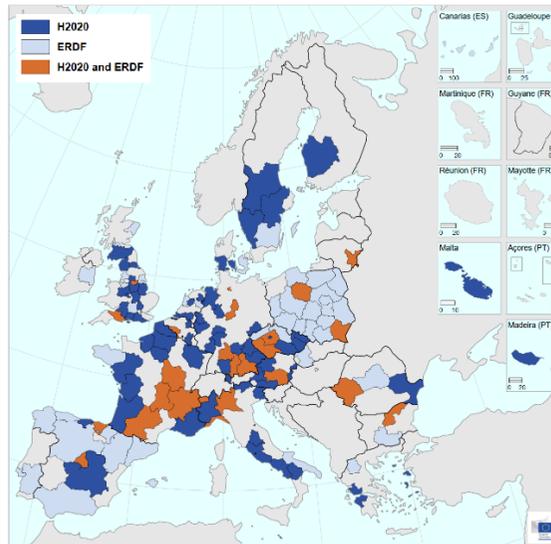
Map 9 Food security, Agriculture and Bioeconomy



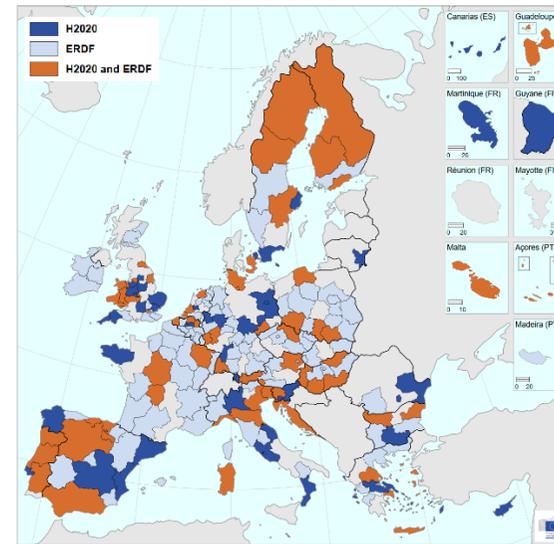
Map 10 Secure, clean and efficient energy



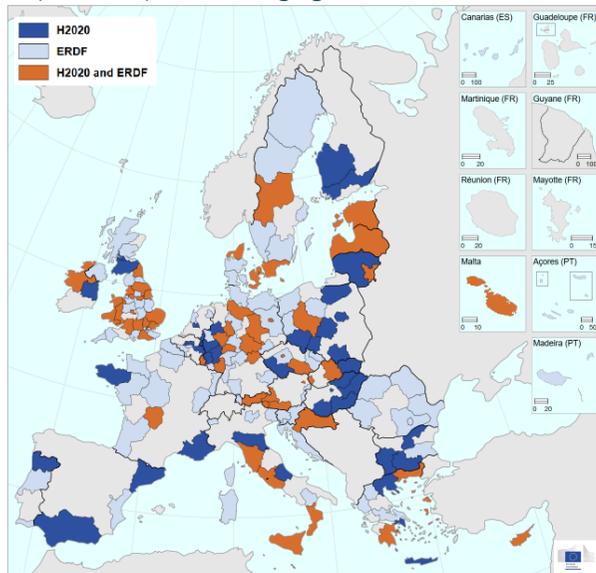
Map 11 Smart, green and integrated transport



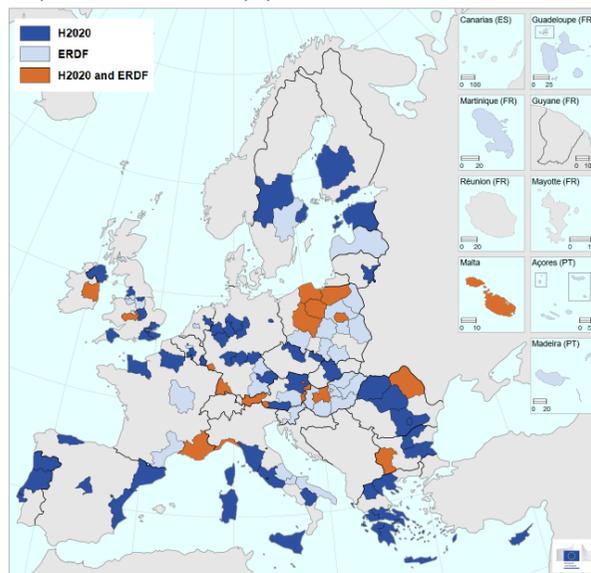
Map 12 Climate action, environment and raw mat.



Map 13 Europe in a changing world



Map 14 Secure society, protection freedom and security for EU



4 Discussion and conclusions

Based on the concept of smart specialisation, European regions are encouraged to generate synergies among EU R&I funding. Indeed, an important element of smart specialisation is the concentration of ERDF funding on specific domains chosen according to place-based assets and opportunities (Foray et al 2009), which should be complemented with other sources of funding, in particular Horizon 2020. The concept of synergies between funding, as assumed and investigated in this report, aims at ensuring a critical mass of funding in specific promising technological and policy fields and appears to be not straightforward to implement. While regional managing authorities select projects to be funded by the ERDF based on regional RIS3 and regional policy programmes, the quality and excellence of the project proposal and the consortium matter for the successful application for Horizon 2020 funds. Barriers for the implementation of synergies are to some extent correlated to the implementation of S3 itself (Ozbolat et al 2018, Sotarauta 2018) and stem from the divide of governance and institutional settings of different funding schemes, with different objectives and mandates, a lack of monitoring data and administrative capacities to (sufficiently) envisage and manage strategic synergies.

Through synergies – especially with key enabling technologies, a region should be enabled to move closer or faster to the productivity frontier in a certain industry or technology, or to gain more excellence in a certain field of research (Montresor and Quatraro 2020). The latter is expected to allow product or process innovations also in other fields, to trigger the creation of new innovative firms and attract more highly qualified workers. Still, there is no empirical evidence on the effects of synergies in R&I funding on regional economic or productivity growth or research outcome (such as patents) yet; however, as the concept of smart specialisation is based on focusing on selected, highly-specific priority area, a concentration of funding on specific thematic (or sectoral) areas implies an alignment with the regulation and targets of the EU's regional innovation policy in 2014-2020.

Therefore, the purpose of this analysis is to show whether Horizon 2020 and ERDF funding is focused on specific technological or policy fields in a region, and if yes, if there is also a concentration of funding of the two schemes on the same field. In order to bridge the datasets and compare their thematic distribution, key enabling technologies and societal grand challenges are assigned to R&I-related ERDF projects based on project summaries and keywords. Therefore, one possible limitation of our analysis is, first, the selection of R&I-related projects - which relies on the correct classification of managing authorities - and, second, the assignation of KET and SGC based on more or less detailed project descriptions.

This report maps the concentration of EU funding among different technological and policy areas in EU regions, showing that there is some political action needed if synergies between EU funding instruments should be further strengthened in the new period 2021-2027. Future analysis should focus on both the determinants of synergies, such as institutional systems, and the relationship with EU policy effects or regional economic growth.

The occurrence of potential synergies resulting from a concentration of ERDF and Horizon 2020 funding in the same KET or SGC differs a lot across areas and from one region to another. Factors expected to influence the concentration of funding are diverse and one of the most important may be the existence of territorial assets (e.g. infrastructures, universities, skilled population) as the concentration of funding reflects the ecosystems benefiting of the funding support. In terms of identifying real synergies between EU policies, this analysis of concentration of funding can be considered as a first essential step. Next, also more qualitative analysis should be conducted to explore the rationale behind the combination of funding models. To start with, an important question to clarify is whether these synergies were planned by the beneficiaries or (regional) policy makers, or whether they emerged by coincidence. Furthermore, it would be interesting to learn more about the characteristics of synergetic projects (e.g. successive upstream,

successive downstream, cumulative or parallel) by applying a combination of further text and data analysis as well as qualitative interviews.

References

- Bachtrögler, J., Doussineau, M. and Reschenhofer, P. (2020a), Dataset of projects co-funded by the ERDF during the multi-annual financial framework 2014-2020, Publications Office of the European Union, Luxembourg, doi:10.2760/491487 (online).
- Bachtrögler-Unger, J. and Doussineau, M. (2020b), EU research & innovation funding schemes: Using project-level data for monitoring & Evaluation - In: fteval Journal for Research and Technology Policy Evaluation, Issue 51 (Europe), doi: 10.22163/fteval.2020.486
- Billing, S. and Johnson, E (2012). The location quotient as an estimator of industrial concentration, *Regional Science and Urban Economics*, Volume 42, Issue 4, July 2012, Pages 642-647
- Conte, A., & Özbolat, Nida K. (2016) "Synergies for Innovation: Lessons Learnt from the S2E National Events". Stairway to Excellence Brief Series, Issue #1, JRC104861, European Commission: Seville-Spain
- Di Cataldo, M., Monastiriotis, V., and Rodríguez-Pose, A. (2020) How 'Smart' Are Smart Specialization Strategies?, *Journal of Common Market Studies*, forthcoming, <https://doi.org/10.1111/jcms.13156>.
- European Commission (2012), "A European strategy for Key Enabling Technologies -A bridge to growth and jobs", Communication adopted on 26 June 2012
- Doussineau, M., Arregui-Pabollet, E., Harrap, N. and, Merida, F.(2018) Stairway to Excellence: Drawing funding and financing scenarios for effective implementation of Smart specialisation strategies, JRC Technical Reports JRC112708
- European Commission (2014), Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes - Guidance for policy-makers and implementing bodies, Luxembourg: Publications Office of the European Union, 2014.
- European Commission (2017), LAB – FAB – APP Investing in the European future we want, Report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes
- Foray D., Goddard J., Goenaga Beldarrain X., Landabaso M., McCann P., Morgan K., Nauwelaers C., Ortega-Argilés R. (2012), Guide to Research and Innovation Strategies for Smart Specialisation (RIS 3), Publications Office of the European Union, ISBN :978-92-79-25094-1 doi:10.2776/65746
- Foray, D., Morgan, K. and Radosevic, S. (2018A), From rivalry to synergy: R&I policy and cohesion policy, EU Directorate-General for Regional and Urban Policy, Working Paper, https://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/rivalry_synergies.pdf.
- Foray, D., Morgan, K. and Radosevic, S. (2018B), The role of smart specialisation in the EU research and innovation policy landscape, EU Directorate-General for Regional and Urban Policy, Working Paper, https://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/role_smartspecialisation_ri.pdf.
- Gianelle, C., Kyriakou, D., McCann P., Morgan, K., (2020) Smart Specialisation on the move: reflections on six years of implementation and prospects for the future, *Regional Studies*, 54:10, 1323-1327, DOI: 10.1080/00343404.2020.1817364
- Haegeman, K., Arregui Pabollet, E., Harrap, N., Horbaczewska, K., Torrecillas Caro, M. and Valero Boned, S. (2019) Joint Undertakings: analysis of collaboration mechanisms with ESI Funds in an S3 context, EUR 29707 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-01486-7, doi:10.2760/000996, JRC116094
- Montresor S., Quatraro F. (2015) Key Enabling Technologies and Smart Specialization Strategies. European Regional Evidence from patent data, European Commission, Joint Research Centre, JRC95313
- Özbolat, N.K. and Harrap, N., Lessons from the Stairway to Excellence (S2E) project, Publications Office of the European Union, Luxembourg, 2018, doi:10.2760/99850.
- Özbolat, N.K. & Harrap, N., Addressing the innovation gap: Lessons from the Stairway to Excellence (S2E) project, EUR (29287 EN), European Commission, Seville, 2018, ISBN (978-92-79-88821-2), doi (10.2760/99850), JRC111888.

Piribauer, P., Bachtrögler, J., Burton, A., Ehn-Fragner, S., Fritz, O., Klien, M., Mayerhofer, P., Weingärtler, M. (2020), Die Wirtschaft in den Bundesländern. II. Quartal 2020 (The Economy in the Austrian Länder. Second Quarter of 2020), Austrian Institute of Economic Research (WIFO).

Pontikakis, D., Doussineau, M., Harrap, N. and Boden, M., Mobilising European Structural and Investment Funds and Horizon 2020 in support of innovation in less developed regions, EUR 29298 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-89850-1, doi:10.2760/77101, JRC112442

Sargent Florence, Theory of Location: Definition, Factors and Criticism (1939)

Sörvik, J., Rakhmatullin, R. and Palazuelos Martínez, M. (2014), Preliminary report on KETs priorities declared by regions in the context of their work on Research and Innovation Strategies for Smart Specialisation (RIS3). JRC Technical Report 2013

Sörvik J., Kleibrink A. (2015) Mapping Innovation Priorities and Specialisation Patterns in Europe S3 Working Paper Series n° 08/2015–January 2015, JRC95227

Sotarauta M., (2018) Smart specialization and place leadership: dreaming about shared visions, falling into policy traps? *Regional Studies, Regional Science*, 5:1, 190-203, doi: 10.1080/21681376.2018.1480902

GETTING IN TOUCH WITH THE EU

In person

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

On the phone or by email

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

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by electronic mail via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

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

EU publications

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

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub
ec.europa.eu/jrc



@EU_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub

