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Funding Synergies for Innovation, Industrial Transition and Entrepreneurship

An analysis of ERDF and RRF support for S3 skills in the 2021-2027 programming period.

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Contents

Abstract

European Regional Development Fund (ERDF) programming in the 2021-2027 financial period recognises the role of human capital in place-based approaches to territorial development and innovative transformation, allowing for investment in *skills for smart specialisation, industrial transition and entrepreneurship*. This research quantifies the amount of investment earmarked across the EU-27 for this, alongside similar investments under the temporary Recovery and Resilience Facility (RRF), acknowledging the importance, and yet complexity, of ensuring complementarity between the funding streams. Whilst the legal basis for both resides in the Union's goal of strengthening economic, social and territorial cohesion and reducing disparities, the design and implementation of the two instruments reflects different governance models, performance frameworks, policy priorities and actors. The analysis aims to capture how these two instruments support skills development relevant to the twin transitions and smart specialisation domains across heterogeneous socio-economic and institutional territories within the context of the European Semester recommendations. However, it provides an overview of *proposed investment* at the point of adoption of the two sets of programmes in 2022 and 2023, recognising that the results and impact of the allocations, and their integration and connection with their local innovation ecosystem, will depend upon the territorial context, the projects and beneficiaries selected and implementation approaches.

Foreword

The Higher Education in Smart Specialisation (HESS) project has been developed by the European Commission's Joint Research Centre in collaboration with DG Education, Youth, Sport and Culture (EAC) since 2016. It seeks to engage stakeholders from Higher Education in regional development processes and regional innovation ecosystems to ensure places contribute to local and broader European growth and transformation. This research has been undertaken as part of Work Package 4 of HESS IV, which looks at the role of European Structural and Investment Funds (ESIF) in integrating human capital and skills in smart specialisation to support territorial competitiveness and growth.

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Executive summary

Policy context

Smart specialisation seeks to ensure the prioritisation of investment on territorial strengths and competitive advantages, identified in a national/regional research and innovation strategy. The design and implementation of a smart specialisation strategy (S3) should recognise the role of human capital[1] in territorial place-based development and involve the provision of high-quality education and training to ensure a realistic supply of skills relevant to the needs of the territory and its smart specialisation domains.

A new specific objective for the European Regional Development Fund (ERDF) support in the 2021-2027 programming period covers '*Skills for Smart Specialisation, Industrial Transition and Entrepreneurship*' (specific objective 1.4)[2]. This places skills development as an integral part of a territorial smart specialisation strategy and process and a place-based approach to innovation, but frames territorial development and smart specialisation increasingly in relation to globalisation, technological change and the shift to a low carbon economy. Industry 4.0 (digitalisation and AI-driven technologies for increasing the efficiency and flexibility of production) and Industry 5.0 (research and innovation as the driver of the transition to a sustainable, human-centric and resilient European industry) are set to have far-reaching implications for the nature of work and employment[3].

The *Harnessing Talent in Europe's regions* communication[4] outlines how, within the context of wider structural transformation and the twin transition, a change in Europe's demographic landscape is hampering EU resilience and competitiveness and has the potential to exacerbate regional disparity. Knowledge and skills are proclaimed the engines of future economic growth especially where demographic challenges, combined with socio-economic factors, such as low innovation capacity, have the potential to limit territorial capacity for development[5]. Tailor-made strategies and policies are necessary to reflect the heterogeneity of regional realities: promoting territorial comparative advantages and addressing local weaknesses and challenges. The communication called on cohesion policy and the Recovery and Resilience Facility (RRF) to design and implement place-based policy responses to stimulate talent and better match it to changing territorial needs and labour market demands. Within this context, this research attempts to identify the extent to which the two funding initiatives have allocated support for appropriate investments and reforms across the two most relevant and significant EU funding initiatives.

As part of the European Semester country reports in 2019, the European Commission elaborated an investment guidance annex (Annex D) for each Member State (MS) on cohesion policy funding priority investment areas under the 2021-2027 programming period[6]. These priority investment areas

[1] The definition of human capital broadly covers rather intangible aspects such as knowledge and skills, education and training, talents and abilities and, sometimes, health (OECD, 2007). This research attempts to measure expenditure related to all aspects of this definition with the exception of health.

[2] Article 3, Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund.

[3] https://s3platform.jrc.ec.europa.eu/en/w/higher-education-for-smart-specialisation-a-handbook-1

[4] European Commission (2023) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Harnessing talent in Europe's regions', COM(2023) 32 final

[5] The communication identifies 46 regions in a 'talent development trap', and 36 at risk regions.

[6] All EU-27 country reports for 2019 are available here: https://commission.europa.eu/publications/2019-european-semester-country-reports_en

reflected investment bottlenecks and needs, as well as regional disparities identified in each of the country reports, and aimed to provide the basis for initial dialogue between the Commission services and the various MS around future programming. The quantification of allocations received from territorial funding programmes for skills, talent, education and training relevant for S3, industrial transition and entrepreneurship[7], their territorial distribution and nature of their activity, are also analysed within the context of the relevant country-specific recommendations and priority investment areas.

A further aspect will consider the extent to which complementarities and synergies exist with the RRF, introduced in February 2021 in response to the changing socio-economic circumstances resulting from the COVID-19 crisis. The RRF also supports investment and reforms in skills, education, research and innovation and recognises the role of human capital as a key driver in social and territorial cohesion. The introduction of the RRF, unprecedented in its scale and ambition, had the potential to impact on the use of ERDF funding for Skills for S3[8]. A consideration of MS reforms and investment proposals included in national Recovery and Resilience Plans (RRPs) will enable a fuller picture of how EU initiatives more broadly support human capital development relevant to territorial development and resilience. A key distinction between the two instruments is their differing territorial focus and governance, with cohesion policy focusing on regional disparities and having a strong territorial articulation, and the RRF expected to finance national reforms and investments linked to country-specific recommendations issued within the framework of the European Semester.

The Higher Education for Smart Specialisation (HESS) project seeks to engage and support regions and stakeholders from higher education in innovation ecosystems, ensuring that higher education (HE) institutions and territories across Europe contribute to local and broader European growth and transformation, acting as engines for development and actors for change in the twin green and digital transitions.[9] The project has sought to monitor and analyse investments in human capital and HE under cohesion policy and to analyse the extent to which different education and skills provision and approaches can contribute to S3 and territorial development and adequately link higher education institutions' (HEI) capacity with regional education and skill needs (Woolford and Boden, 2021).

Methodology

The research involved an analysis of ERDF programmes to determine overall allocations to:

- Specific Objective (SO) 1.4 (Developing skills for smart specialisation, industrial transition and entrepreneurship), and
- Category of Expenditure (CoE) 23 (Skills development for smart specialisation, industrial transition, entrepreneurship and adaptability of enterprises to change).

[7] For an earlier attempt to quantify funding for Skills for S3 under the 2014-2020 programming period, see European Commission, Joint Research Centre, Woolford, J., Bachtrögler-Unger, J., Burton, A., Lalanne, M. and Gulda, K., Skills for Smart Specialisation, Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2760/768385, JRC137083.

[8] Throughout the report, the terms 'Skills for S3' or 'S3 skills' are utilised as an abbreviation for *Skills for S3, industrial transition and entrepreneurship*.

[9] European Commission (2022) Communication from the Commission, on a European Strategy for Universities, COM(2022)16.

A dataset from DG REGIO, extracted from their Open Data Portal[10], was analysed and enhanced for the purpose of the research. 190 ERDF Operational Programmes (OPs) across the EU-27 were included in the research (out of a total of 198, with eight Technical Assistance programmes discarded).

An analysis of measures proposed under the RRF sought to determine the extent to which this instrument targeted similar or complementary activity related to *skills for smart specialisation, industrial transition and entrepreneurship*. The RRF has a number of pillars targeting human capital [11], and the Bruegel dataset[12] which contains data from 26 MS at the *point of submission* of the RRP to the European Commission[13] was utilised to determine relevant allocations under the RRF. Due to the lack of granularity of the data, determining the exact nature of the reform or investment was at times problematic, and potentially relevant measures were therefore categorised as of either *definite* or *possible* relevance to Skills for S3.

Main findings

Of the 190 ERDF 2021-2027 programmes, 68 of them (36%) include a financial allocation for SO 1.4 and 94 of them (49%) for CoE 23. Of the total ERDF allocation for all EU-27 programmes, 1.01% or EUR 2.1 bn is allocated to SO1.4 and/or CoE23 (where allocations fall under both classifications they are only counted once[14]). At MS level, allocations range from 6.4% of the Swedish ERDF total allocation to no allocation for Austria, Cyprus, Denmark, Ireland, and Luxembourg. At programme level, allocations tend to be low: only about 10% of the 190 programmes have an allocation above two percent of the total.

At regional level, 40% of the EU-27's 240 NUTS 2 regions allocate some funding under SO1.4 and 55% under CoE23. All Portuguese, Romanian, and Swedish regions allocate funding to SO1.4, as well as most of the Italian regions, with Italy and Romania the only MSs with both national and regional programmes with Skills for S3 allocations. The highest percentage allocation of any programme occurs in the German region of Rheinland-Pfalz, where 16.4% of the total ERDF allocation is destined for CoE23.

The estimated[15] total value of RRF funding categorised as directly relevant to Skills for S3 is EUR 60.55 billion (12.2%), with a further EUR 28.12 billion (5.72%) allocated to activity that could possibly include or be relevant for S3 skills, suggesting a potential total of up to EUR 88.3 billion (around 18% of the total EUR 491.51 billion)[16].

[10] Open Data Portal for the European Structural Investment Funds - European Commission | Data | European Structural and Investment Funds (europa.eu).

[11] Pillars 1 "green transition", 2 "digital transformation", 3 "smart, sustainable and inclusive growth, including economic cohesion, jobs, productivity, competitiveness, research, development and innovation, and a well-functioning internal market with strong small and medium enterprises (SMEs)", 4 "social and territorial cohesion" and 6 "policies for the next generation". See the Recovery and Resilience Scoreboard and European Commission, Regulation 2021/241 establishing the Recovery and Resilience Facility.

[12] https://www.bruegel.org/dataset/european-union-countries-recovery-and-resilience-plans

[13] The Bruegel database does not include the Netherlands due to their delayed submission of their RRP.

[14] SO1.4 and CoE23 are not necessarily coterminous in ERDF programmes, with only 71.5% of CoE23 investment allocated under SO1.4.

[15] Funding allocations under the RRF are estimated costs only, whilst not all measures have costs associated as some are reforms.

[16] Utilising the Bruegel database, ibid.

At MS level, nearly 85% of the total RRF investment in Skills for S3 across the EU-27 RRF was allocated in Italy (EUR 28.85 billion), Spain (EUR 17.53 billion) and France (EUR 4.71 billion). On average, MS have allocated 12.20% of their RRF allocations to investments relevant to S3 skills. Spain allocates the greatest relative amount (25.21%), followed by Lithuania (16.37 and Italy (15.07%). Nevertheless, if measures identified as possibly relevant to Skills for S3 are also included then Cyprus (32.66%) would be the highest relative spender on Skills for S3, followed by France (29.33%) and Spain (29.1%).

In terms of the type of activity funded under the RRF, the greatest number of measures were found to relate to activity to strengthen R&D&I ecosystems, although the majority of the funding allocation to Skills for S3 (37%) targeted support to SMEs. The lowest volume of funding and number of investments relate to entrepreneurial skills. Both skills development in HEIs and skills development in firms were most likely to be included as complementary activity in investments with a different primary focus.

The amounts allocated to Skills for S3 under the RRF across the EU-27 (EUR 60.55 billion) dwarf those available under ERDF (EUR 2.09 billion). Across the two funding instruments, Italy allocates significantly greater funding to Skills for S3 than any other EU MS (EUR 29.42 billion) but in terms of percentage Spain allocates more (19.12%). Some of the smallest MS (Luxembourg, Estonia, Cyprus) unsurprisingly allocate the lowest total amounts, reflecting lower funding receipts.

In their country reports' Annex D for 2019 all EU27 MS received a recommendation related to Skills for S3, industrial transition and entrepreneurship. Many of the smaller MS (e.g. Austria, Cyprus, Denmark) seem to have chosen to use their RRF allocations, as a new and larger funding source, to address skills for S3 needs, and some adaptation of ERDF programming activity in the 2021-2027 programming period may have occurred as a result of its introduction. There tends to be little correlation however between the number of skills needs identified in Annex D and the overall amount and nature of allocations at national level. Finally, the analysis notes that there is a degree of complementarity across the instruments but that the demarcation between the two funding streams may in fact be more problematic.

Key conclusions

The research highlights investment across the EU-27 in skills for adaptation and transformation of territorial ecosystems in relation to the industrial, digital and green transitions and in alignment with other territorial development and innovation strategies (specifically S3). It contributes to an understanding of the extent to which different governance actors have placed future skills at the centre of their territorial transformation.

However, it is clear that mapping funding across the two funding instruments is not short of complications, and that whatever level of allocation has been identified, the ultimate achievement of results and impacts in the field of skills for S3 is still dependent on factors such as project selection, beneficiaries, policy coordination, absorption capacity and governance model. As demonstrated by the allocations across the two funding streams, skills development policies and investment are multi-level and cross-sectoral, implying significant potential governance challenges in relation to coordination, efficiency and complementarity.

The potential drop in investment under ERDF since the 2014-2020 programming period amounts identified in previous exercises[17], could reflect the fact that once the (earlier) RRF came on-stream the ERDF programmes needed to fund more diverse activity and diverge from previous funding patterns. However, it could also reflect the fact that the more precise set of programming categories in the 2021-2027 programming period has enabled more robust programming and targeting of funding by Managing Authorities, as well as enhanced calculation and analysis in the research methodology. There are a few programming anomalies that could reflect the fact that the guidance on ERDF Policy Objective 1 is internal to the Commission and not shared with Managing Authorities in advance of programme negotiations, for example, the lack of coincidence between SO1.4 allocations and the use of CoE23. Whilst the majority of other activity included is relevant and aligned with the objectives of SO1.4 Skills for Smart Specialisation, there are a few examples where activity could arguably be seen to be less consistent with a focus on skills development. In a number of cases, Skills for S3 activity seems to have been incorporated into a broader portfolio of investment in order to increase programming flexibility and synergies. Overall, however, under the RRF and, to a lesser extent, also ERDF the level of detail provided does not enable easy classification or a definitive understanding of final investments.

The research is limited in its coverage by the focus on only two key funding initiatives, despite the fact that other EU initiatives, such as the ESF+ and the Just Transition Fund, are also able to fund green and digital skills, R&I and smart specialisation related activity and challenges identified in the European Semester. A further limitation in the comparative analysis of the two periods is that this analysis of 2021-2027 does not include Interreg expenditure where, as found in our analysis of the 2014-2020 programming period[18], highly relevant examples of skills for S3 activity exist e.g. Talent4S3 under Interreg Europe[19].

Related and future JRC work

In response to the regulatory change of the 2021-2027 programming period and the incorporation of the SO1.4 on skills for S3 and novel territorial investment choices, the HESS project undertook an initial piece of work to attempt to determine relevant Skills for S3 allocations under ERDF and ESF in the 2014-2020 programming period. This provided a baseline analysis of investment from territorial funding programmes for skills, talent, education and training relevant for S3, industrial transition and entrepreneurship[20]. However, the 2014-2020 European Structural and Investment Funds' (ESIF) regulatory framework did not specifically set out to fund skills projects related to S3, and hence did not include relevant categorisation codes, and so comparisons with the amounts determined in this report are problematic, as outlined above.

[17] Roughly 24 bn eur of ERDF was identified as potentially relevant for Skills for S3 in the 2014-2020 programming period through a keyword search. See European Commission, Joint Research Centre, Woolford, J., Bachtrögler-Unger, J., Burton, A., Lalanne, M. and Gulda, K., Skills for Smart Specialisation, Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2760/768385, JRC137083.

[18] Woolford et al, 2024.

[19] https://www.interregeurope.eu/talent4s3

[20] European Commission, Joint Research Centre, Woolford, J., Bachtrögler-Unger, J., Burton, A., Lalanne, M. and Gulda, K., *Skills for Smart Specialisation*, Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2760/768385, JRC137083

The results of the analysis can help provide direction to future ESIF investments in skills and human capital and future programming frameworks under cohesion policy but also more widely. The analysis could enhance understanding of the complementarities between ERDF and RRF, as well as other EU funding initiatives that address human capital and education such as Erasmus+, European Institute of Innovation and Technology Knowledge and Innovation Communities (EIT-KICs), Just Transition Fund and Digital Europe.

1 Introduction

Smart specialisation strategies (S3) were introduced under Cohesion Policy in the 2014-2020 programming period. The establishment of a territorial research and innovation strategy provides a framework for ERDF investment for research and innovation, ensuring the prioritisation of funding on territorial strengths and competitive advantages and hence strengthening regional innovation ecosystems.

A place-based economic transformation agenda should incorporate the provision of high-quality education and training that is relevant to, and specifically targets, the needs of the territory and its labour market in skills and human capital provision. Under the ERDF 2021-2027 programming framework, the role of human capital as a key driver of smart specialisation was specifically recognised with the introduction of Specific Objective 1.4 *'Skills for Smart Specialisation, Industrial Transition and Entrepreneurship'*[21]. All investments under this specific objective require alignment with the relevant territorial smart specialisation strategy and domains, and match R&I strengths and activities with business needs[22].

The JRC has been collaborating with DG EAC since 2016 on the Higher Education for Smart Specialisation (HESS) project, which looks to engage and support regions and stakeholders from higher education in regional development and regional innovation ecosystems. It seeks a closer integration and increased synergies across relevant EU policy areas, with universities acting as engines for development and actors for change in the twin green and digital transitions.[23] The project has sought to monitor and analyse investments in human capital and HE under cohesion policy and to analyse the contribution to S3 and territorial development.

To date, there has been little attempt to quantify the investment or allocation from territorial funding programmes relevant for S3 and regional productivity and growth from the perspective of human capital development. A previous exercise under HESS sought to map ERDF and ESF funding for S3 skills in the 2014-2020 programming period (see Woolford et al, 2024). This research further looks to fill that gap through providing a measure of the level and territorial distribution of ERDF investment in '*Skills for Smart Specialisation, Industrial Transition and Entrepreneurship*' in the 2021-2027 programming period.

However, in response to the global pandemic, proposals for a Recovery and Resilience Facility (RRF) meant far greater allocations of EU funding could potentially be invested under this vehicle to support investment and reforms in skills, education, and research and innovation. The changing socio-economic circumstances resulting from the COVID-19 crisis as well as the creation of additional EU programmes would impact potentially on the use of ESI funding in skills, talent, education and training in relation to smart specialisation, industrial transition and entrepreneurship.

The original analysis of ERDF programming across the EU-27 to determine allocations to Skills for S3 was therefore expanded in scope to include a consideration of funding amounts proposed under the RRF for similar or complementary activity. Previous academic research has focused on the alignment

[21] European Commission (2018) Proposal for a Regulation of the European Parliament and of the Council on the European Regional Development Fund and on the Cohesion Fund, COM(2018) 372 final, Annex IV.

[22] Regulation (EU) No 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund, recital 14.

[23] European Commission (2022) Communication from the Commission, on a European Strategy for Universities. COM (2022) 16.

of the RRPs with smart specialisation priority domains (see for example, Santos, 2021, and Fernández-Zubieta, 2022) and the divergent governance models and performance frameworks across the instruments (see Conte et al, 2023). Little work has been undertaken however, to determine funding synergies across the two instruments in relation to a specific theme or area of investment, and this is particularly the case in relation to investment in *skills for innovation, industrial transition and entrepreneurship*, which is a new specific objective under ERDF in the current programming period. The research enables an understanding of the *amount* of funding available across the EU under these instruments for such activity, and its nature, and therefore a fuller picture to be developed of how EU initiatives more broadly support human capital development relevant to the twin transitions and smart specialisation domains and their synergies and complementarities.

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2 Background

2.1 ERDF and Smart Specialisation

Cohesion policy is the main long-term investment policy in the EU budget and accounts for around a third of its budget. It was introduced in the Treaty of Rome 'to strengthen economic and social (and later territorial[24]) cohesion' among MS through the reduction of disparities in the level of development between regions. The EU budget for cohesion policy under the 2021-2027 programming period is €373 billion, channelled through three funds: the European Regional Development Fund (ERDF), the European Social Fund Plus (ESF+) and the Cohesion Fund (CF). The ERDF incorporates a specific focus upon 'participation in the structural adjustment of regions whose development is lagging behind and in the conversion of declining industrial regions'[25].

Cohesion policy supports five policy objectives under the 2021-2027 programming period (see Box 1), which are broken down into specific objectives at the level of each fund. Box 2 outlines the specific objectives under Policy Objective 1 for ERDF.

Box 1: 2021-2027 cohesion policy objectives[26]

— a more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity;

— a greener, low-carbon transitioning towards a net zero carbon economy and resilient Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility;

— a more connected Europe by enhancing mobility;

— a more social and inclusive Europe implementing the European Pillar of Social Rights;

— a Europe closer to citizens by fostering the sustainable and integrated development of all types of territories and local initiatives

Box 2: Specific objectives under ERDF Policy Objective 1: A more competitive and smarter Europe by promoting innovative and smart economic transformation and regional ICT connectivity[27]

SO1.1: developing and enhancing research and innovation capacities and the uptake of advanced technologies

[24] Territorial cohesion was included in the Lisbon Treaty in 2010.

[25] Article 3, Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund

[26] Article 5(1) of Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy

[27] Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund

SO1.2: reaping the benefits of digitisation for citizens, companies, research organisations and public authorities

SO1.3: enhancing sustainable growth and competitiveness of SMEs and job creation in SMEs, including by productive investments

SO1.4: developing skills for smart specialisation, industrial transition and entrepreneurship

SO1.5: enhancing digital connectivity

Under cohesion policy, each MS is responsible, in cooperation with partners, for the preparation and submission to the Commission of a Partnership Agreement, setting out the strategic orientation for the programmes, and arrangements for the use of the funds. The basis for initial dialogue between Commission services and national authorities was provided by Annex D of the European Semester country reports in 2019, where an investment guidance annex was developed for each MS on funding priority investment areas under the 2021-2027 programming period[28].

Following the development of a national Partnership Agreement, national and / or regional programmes are prepared and submitted to the Commission for negotiation and adoption. These should include a strategy in relation to the policy objectives, a summary of challenges, a justification for selected priority objectives, a set of specific objectives and actions and an overview of complementarities and synergies with other funding sources[29].

Since 2010, the Commission has required national and regional governments to develop smart specialisation strategies as the basis for research and innovation investments under the European Regional Development Fund (ERDF). Under the 2014-2020 programming period, the development of a national or regional smart specialisation strategy became an ex-ante conditionality[30] for the allocation of ERDF under Thematic Objective (TO) 1 *Strengthening research, technological development, and innovation*. All operations funded under TO1 had to contribute to the implementation of the relevant smart specialisation strategy.

In the 2021-2027 programming period, good governance of smart specialisation is an enabling condition[31] for ERDF Policy Objective 1. An enhanced focus on the development of human capital as part of the Smart Specialisation process is embodied in ERDF specific objective 1.4 "*Developing skills for smart specialisation, industrial transition and entrepreneurship"*. All investments proposed under this specific objective should align with the relevant territorial smart specialisation strategy and domains. Box 3 outlines possible areas for investment under the specific objective 1.4: *Developing skills for smart specialisation, industrial transition and entrepreneurship* according to EC (internal) guidance.

[28] All EU-27 country reports for 2019 are available here: https://commission.europa.eu/publications/2019-european-semester-country-reports_en

[29] Articles 10 and 22 of Regulation (EU) 2021/1060.

[30] Ex-ante Conditionalities are conditions, elaborated in the Common Provisions Regulation (Regulation (EU) No 1303/2013) which are regarded as necessary prerequisites for the effective and efficient use of the EU funding for all ESI funds.

[31] Enabling conditions ensure that the necessary conditions for the effective and efficient use of the Funds are in place. They are linked to policy and strategic frameworks (to ensure that the strategic documents at national and regional level are of high quality and regulatory frameworks (to ensure that implementation of operations complies with the EU acquis). The 2021-2027 enabling conditions must be monitored and respected throughout the whole programming period in order for expenditure to be reimbursed form the Union budget.

Box 3: Possible areas for investment under the specific objective 1.4: *Developing skills for smart specialisation, industrial transition and entrepreneurship* (PO1 Policy Paper, DG REGIO)

1.4.1. **Innovation management in SMEs,** which includes all systematic activities to plan, govern and control internal and external resources for innovation;

1.4.2. **Specific training and reskilling** for smart specialisation areas **at all levels within firms** and building the necessary administrative capacity, with the need to address the digital, green and industrial transitions;

1.4.3. Promotion of **entrepreneurship skills** at all levels of education and training, including in enterprises;

1.4.4. **Skills development for higher education and research institutions to deepen their cooperation with economic operators**, accompany their transition to more entrepreneurial organisations, increase the commercial viability and market relevance of their research projects as well as their capacities to take part in interactive and open innovation processes to ensure innovativeness;

1.4.5. **Strengthening the integration of education and training institutions** including high education and centres of vocational excellence within national and regional innovation, technology diffusion and skills development ecosystems.

All ERDF expenditure is allocated, in the relevant OP, a category or intervention field in accordance with Annex I of the Common Provisions Regulation (CPR)[32]. Category of Expenditure (CoE) 23 identifies allocations for *Skills development for smart specialisation, industrial transition, entrepreneurship and adaptability of enterprises to change.* The definition reflects that of SO1.4 but includes an additional reference to "*adaptability of enterprises to change".* Nevertheless, Managing Authorities are free to choose any intervention field that is likely to reflect activity expected to be funded.

MSs are required 'to establish a performance framework for each programme covering all indicators, milestones and targets to monitor, report on and evaluate programme performance' (Recital 23, CPR)[33]. There are 137 *common ERDF indicators* defined by the European Commission (EC) for use by ERDF programming authorities, but MAs can also choose to define *programme specific indicators (PSIs)*[34].

2.2 RRF and the European Semester

The Resilience and Recovery Facility (RRF) is a temporary instrument introduced in February 2021 in response to the changing socio-economic circumstances resulting from the COVID-19 crisis to enable the EU to emerge stronger and more resilient. Through the Facility (€648 billion at the end of 2023: approximately €357 billion in grants and €291 billion in loans[35]), EU MS should implement ambitious

[32] Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy

[33] Ibid.

[34] 172 out of the 190 ERDF programmes contain programme specific indicators.

[35] https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html?lang=en

reforms and investments to make their economies and societies more sustainable, resilient and prepared for the green and digital transitions as well as address the challenges identified in country-specific recommendations under the European Semester[36].

The RRF is structured around 6 pillars representing EU policy areas or investment areas that need strengthening to improve EU resilience. It introduced an alternative source of investment for EU MS in skills and education (see Box 4). Each MS produced a National Recovery and Resilience Plan (NRRP) outlining commitments to a series of reforms and investments to meet the fund's objectives and address their CSRs, as well as a set of commonly identified challenges (European flagships)[37].

Box 4: The six pillars of the RRF

1. green transition;

2. digital transformation;

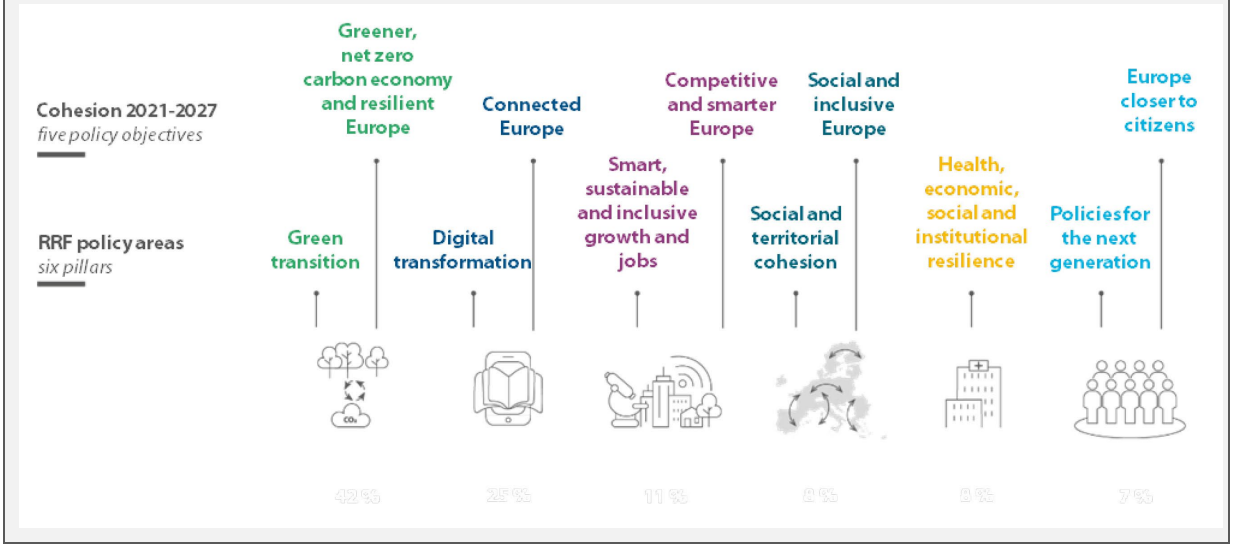
3. smart, sustainable and inclusive growth, including economic cohesion, jobs, productivity, competitiveness, research, development and innovation, and a well-functioning internal market with strong small and medium enterprises (SMEs);

4. social and territorial cohesion;

5. health, and economic, social and institutional resilience with the aim of, inter alia, increasing crisis preparedness and crisis response capacity; and

6. policies for the next generation, children and the youth, such as education and skills.

Cohesion policy objectives and RRF pillars (Source: ECA, 2023)



[36] REGULATION (EU) 2021/241 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 February 2021 establishing the Recovery and Resilience Facility

[37] There are seven European flagships identified in the 2020 annual sustainable growth strategy: 1) Power up, 2) Renovate, 3) Recharge and Refuel, 4) Connect, 5) Modernise, 6) Scale-up and 7) Reskill and upskill

2.3 Comparative Overview

Both the RRF and the ERDF have their legal basis within the economic, social and territorial cohesion title of the Treaty on the Functioning of the European Union (TFEU) and support "Cohesion, resilience and values" investments under heading 2 of the multiannual financial framework (MFF) for the 2021-2027 period. The heading is the largest in terms of budget and most diverse in terms of types of programme and fund[38].

The introduction and considerable size of the RRF, a one-off temporary instrument intended to contribute to recovery from the economic crisis caused by the COVID-19 pandemic, had the potential to impact significantly upon ERDF programming, the long term investment policy of the EU. MS enjoyed considerable discretion in determining which instruments would finance which investments, with some overlap in objectives across the two (see Box 4)[39]. The Commission's *Harnessing Talent* communication specifically referenced the two instruments in relation to funding demand for and supply of talent in the so-called regions in, or at risk of falling into, a talent development trap and increasing the capacity of regions to build sustainable, competitive and knowledge-based economies[40].

A key distinction between the two instruments is their differing territorial focus and governance. The ERDF focuses on territorial cohesion, and is allocated via a method that takes into account *regional disparities*. Meanwhile, the RRF finances national reforms and investments linked to country-specific recommendations issued within the framework of the European Semester: its allocation method considers development disparities at *national* level prior to the pandemic[41].

Similarly, ERDF implementation occurs through regional and national programmes under *shared management*, and the principle of partnership, or a multi-level governance approach, is a key feature in its implementation. 'The involvement of regional, local, urban and other public authorities, civil society, economic and social partners and, where appropriate, research organisations and universities'[42] is expected throughout programming, implementation, monitoring and audit in line with the European code of conduct on partnership[43]. The RRF, on the other hand, is implemented under *direct management*, with MS as beneficiaries and having overall responsibility. When drawing up RRPs, national authorities are only required to consult other stakeholders to the extent required by their domestic legislation[44]. The divergent governance models of the RFF and ERDF has the potential to affect the territorial distribution of the funds (Santos and Conte, 2024).

The RRF's use of milestones and targets represents a shift towards performance-based management, focused on achieving policy objectives, as opposed to the ERDF focus upon evidence of expenditure.

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[38] Sapala M., Cohesion, resilience and values Heading 2 of the 2021-2027 MFF, EPRS, European Parliament 2021.

[39] ECA, 2023, *EU Financing through cohesion policy and the Recovery and Resilience Facility: A comparative analysis.*

[40] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Harnessing talent in Europe's regions* COM(2023), 23. The European Commission has identified 46 regions already experiencing a regional development trap and 36 regions in danger of falling into a regional development trap.

[41] ECA, 2023, *EU Financing through cohesion policy and the Recovery and Resilience Facility: A comparative analysis.*

[42] Recital 14, REGULATION (EU) 2021/1060 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund..

[43] Commission Delegated Regulation (EU) No 240/2014 (8) The 'European code of conduct on partnership'

[44] ECA, 2023 *EU Financing through cohesion policy and the Recovery and Resilience Facility: A comparative analysis.*

For both instruments, common indicators exist to measure their overall performance at EU level. However, most territories have chosen indicators, milestones and targets for monitoring and evaluation that are specific to each programme/plan rather than common indicators, making an aggregation or comparison of performance at EU level or across instruments problematic.

Under the two funds, MS were required to outline coordination, demarcation, complementarities and synergies between the two, and with other sources of EU financing. In most cases, the RRP preceded ESIF programming documents and therefore contained minimal information on potential synergies. Programming authorities therefore had to take the content of their RRPs into account in their 2021-2027 programmes, and provide fuller descriptions of synergies and complementarities across the two instruments.

3 Methodology

The research aims to analyse ERDF allocations to the ERDF specific objective on *Developing skills for smart specialisation, industrial transition and entrepreneurship* in the 2021-2027 programming period and to gain an understanding of the level of financing allocated across different regions of the EU, the type of initiative funded and potential beneficiaries. Measures proposed under the RRF were also analysed to determine the extent to which this instrument targeted similar or complementary activity and had the potential to impact ERDF programming, and enabled a broader picture of EU investment in skills relevant to territorial development and resilience to be developed.

Under both instruments, case studies were developed: territories were selected on the basis of varying a) territorial characteristics such as the category of region and level of development; b) funding approaches such as the amount or nature of the activities allocated funding, and finally c) the quality or granularity of the information available within the ERDF programming documents or RRPs.

3.1 ERDF

The research involved an analysis of ERDF programmes to determine overall allocations to the SO 1.4 (*Developing skills for smart specialisation, industrial transition and entrepreneurship*) and CoE 23 (*Skills development for smart specialisation, industrial transition, entrepreneurship and adaptability of enterprises to change*) and any emerging patterns. Relevant allocations were identified from a dataset received from DG REGIO, extracted from their Open Data Portal[45], and enhanced for the purpose of the research.

The dataset included programme financial allocations and targets for all 198 ERDF programmes in the 2021-2027 programming period, as well as the relevant programming text. Eight Technical Assistance programmes were removed from the analysis due to lack of relevance and hence the analysis covered 190 ERDF OPs in total.

Financial data for each programme was provided at SO, CoE, priority axis, and category of region (more developed, transition or less developed). The financial data included the EU amount, the total amount, and the EU co-financing rate: as total amounts (which include *indicative* national contributions) are calculated at priority level rather than at SO level, the analysis focused upon ERDF allocations only. The data included OP indicators and targets used under SO1.4 and the relevant sections of OP texts across the EU27, but these were not available at the level of CoE[46], which limited the scope of the analysis in certain aspects to SO1.4 allocations. Finally, an analysis was undertaken to classify and produce a typology of main target groups and types of actions across the 68 programmes that include SO1.4.

3.2 RRF

The quantitative work utilised the 'Bruegel RRP' dataset (dated 20 February 2023),[47] and the MS' Recovery and Resilience Plans (RRP).

[45] Open Data Portal for the European Structural Investment Funds - European Commission | Data | European Structural and Investment Funds (europa.eu) at 11.04.2023.

[46] This is not a reflection of gaps in the dataset but rather the programming process and programme structure.

[47] https://www.bruegel.org/dataset/european-union-countries-recovery-and-resilience-plans

The analysis looked to identify and classify funding allocations for S3 skills on the basis of the DG REGIO policy paper on Policy Objective 1 and the five categories elaborated under Objective 1.4 (see Box 3) as well as a specific focus upon industrial transition or S3 (domains). A wider exercise to include beneficiaries (e.g., HEI, SMEs etc), and milestones and targets was considered problematic due to the lack of granularity in the RRF.

Initial analysis to identify measures relevant to Skills for S3 across the EU-26[48] was undertaken by a number of experts manually and followed a number of steps. Firstly, the elimination of data entries for RRF Pillar 5 '*Health, and economic, social and institutional resilience, with the aim of, inter alia, increasing crisis preparedness and crisis response capacity*' which was deemed not relevant to Skills for S3. Entries under the remaining 5 pillars[49] were retained, leaving 1,664 out of the original total of 1,889 entries. These 1,664 entries were then reviewed and entries that were judged irrelevant to S3 Skills were eliminated, leaving 427 entries.

Remaining entries were cross-checked with the MS RRP text in order to validate their relevance. In many cases, there was still not sufficient detail to ascertain relevance to Skills for S3. In cases where relevance could not be ruled out and opportunities to support human capital in relation to S3 and industrial transition could potentially be funded, the activity was maintained in the selection, and the activity was marked as 'of possible relevance'. 242 RRF entries overall[50] are categorised as of definite or possible relevance to Skills for S3.

A desk review was additionally undertaken of the MS' Country Specific Recommendations (specifically Annex D of the 2019 European Semester Country Reports) to identify strategic focus on skills for S3 and industrial transition and relevant recommendations given to MS in relation to investment in S3 skills.

3.3 Limitations of the research

A key limitation of the research is that the research did not identify and analyse technical documents or procedures established at MS level to promote complementarities and synergies across the two funding streams, but instead has treated the two instruments relatively separately. Similarly each instrument analysed, and sometimes the analysis of different databases and different MS was undertaken by different experts, to some extent based upon their subjective opinion, and a final layer of quality control and oversight has not been possible, specifically in the work on the RRF. Additionally, there were issues around comparability and accuracy when the submission of programmes/ plans takes place in the MS language, and these are then translated into English from numerous different languages using translation software.

Limitations of the research specific to each of the two instruments are outlined below.

[48] Netherlands is missing from the database due to its late RRP submission.

[49] Pillars 1 'Green transition', 2 'Digital Transformation', 3 'Smart, sustainable and inclusive growth, including economic cohesion, jobs, productivity, competitiveness, research, development and innovation, and a well-functioning internal market with strong SMEs', 4 'Social and territorial cohesion' and 6 'Policies for the next generation, children and the youth, such as education and skills'.

[50] Please note that whilst the Bruegel dataset allowed identifying 242 entries, for five of these entries there appeared to be no corresponding data in the RRPs, and hence in places we refer to 237 entries.

3.3.1 ERDF

- The research may not identify all relevant activity related to skills in S3, industrial transition and entrepreneurship if programming authorities have not classified the activity as SO1.4 or CoE23, but incorporated it as complementary activity in another area of the programme.
- Similarly, whilst texts for all ERDF programmes were available for most MS, only the SO1.4/CoE23 elements were provided in the cases of Greece, Spain, France, and Poland, and other programme priorities could contain relevant activity.
- Indicators and targets are not programmed at the level of CoE, so expected achievements for CoE23 cannot be analysed if programming authorities have not used CoE23 conterminously with SO1.4.
- The geographical coverage of activity is not always clear or articulated i.e. activity may not be foreseen to cover a whole MS territory, but rather certain regions only.
- It is not possible to determine how much is specifically allocated to Skills for S3 under programmes that have included additional activity under the same SO.
- National co-financing per SO is indicative, and total amounts are calculated at the priority level rather than the SO level, and so may include allocations for other measures under other SOs. Therefore, we have had to use ERDF allocations only, as we are not able to determine the total allocation.
- The use of PSIs across different programmes and MS, and varying or unclear definitions, leads to a lack of consistency and comparability across the OPs. Similarly, Managing Authorities (Mas) have interpreted programming elements (SOs, COEs) differently and there is not a standard classification or clear demarcation of activity.
- The OP data and text relates to the original adoption of each OP. The activities and allocations can be at any time renegotiated by the MA with the EC. The analysis is a snapshot in time, and the actual implementation against these documents and final levels of investment is uncertain.
- There is only a general description of actors / target groups and activities proposed in some cases: “actors of the research and innovation ecosystem (quadruple helix)” (Czechia), “workers and entrepreneurs in the region’s strategic S3 sectors” (Murcia), and “actors making up the quadruple helix” (Molise).

3.3.2 RRF

- The Bruegel database does not include and entry for the Netherlands, as the last Member State to submit. The data from Netherlands included here in the report is from internal Commission sources and potentially not completely consistent with the original exercise undertaken. The data is therefore only included specifically to avoid a gap in the EU-27 picture in the final section of the report on complementarity across the two instruments. No in-depth analysis or review of the Netherlands RRP has been undertaken nor data included in the in-depth analysis and country factsheets in Annex 5.
- The differing granularity in descriptions of RRP activity makes classification problematic – some of the RPPs provide considerable detail on individual activities but others provide vague and ambiguous descriptions.

- RRF entries do not easily lend themselves to classification under the categories provided in the ERDF policy paper, and their classification by experts was ultimately subjective.
- The RRF covers not only investments but also reforms, which have a different purpose and are often without cost. It is therefore misleading to refer only to levels of investment under the RRF. For this purpose, non-cost reforms are also included in the total number of measures.
- There were a number of gaps, duplications (removed) or anomalies in the Bruegel dataset (e.g. funding amount missing, or no corresponding entry in the RRP) which was populated at the point of submission of the draft RRPs. In all cases, the adopted MS RRP was referred to as the definitive information source.

4 Skills for S3 - ERDF investment, activity and beneficiaries

4.1 Skills for S3 ERDF investment

Of the 190 ERDF programmes, 68 of them (36%) include a financial allocation for SO1.4 and 94 of them (49%) for CoE23: Annex 1 provides a list of programmes with allocations to Skills for S3 and the overall allocations are in Table 1 below. Of the total ERDF allocation for all programmes, 0.73% is allocated to SO1.4, and 0.94% to CoE23. As 0.67% (1.4b€) of ERDF is both SO1.4 and CoE23 and should only be counted once, the total percentage allocated to SO1.4 and/or CoE23 is 1.01% (a total EU amount of 2.1b€).

Table 1. Overview of ERDF funding allocated to SO1.4/CoE23 by type of OP.

	National	Multi-regional	Regional	TOTAL
All ERDF OPs	33	21	136	**190**
ERDF amounts (EUR)	74,554,865,643	40,788,258,037	94,367,108,417	**209,710,232,097**
OPs with SO1.4	11	2	55	**68**
ERDF amounts (EUR) for SO1.4	577,898,179	401,046,646	560,363,693	**1,539,308,518**
SO1.4 % of total ERDF	0.78%	0.98%	0.59%	**0.73%**
OPs with CoE23	14	3	77	**94**
ERDF amounts (EUR) for CoE23	730,748,473	462,168,774	771,488,070	**1,964,405,317**
CoE23 % of total ERDF	0.98%	1.13%	0.82%	**0.94%**

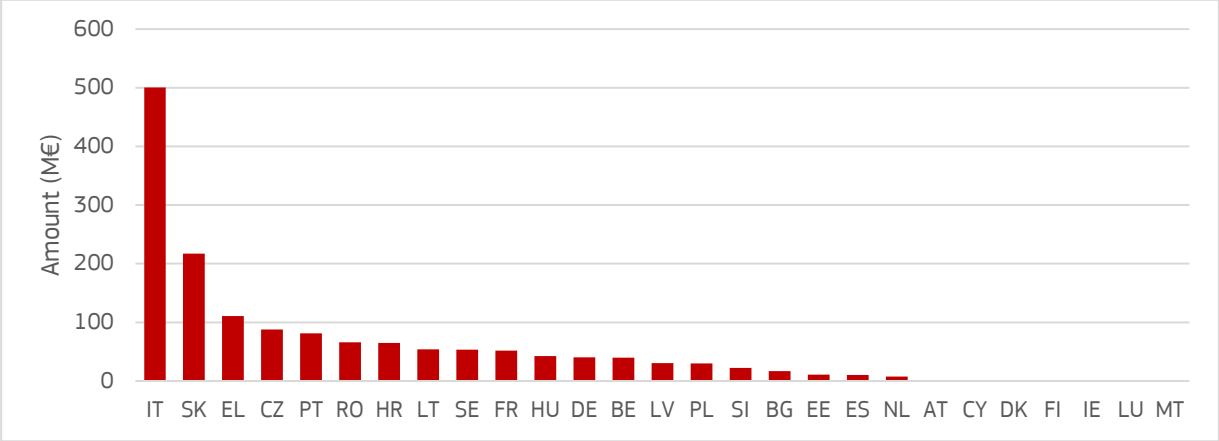
(Source: authors' elaboration)

SO1.4 and CoE23 are therefore, overall at EU27 level, allocated relatively small amounts of ERDF. Generally, there is a tendency for national/multi-regional programmes to spend a greater percentage amount on SO1.4/CoE23 than regional programmes. Italy's Research, Innovation, and Competitiveness programme for instance, allocates 290m€ (7.8%) and 329m€ (8.6%) to SO1.4 and CoE23 respectively. Slovakia allocates 217m€ to both under its national ERDF programme.

Figures 1 and 2 show allocations to SO1.4 and CoE23 at MS level: there are five MSs with no funding allocated to SO1.4 or CoE23 (Austria, Cyprus, Denmark, Ireland, and Luxembourg). In a number of cases, there is a clear lack of correlation between the incorporation of SO1.4 and CoE23: Finland and Malta allocate funds to CoE23 but do not include SO1.4 in their programmes; the Polish national Smart Growth programme allocates 119m€ to CoE23 but only 30m€ to SO1.4. In total, 14 MS have higher allocations to CoE23 than SO1.4, with the overall EU27 allocation to CoE23 28% higher than the allocation to SO1.4.

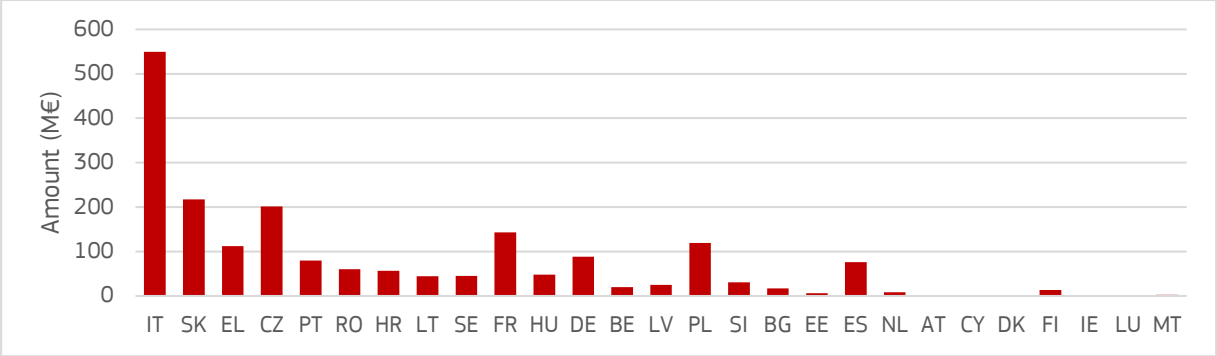
For SO1.4, the financial allocation of Italy dwarfs that of other MSs (see Figure 1), its large multi-regional programme has a high SO1.4 percentage allocation, and 17 of its 21 regional programmes also allocate funding to SO1.4. Similarly, Romania allocates significant funding to SO1.4 through a national programme and all eight of its regional programmes. In terms of ERDF allocations to CoE23, Italy and Slovakia again allocate the greatest amounts.

Figure 1. SO1.4 ERDF allocations by MS.



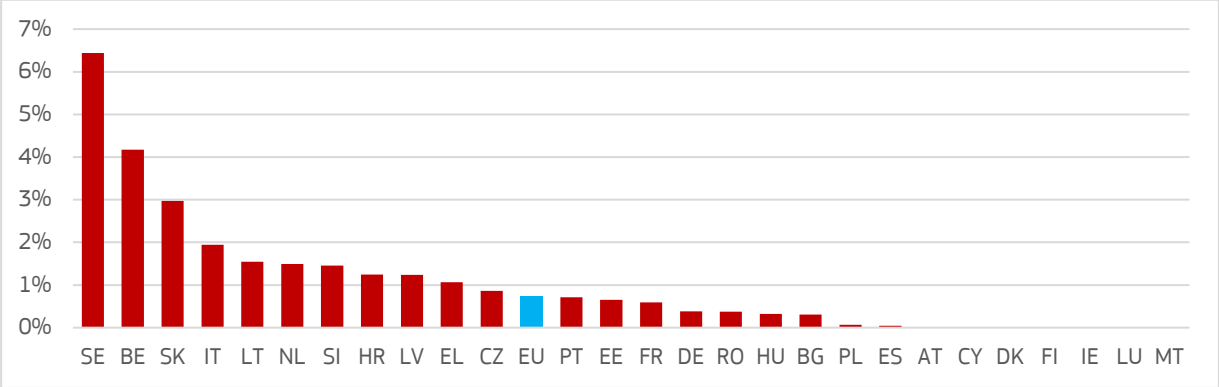
(Source: authors' elaboration)

Figure 2. CoE23 ERDF allocations by MS (in SO1.4 order).



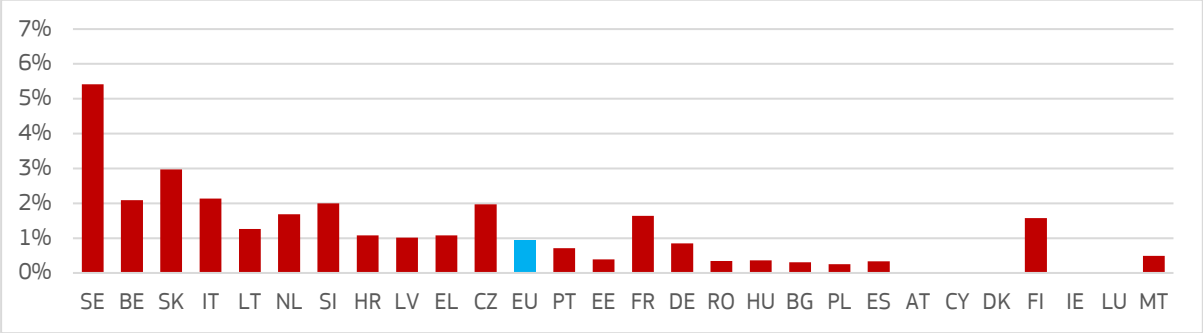
(Source: authors' elaboration)

Figure 3. SO1.4 allocation as a percentage of total ERDF.



(Source: authors' elaboration)

Figure 4. CoE23 allocation as a percentage of total ERDF



(Source: authors' elaboration. NB order reflects SO1.4 percentage allocation)

In terms of relative allocations, Sweden has proportionally allocated considerable resources to both SO1.4 (6.4% compared to the EU average of 0.73%) and CoE23 (5.41% compared to an EU average of 0.94%). IT, though still high, is less of an anomaly when viewed in percentage rather than nominal terms, and on the contrary, some MSs such as NL who receive smaller overall allocations of ERDF, in percentage terms have significant allocations. Poland and Spain, as significant net receivers, allocate a low percentage of their total ERDF to SO1.4 and CoE23. Table 2 provides the nominal and percentage amounts allocated to SO1.4, CoE23, and SO1.4 and/or CoE23 at both EU and MS levels. For the latter, allocations of SO1.4 and CoE23 that are coterminous are counted only once and so this provides the most robust indication of overall Skills for S3 ERDF allocations.

Table 2 and figures 5 and 6 demonstrate that at MS level, the greatest allocations in nominal terms are from France, Italy, Czechia and Slovakia, to some degree reflecting the fact that Italy, Czechia and Slovakia have national-level programmes with a strong relative presence of SO1.4 and CoE23. In terms of percentage allocations, the highest amounts allocated are in Sweden and Slovakia, followed by Slovenia, and the lowest - with zero allocation - in Austria, Cyprus, Denmark, Ireland and Luxembourg. The EU-27 allocation is EUR 2bn or 1% of the total ERDF allocation. Annexes 2 and 3 contain maps of the nominal and percentage amounts at national and regional levels separately for SO1.4 and CoE23.

At MS level, of the 22 MS that allocate funding to CoE23, only 6 of them (BE, BG, LT, RO SE, and SK) do so exclusively under SO1.4, with only 71.5% of CoE23 allocations allocated under SO1.4. 12.7% is allocated under SO1.1, with Poland a notable outlier, allocating 81% of its CoE23 amount under SO1.1 (see box 5). Germany (55%), Spain (83%), Finland (67%) and Malta (100%) have high allocations to CoE23 under SO1.3. A small amount of CoE23 allocation falls under SO1.2 (1.0%), 'Reaping the benefits of digitisation for citizens, companies, research organisation and public authorities'.

Box 5: Smart Economy, Poland

The Polish Smart Economy programme includes an ERDF CoE23 allocation of 70m€, 0.9% of the programme's total ERDF budget, allocated under SO1.1 (*developing and enhancing research and innovation capacities and the uptake of advanced technologies).* Potential activities to be funded include:

-the creation of "learning factories" to implement staff training in the commercialisation of R&D, technology transfer, and innovation management;

-the testing of new solutions by entrepreneurs;

-improving the business competences of research teams in universities and commercialisation knowledge among the managers of other research organisations.

-the creation of an "innovation Coach" information service, which assesses an innovation start-up's innovation potential and provides entrepreneurial skills training to its staff. Expert advice and financial support is available for concept development and preparation of a first R&D project.

Table 2. ERDF allocations by MS to Skills for S3 (SO1.4 and CoE23)

(Source: authors' elaboration)

MS	SO1.4 ERDF amount (EUR)	SO1.4 ERDF amount (%)	CoE23 ERDF amount (EUR)	CoE23 ERDF amount (%)	SO1.4+CoE23-[SO1.4 AND-CoE23] (EUR)	SO1.4+CoE23-[SO1.4 AND CoE23] (%)	Total ERDF amount (EUR)
AT	-	0.00%	-	0.00%	-	0.00%	491,882,802
BE	40,011,338	4.17%	20,005,669	2.09%	40,011,338	4.17%	959,257,262
BG	17,000,000	0.31%	17,000,000	0.31%	17,000,000	0.31%	5,541,138,777
CY	-	0.00%	-	0.00%	-	0.00%	466,925,267
CZ	87,983,010	0.86%	201,151,095	1.97%	201,151,095	1.97%	10,203,463,722
DE	40,070,800	0.38%	88,338,882	0.84%	94,738,882	0.91%	10,454,509,667
DK	-	0.00%	-	0.00%	-	0.00%	247,160,723
EE	10,700,000	0.65%	6,413,900	0.39%	11,313,900	0.69%	1,644,020,439
EL	110,987,336	1.06%	112,262,336	1.08%	112,262,336	1.08%	10,439,492,083
ES	10,456,674	0.05%	76,233,806	0.34%	80,933,806	0.36%	22,596,081,299
FI	-	0.00%	13,249,928	1.58%	13,249,928	1.58%	840,698,161
FR	51,590,000	0.59%	142,776,543	1.63%	147,746,543	1.69%	8,735,057,552
HR	65,000,000	1.24%	56,548,428	1.08%	74,748,428	1.43%	5,221,941,085
HU	42,699,491	0.32%	47,662,243	0.36%	47,662,243	0.36%	13,171,468,471
IE	-	0.00%	-	0.00%	-	0.00%	373,317,005
IT	500,386,494	1.94%	549,843,511	2.13%	573,403,637	2.22%	25,771,124,645
LT	54,210,578	1.54%	44,416,700	1.26%	54,210,578	1.54%	3,511,735,193
LU	-	0.00%	-	0.00%	-	0.00%	14,120,179
LV	30,685,000	1.24%	25,093,162	1.01%	33,593,162	1.36%	2,476,230,764
MT	-	0.00%	2,250,000	0.49%	2,250,000	0.49%	459,895,691
NL	7,311,686	1.49%	8,225,647	1.68%	8,225,647	1.68%	489,129,590
PL	29,971,970	0.06%	119,482,658	0.25%	133,108,098	0.28%	46,866,659,213
PT	81,000,000	0.72%	80,000,000	0.71%	82,000,000	0.72%	11,328,403,293
RO	65,947,902	0.37%	60,391,752	0.34%	65,947,902	0.37%	17,721,867,928
SE	53,676,139	6.44%	45,098,957	5.41%	53,676,139	6.44%	833,355,971
SI	22,520,100	1.46%	30,860,100	2.00%	35,450,100	2.29%	1,545,686,286
SK	217,100,000	2.97%	217,100,000	2.97%	217,100,000	2.97%	7,305,609,029
EU	**1,539,308,518**	**0.73%**	**1,964,405,317**	**0.94%**	**2,099,783,762**	**1.00%**	**209,710,232,097**

Box 6: Smart Transformation, Bulgaria

The Bulgarian national *Smart Transformation* programme has a SO1.4 allocation of 17m€ or 1.9% of the programme's total ERDF) which is entirely classified as CoE23 (and vice versa) with two common indicators (RCO101 and RCR98).

Smart Transformation aims to develop human capital through skills training to avoid a loss of jobs from the digital, industrial, green, and blue transitions and ensure the continued competitiveness of enterprises. A key objective is to address the mismatch in some highly skilled occupations and to develop specific digital and technological skills as outlined in the 2019 country specific recommendations for Bulgaria. Particular emphasis is placed upon skills for participation in the innovation cycle and skills for entrepreneurship within the relevant S3 areas (skillsets mentioned include data analysis, basic digital skills, entrepreneurship skills, green transition, blue transition, clean technologies, and new technologies in sectors such as agriculture, food, health, information, and mechatronics). The programme also recognises the need to implement EDP within the identified S3 areas and to stimulate cooperation at both national and international level with research organisations and HEIs. The activities include:

— direct provision of skills training to SME staff,

— support to SMEs or other organisations for the development of skills training academies and/or new models for training provision,

— the development of acceleratory programmes for start-ups,

— teacher training, training students (of all levels including doctoral) in entrepreneurship skills, and

— support for national online adult learning programmes,

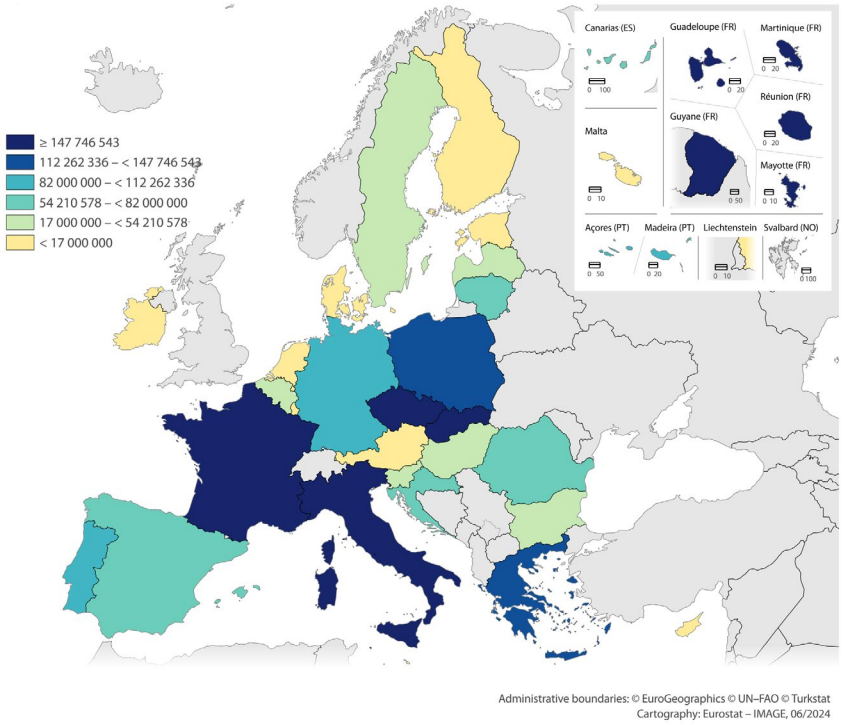
— regional hackathons to support EDP.

The target groups mentioned for the above activities include SMEs, research organisations, HEIs, entrepreneurial organisations, innovation clusters, Sofia Tech Park, European digital and innovation hubs, and research and innovation bodies.

The Smart Transformation programme aims to train 17 staff per SME, although this varies according to the Bulgarian region. The Southwestern region (which includes Sofia) has 2029 target values of 78 and 382 and hence 4.8 staff members per SME; the remaining five regions having combined target values of 49 and 1810 corresponding to training for roughly 37 staff members per SME (see Table 6).

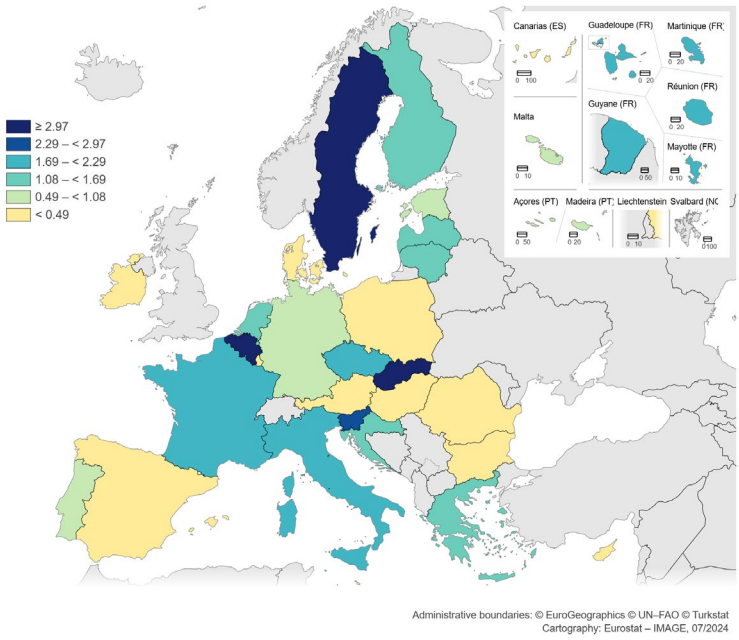
The highest ERDF nominal allocations at regional level to Skills for S3 when considering all programme allocations i.e. national, multi-regional and regional (see Figure 9) are Puglia, Campania, Slovakian regions, Hauts de France, followed by Flanders and Norte. In percentage terms (see Figure 10), Northern (Scandinavian and Baltic) countries and some western regions of France and Portugal have the highest allocations. Whilst Italy at national level has one of the highest nominal allocations of the EU-27, at regional level no region has an allocation of more than 0.49% of the ERDF allocation available (with the caveat that the national programme amounts have been divided equally amongst the number of regions and final investment levels could differ considerably).

Figure 5. Map of nominal ERDF allocations to SO1.4 and CoE23 at MS level



(Source: authors' elaboration)

Figure 6. Map of percentage allocation of ERDF to SO1.4 and CoE23 at MS level

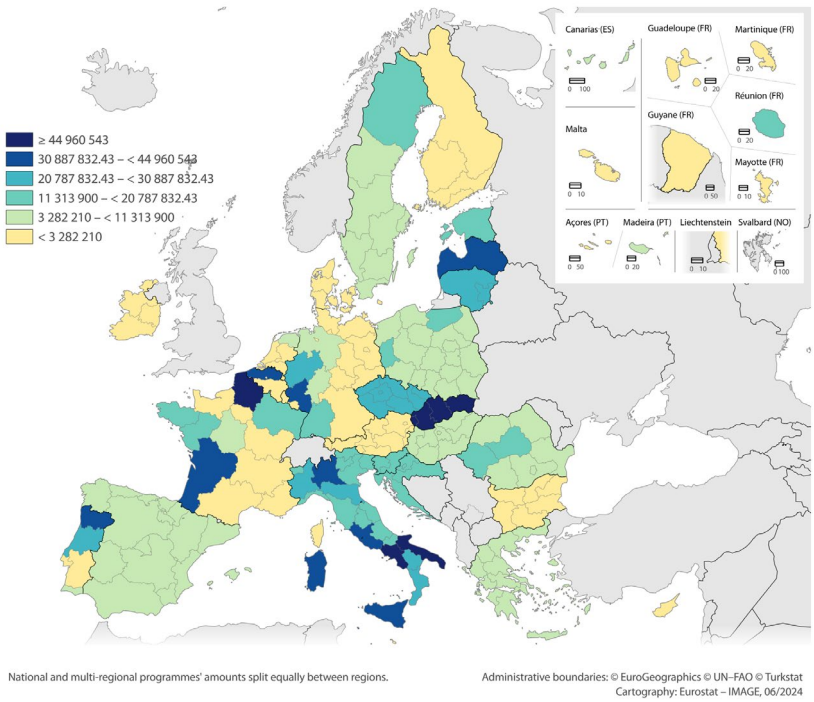


(Source: authors' elaboration)

Few regions or programmes allocate high percentages: less than 10% of the 190 programmes have an SO1.4 percentage allocation higher than 2% and a CoE23 percentage higher than 3%. The highest percentage allocation of a regional programme is Rheinland-Pfalz, whose CoE23 percentage stands at 16.4%, followed by Flanders with a allocation of 15% of its ERDF to SO1.4. In terms of nominal allocations to SO1.4, Puglia has allocated 82m€, more than double that of Flanders in actual amounts, and not far behind some of the largest MS level allocations. Flanders, Norte and Nouvelle-Aquitaine all allocate over 30m€ to SO1.4. Table 3 provides a list of programmes with the greatest allocations of funding to SO1.4 and CoE23.

In terms of the regional level programmes, out of the 240 NUTS 2 regions across the EU27, at least 97 of them have some allocations for SO1.4 and at least 133 for CoE23[51]. This equates to 40% and 55% respectively. Puglia, Norte, and Nouvelle-Aquitaine allocate some of the highest percentages to SO1.4 and CoE23 and have a one-to-one correspondence between SO1.4 and CoE23. Otherwise, the highest percentages under SO1.4 are allocated in Flanders (15%), South Sweden (11.5%), and Småland and the islands (11.2%). All of the Portuguese, Romanian, and Swedish regions allocate funding to SO1.4, as well as most of the Italian regions. Meanwhile, only two or three regions in Germany, Spain and France allocate funding to SO1.4, and five out of 16 Polish regions. CoE23 has wider geographical coverage than SO1.4 and similarly to the pattern noted at national level, a number of regions allocate funds to CoE23 but do not include SO1.4 in their programmes.

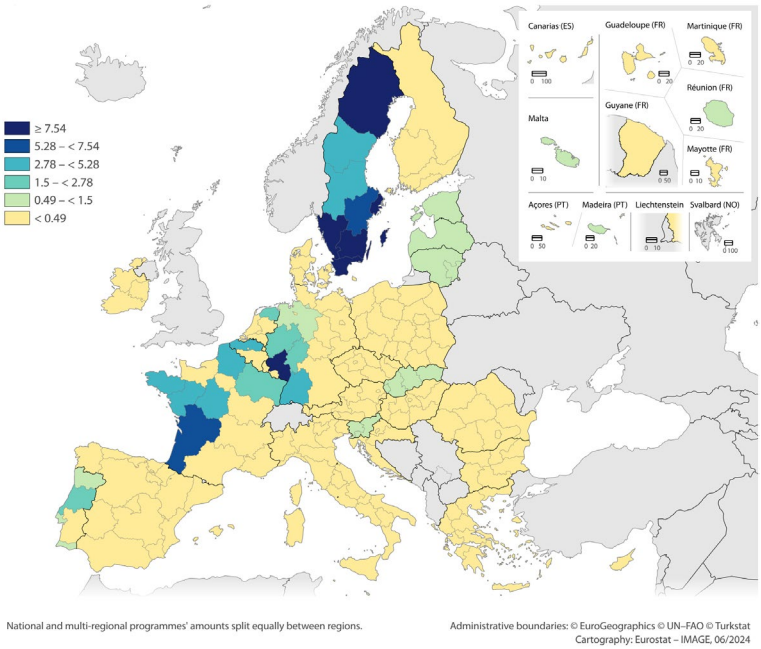
Figure 7. Map of nominal ERDF allocations to SO1.4 and CoE23 at regional level



(Source: authors' elaboration)

[51] The territorial coverage of multi-regional programmes could not always be clarified.

Figure 8. Map of percentage allocation of ERDF to SO1.4 and CoE23 at regional level



(Source: authors' elaboration)

Table 3. Regional programmes with the greatest allocations to SO1.4 and CoE23.

Regional programme	**MS**	**SO1.4 amount (m€)**
Puglia	IT	82.0
Flanders	BE	40.0
Norte Regional	PT	40.0
Nouvelle-Aquitaine	FR	37.5
Centro	PT	28.0
Nordrhein-Westfalen	DE	25.1
Sicilia	IT	19.8
Lombardia	IT	17.6
Sardegna	IT	15.0
Upper Norrland	SE	14.3

Regional programme	**MS**	**SO1.4 %**
Flanders	BE	15.0%
South Sweden	SE	11.5%
Småland and the islands	SE	11.2%
West Sweden	SE	10.5%
Stockholm	SE	10.0%
Upper Norrland	SE	7.5%
Noord-Nederland	NL	7.0%
East-Central Sweden	SE	7.0%
Nouvelle-Aquitaine	FR	5.3%
Baden-Württemberg	DE	5.3%

Regional programme	**MS**	**CoE23 amount (m€)**
Puglia	IT	82.0
Hauts de France	FR	45.0
Norte	PT	40.0
Murcia	ES	39.9
Rheinland-Pfalz	DE	39.5
Nouvelle-Aquitaine	FR	37.5
Campania	IT	30.3
Centro	PT	28.0
Nordrhein-Westfalen	DE	25.1
Flanders	BE	20.0

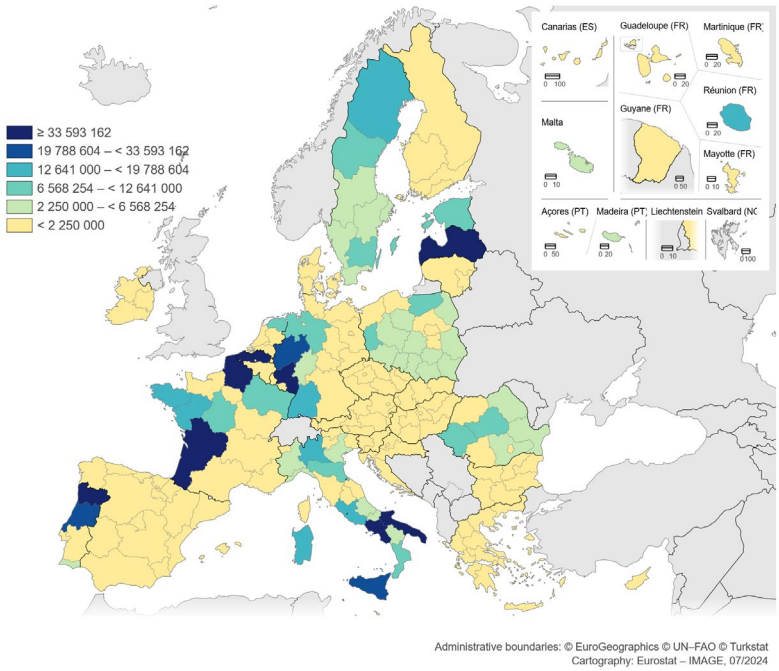
Regional programme	**MS**	**CoE23 %**
Rheinland-Pfalz	DE	16.4%
Murcia	ES	12.0%
South Sweden	SE	11.5%
Småland and the islands	SE	11.2%
West Sweden	SE	10.5%
Stockholm	SE	10.0%
Noord-Nederland	NL	7.9%
Flanders	BE	7.5%
East-Central Sweden	SE	7.0%
Nouvelle-Aquitaine	FR	5.3%

(Source: authors' elaboration)

There are 27 programmes with CoE23 but no SO1.4 (with CoE23 funding under SO1.1 and/or SO1.3 instead). Rheinland-Pfalz programme allocates the highest percentage to CoE23 (16.4%) but entirely under SO1.3; Murcia allocates 40m€ (12%) to CoE23 mostly under SO1.3. Conversely, there is only one programme with allocations for SO1.4 but not CoE23 (Castilla La Mancha), instead CoE26 (see Table 4 below). Figures 9-10 map allocations of ERDF to SO1.4 and CoE23 in regional programmes only.

Of the 68 programmes including SO1.4, 67 use CoE23, and 45 of them (66%) classify all the projected expenditure as CoE23. The other 23 OPs[52] incorporate 15 different CoEs. Table 4 provides an overview of the SO1.4 allocations that are not exclusively CoE23 and the respective programmes. The majority of these codes are relevant and aligned with the objectives of SO1.4 Skills for Smart Specialisation, such as support for networking, clustering and cooperation, support for SMEs, entrepreneurs and the twin transitions (see Box 3). Nevertheless, a couple of programmes use CoEs for SO1.4 referring to fixed assets (CoE4 – Murcia) and business infrastructure (CoE20 Upper Norrland) which could arguably be seen to be less consistent with a focus on skills development. Overall, however these amounts are small in relation to the EU27 total SO1.4 allocation (0.1% and 0.28% respectively).

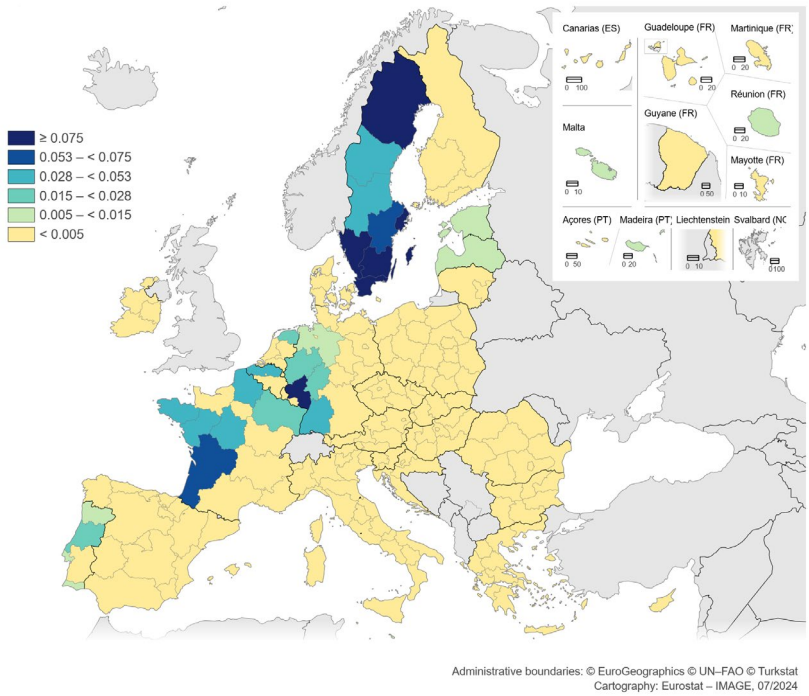
Figure 9. Map of nominal ERDF allocations to SO1.4 and CoE23 in regional programmes



(Source: authors' elaboration)

[52] Castilla-La Mancha is the exception, see above.

Figure 10. Map of percentage allocations of ERDF to SO1.4 and CoE23 in regional programmes



(Source: authors' elaboration)

At programme level, of the 94 programmes using CoE23, 67 of them (71%) include allocations under SO1.4. The number of programmes with CoE23 planned under SO1.1, SO1.2, and SO1.3[53] (sometimes in combination) are 27, 3, and 23 respectively.

This dislocation between SO1.4 and CoE23 could suggest a simplification in the programming exercise by Managing Authorities, looking to reduce the number of specific objectives and / or responsible and implicated actors (e.g. governmental departments) and hence increase programming flexibility, or equally a strongly synergistic approach, with Skills for S3 incorporated and integrated into broader funding portfolios.

[53] SO1.1: developing and enhancing research and innovation capacities and the uptake of advanced technologies; SO1.2: reaping the benefits of digitisation for citizens, companies, research organisations and public authorities; SO1.3: enhancing sustainable growth and competitiveness of SMEs and job creation in SMEs, including by productive investments.

Table 4. ERDF Categories of Expenditure allocated funding under SO1.4 in EU-27 programmes.

CoE	Description	% of EU27 SO1.4 allocation	programmes and % of SO1.4 allocation
4	*R+I fixed asset investment: Public research centres + HEI* Investment in fixed assets, including research infrastructure, in public research centres and higher education directly linked to research and innovation activities	0.10%	Murcia 22%
12	*R+I activities in public research centres, HEI +* Research and innovation activities in public research centres, higher education and centres of competence including networking (industrial research, experimental development, feasibility studies)	1.07%	Murcia 22%; Croatia Competitiveness and Cohesion Programme 30%
15	*Digitising SMEs or large enterprises - GHG reduction* Digitising SMEs or large enterprises (including e-Commerce, e-Business and networked business processes, digital innovation hubs, living labs, web entrepreneurs and ICT start-ups, B2B) compliant with greenhouse gas emission reduction or energy efficiency criteria	0.88%	Italy's R&I and competitiveness programme 5%
18	*IT services + applications for digital skills + inclusion* Digitising SMEs or large enterprises (including e-Commerce, e-Business and networked business processes, digital innovation hubs, living labs, web entrepreneurs and ICT start-ups, B2B) compliant with greenhouse gas emission reduction or energy efficiency criteria	1.11%	Warmia y Mazury 73% Latvia 28%
20	*Business infrastructure for SMEs* Business infrastructure for SMEs (including industrial parks and sites)	0.28%	Upper Norrland 30%
23	***Skills for smart specialisation, industrial transition*** **Skills development for smart specialisation, industrial transition, entrepreneurship and adaptability of enterprises to change**	91.20%	Algarve 60%, Baden Württemberg 55%, Bucharest Ilfov 86%, Campania 38%, Castilla La Mancha 0%, Croatia Competitiveness and Cohesion Programme 64%, Estonia 54%, Flanders 50%, Italy's R&I and competitiveness programme 95%, Latvia 72%, Lithuania 81%, Lubelskie 52%, Lubuskie 55%, Molise 60%, Murcia 57%, NE Romania 41%, Podkarpacie 40%, Reunion 55%, SE Romania 80%, Slovenia 80%, Upper Norrland 40%, Warmia y Mazury 27%, West Romania 75%
24	*Advanced support services for SMEs and groups of SMEs* Advanced support services for SMEs and groups of SMEs (including management, marketing and design services)	0.68%	Podkarpacie 60% Upper Norrland 30% Croatia Competitiveness and Cohesion Programme 6%

CoE	Description	% of EU27 SO1.4 allocation	programmes and % of SO1.4 allocation
25	*Incubation, support to spin offs/outs + start ups* Incubation, support to spin offs and spin outs and start ups	0.74%	Baden Württemberg 45% Reunion 45%
26	*Innovation cluster support and business networks for SMEs* Support for innovation clusters including between businesses, research organisations and public authorities and business networks primarily benefiting SMEs	1.41%	Castilla la Mancha 100% Flanders 50%
28	*Technology transfer and cooperation* Technology transfer and cooperation between enterprises, research centres and higher education sector	0.38%	Lubuskie 13% Estonia 46%
29	*Low carbon R+I processes, tech-transfer and cooperation* Research and innovation processes, technology transfer and cooperation between enterprises, research centres and universities, focusing on the low carbon economy, resilience and adaptation to climate change	0.67%	Lithuania 19% Lubelskie 24%
30	*Circular economy R+I processes, tech-transfer + cooperation* Research and innovation processes, technology transfer and cooperation between enterprises, focusing on circular economy	0.03%	Lubelskie 24%
145	*Digital skills* Support for the development of digital skills	0.22%	Campania 24%
146	*Adaptation to change of workers, firms and entrepreneurs* Support for adaptation of workers, enterprises and entrepreneurs to change	0.34%	Campania 38%
170	*Improve the capacity of programme authorities and bodies* Improve the capacity of programme authorities and bodies linked to the implementation of the Funds	0.75%	Slovenia 20% Molise 40% Bucharest Ilfov 14% SE Romania 20% NE Romania 59% W Romania 25%
173	*Institutional capacity for territorial cooperation* Enhancing institutional capacity of public authorities and stakeholders to implement territorial cooperation projects and initiatives in a cross-border, transnational, maritime and inter-regional context	0.13%	Algarve 40%

(Source: authors' elaboration)

4.2 Skills for S3 ERDF activity

As indicators and targets are not programmed at the level of CoE, the research is able to analyse programme activity and expected achievements only at the level of SO. Under SO1.4 in the 68 relevant programmes, 291 indicators are used, of which 221 (82%) relate to 18 common indicators (see Table 5), and 70 (18%) are PSIs.

Table 5. Common indicators under SO1.4 and number of programmes.

Code	Definition	Number of OPs
RCO01	Enterprises supported	30
RCO02	Enterprises supported by grants	17
RCO04	Enterprises with non-financial support	11
RCO05	New enterprises supported	1
RCO101	SMEs investing in skills for smart specialisation, for industrial transition and entrepreneurship	53
RCO15	Capacity of incubation created	2
RCO16	Participations of institutional stakeholders in entrepreneurial discovery process	32
RCO74	Population covered by projects in the framework of strategies for integrated territorial development	2
RCO75	Strategies for integrated territorial development supported	2
RCR01	Jobs created in supported entities	2
RCR02	Private investments matching public support	7
RCR03	SMEs introducing product or process innovation	1
RCR04	SMEs introducing marketing or organisational innovation	1
RCR06	Patent applications submitted	1
RCR17	New enterprises surviving in the market	1
RCR18	SMEs using incubator services after incubator creation	3
RCR97	Apprenticeships supported in SMEs	3
RCR98	SMEs staff completing training for skills for smart specialisation, for industrial transition and entrepreneurship	52

Nine output indicators (RCO) and nine results indicators (RCR)[54] are utilised under SO1.4, with the four most frequent being RCO101, RCR98, RCO16, and RCO01. Unsurprisingly, individual MS tend to use the same or similar sets of common indicators across their programmes under SO1.4, for example, the 17 Italian programmes that use mostly RCO101 and RCR98, and the six Portuguese programmes with RCO16 as their sole common indicator for their SO1.4 components.

The two most widely used common indicators under SO1.4 are:

- RCO101 (*SMEs investing in skills for smart specialisation, for industrial transition and entrepreneurship*), and

[54] 'Output indicator' refers to an indicator to measure the specific deliverables of the intervention. 'Result indicator' measures the effects of the interventions supported, with particular reference to the direct addressees, population targeted or users of infrastructure. See CPR Article 2.

- RCR98 (*SMEs staff completing training for skills for smart specialisation, for industrial transition and entrepreneurship*).

Out of 68 programmes incorporating SO1.4, 53 and 52 programmes respectively have incorporated them and almost always in combination with each other (in 49 programmes). Seventeen programmes use RCR101 and RCR98 as their only two indicators under SO1.4. RCO16, *participations of institutional stakeholders in entrepreneurial discovery process* appears in 32 programmes.

In the majority of cases, where SO1.4 contains other activity and indicators, it is not possible to link financial allocations to target value. Nevertheless, Italian and Bulgarian programmes contain only CoE23 within their SO1.4 and use both, and only, RCO101 and RCR98 indicators. For those programmes it is therefore possible to calculate the number of staff trained per SME (ranging from 0.8 FTE to nearly 37) and the cost of training one staff member (ranging from €3,279 to €75,000) (see Table 6).

On average, SO1.4 investment relates to an average of 3.25 common indicators per programme and one or two PSIs tend to be additionally incorporated in programmes that use them. PSIs are used under SO.1.4 by 39 programmes across 14 MSs[55], with one programme (Nouvelle-Aquitaine) using PSIs exclusively under SO1.4. Generally, where SO1.4 activity is categorised as other than CoE23 PSIs are used more frequently[56], and the range of PSIs utilised under SO1.4 tend to be result rather than output orientated. In most cases, the PSIs tailor the performance framework to specific actions and territorial contexts, for example, the programme for Hamburg plans training for skills for S3 for staff in non-profit organisations rather than SMEs.

All programmes except three use at least one of RCO16 or RCO01/RCR98, suggesting that SO1.4 will mostly fund two main types of activity across the EU27:

- training for skills for S3, mostly supporting firms and measured by RCO101 and/or RCR98 (usually together) and sometimes also RCO01.
- supporting EDP, which is measured solely through RCO16 (and some PSIs).

According to the indicators used, eight of the 68 programmes fund EDP activities only under SO1.4 (see Box 7 on Portuguese programmes), 36 fund S3 skills training only, and 23 fund both. However, an analysis of the incorporation of other common indicators, PSIs, and CoEs other than CoE23, and programme texts suggests other fields of activity and beneficiaries corresponding to the 5 categories outlined in the DG REGIO policy paper (see Box 3), for example, support for newly formed start-ups is reflected by targets against RCO15 and RCR18 indicators. Similarly, in terms of skills training, beneficiaries include SMEs and HEIs and their staff and students, coinciding with the categories in the policy paper, but also secondary schools (for entrepreneurship training) and adult vocational training. A range of approaches are apparent, with programmes providing skills training directly, assisting training bodies with development of their training programmes, and/or assisting the development of in-company training for managers. Notably, there is no ERDF common indicator that covers skills development in HEIs.

[55] Germany, France, Portugal, Romania, and Sweden in particular make extensive use of PSIs under SO1.4.

[56] All 6 programmes with funding allocated to CoE170 (capacity building) use their own PSIs to cover this aspect since there is no logical common indicator associated with the activity.

Table 6. Investment and targets against S3 related indicators for selected programmes.

Programme	EU amount for Skills for S3 (EUR)	RCO101 target value: No of SMEs investing in S3 skills	RCR98 target value: No of SME staff trained	Number of staff trained per SME (RCR98/RCO101)	Cost of training one SME employee (ERDF /RCR98)
Smart Transformation - BG[57]	14,432,564	49	1,810	36.9	7,974
Smart Transformation - BG[58]	2,567,436	78	382	4.9	6,721
Abruzzo	3,200,000	50	90	1.8	35,556
AP Trento	1,200,000	32	35	1.1	34,286
Basilicata	4,900,000	100	1,000	10.0	4,900
Emilia-Romagna	7,869,347	600	2,400	4.0	3,279
Lazio	14,000,000	290	2,300	7.9	6,087
Liguria	2,960,506	208	245	1.2	12,084
Puglia	82,000,000	1,500	3,000	2.0	27,333
Sardegna	15,000,000	200	200	1.0	75,000
Sicilia	19,788,604	850	689	0.8	28,721
Umbria	1,200,000	300	300	1.0	4,000

[57] Other regions except SW

[58] SW / capital region

Box 7: Portuguese programmes: SO1.4 funding for the EDP

Under the Portuguese programmes, SO1.4 allocations target almost identical activity and target groups and focus exclusively on the EDP, and bringing together different types of stakeholders (SMEs, universities, R&D centres, public agencies etc.) to identify new opportunities for investment and explore collective actions. A possible beneficial by-product of EDP is the improvement of skills and qualifications of innovation ecosystem actors but measures funded under SO1.4 will not include any kind of training.

Five types of EDP activity are mentioned:

1. *collaborative value chains and networks* – activities to demonstrate the economic valorisation potential of R&D projects;

2. *strategic concertation and coordination of actors* – activities to stimulate collective action to develop EDP, enabling the identification of investment initiatives and funding opportunities and the consolidation of collaborative ecosystems in the different areas of smart specialisation;

3. *integrated investment planning and programming* – implementation of S3 action plans and enabling the territorialisation of S3 strategies to identify investment projects, collective action logics, and corresponding funding sources;

4. *enabling smart specialisation* – activities helping actors to develop EDP, to carry out investment plans, to manage shared innovation processes, and to identify new investment opportunities, joint projects, and partnerships;

5. *innovation, governance and internationalisation platforms* – creation of technical teams for S3 governance and development of S3 platforms to bring together actors in EDP.

In the case of Norte, for example, which has the largest allocation to SO1.4 of the Portuguese programmes (40m EUR), the target is 125 participations of institutional stakeholders in EDP (CO16) and the involvement of 60 institutions in the EDP (SR03).

Target groups include: regional entities of the National Science and Technology System, technology transfer and development centres, technology and innovation centres, science and technology parks, technology-based companies, start-ups, and spinoffs.

Box 8: Three regional programmes SO1.4/CoE23 allocations

Abruzzo ERDF OP

The Abruzzo programme has a SO1.4/CoE23 ERDF allocation of 3.2m€[59], or 1.2% of the total programme budget, which focuses exclusively on training for SME employees: either to acquire/refresh technological or managerial skills[60] or to work towards an "industrial doctorate"[61]. The goal is to increase innovation and productivity within companies, and improve skills related to Abruzzo's smart specialisation areas. The programme hopes to target the automotive and aerospace industries, innovation in design, the agri-food sector, and the development of digital innovation hubs. Projects

[59] In the case of Abruzzo, the SO1.4 and CoE23 allocations are equal and coterminous (i.e. all of the SO1.4 allocation is categorised as CoE23 and vice versa).

[60] Technological skills relate to integrating new technologies for industrial and green transitions and include machine usage, robotics and 3D modelling software. Managerial skills include marketing, e-commerce, business models, and corporate social responsibility.

[61] The industrial doctorates will involve a research project within the SME alongside training provided through collaboration between the SME and a university.

will be co-created through dialogue with SMEs on their specific human resources needs and have a particular focus on young people as target group (and potentially women where there is a gender imbalance found) and on industrial and green transition.

South Sweden ERDF OP

The South Sweden programme includes the highest percentage of ERDF allocated to SO1.4 of all of the Swedish programmes (11.5%) and the second highest overall (after Flanders). It responds to skills shortages locally that make recruiting qualified staff a challenge, allocating 6.2m€ ERDF to SO1.4, all of which is categorised as CoE23. The investment has two strands or "results chains":

— strengthening the supply of skills in specialisation domains, through direct actions in SMEs with the aim to improve productivity and human resource management and recruitment. Actions relate to skills pertaining to the enterprise's core activity, management skills, entrepreneurial skills, green skills, recruitment training, and training to senior staff on how to provide in-company training.

— assisting organisations involved in skills provision and entrepreneurship cultivation[62] to develop support structure and test new approaches to training and the facilitation of entrepreneurship including through the EDP.

This activity aims to support 109 SMEs to invest in skills for S3, industrial transition and entrepreneurship, 121 users of support structures and encourage 35 participations of institutional stakeholders in EDP. The programme highlights the importance of considering S3 in Denmark to maximise the effectiveness of Sweden's own SO1.4 activities, alongside synergies with the Öresund-Czechock-Kattegat Interreg programme between Sweden, Norway, and Denmark.

Rheinland-Pfalz ERDF OP

Rheinland-Pfalz has the highest CoE23 percentage (16.4%, or 39m€) of any programme, but with all of it allocated under SO1.3 (enhancing sustainable growth and competitiveness of SMEs and job creation in SMEs, including by productive investments). The funds support SMEs with reference to industrial/digital transition and strengthening the regional innovation ecosystem through a number of activities including:

— Tourism 4.0. - improving the competitiveness of SMEs in the sector of tourism through strengthening their innovation and digitalisation skills and encouraging them to invest in new tourism experiences. Activities include advice, coaching, skills development, networking, and facilitation of knowledge transfer. Target groups are local authorities, tourism associations, and SMEs in the tourism industry.

— Implementation of Operational Innovation: creation of a fund to financially support SMEs (including with grants) to implement innovation measures to exploit technological changes and digitisation.

4.3 Skills for S3 ERDF beneficiaries

Based upon an analysis of the programme texts, a typology of target groups for SO1.4 allocations was elaborated (see Table 7).

[62] Public agencies (municipalities etc.), business and innovation promotors (incubators, cluster organisations and science parks), and educational actors (universities etc.)

Table 7. Typology of target groups for SO1.4 investment

Target group	**Description**
HEIs	higher education, further education, college, polytechnic, university, academia, knowledge institutions
Other education/training	training and education providers, secondary schools/ high schools, adult education, accredited training institutions, centres of vocational education and training, educational institutions, associations, foundations, pupils, education professionals
Research	strategic research centres, research organisations, R&D institutions, state laboratories, R&D, collaborative laboratories, research and innovation institutions and bodies, non-university research organisations, doctoral students, postdoctoral researchers, actors of the research and innovation ecosystem,
Innovation promoters	innovation clusters, innovation agencies, networks, innovation hubs, consortia, European digital and innovation hubs, technology dissemination units, cluster agencies, innovation intermediaries, technology resource centres, science and technology parks, technology centres, centres for technology transfer, development and valorisation, technology transfer units, Knowledge Innovation Communities, technological interface centres, incubation infrastructures
Enterprises	enterprises, business, companies, undertakings, SMEs, start-ups, MSMEs, spin-offs, business representatives, workers, entrepreneurs, stakeholders in entrepreneurial discovery,
Business associations	business associations, entrepreneurial organisations/foundations, chambers of commerce, business promoters, business consultancy / advisory services, business support institutions, employers' associations, industry and trade union organisations, business support institutions
Civil society	Non-profit organisations / NGOs, social enterprises, civil society organisations, churches and religious communities, citizens
Public agencies	Central government, ministries, government services, S3 authorities, public authorities/agencies, regional administration, local government, municipalities,

Annex 6 provides an overview of these beneficiary groups at MS level. Almost all of the programmes mentioned enterprises or business as target groups, which corresponds to the indicators chosen under SO1.4. In total, exactly half of the 68 programmes that contain SO1.4 mention HEIs as a target group, with more programmes targeting HEIs than other types of education/training (23 programmes target both, 11 programmes target HEIs only, and 5 programmes other education/ training only).

Box 9: Flanders OP

Flanders has the highest percentage SO1.4 of all EU-27 programmes, at 15% (40m€). Only 50% of its SO1.4 is categorised as CoE23, the other 50% comes under CoE26 (*support for innovation clusters*

including between businesses, research organisations and public authorities and business networks primarily benefiting SMEs).

The SO has a strong focus on the application of high-tech technologies and skills for industrial (digital/technological) transition, although investment will be in line with the Flemish S3 and target SMEs and entrepreneurs. SO1.4 will fund:

— the creation of demonstration spaces to display technological innovations within particular sectors, thus helping SMEs in that sector better understand the technological possibilities available for their further development.

— the creation of state of the art digital training infrastructure for both professional and adult learning (e.g. simulators and virtual reality experiences).

— the development of high-tech applications with societal value, such as training in technology to assist workers with disabilities.

Regarding target groups, the programme document distinguishes between direct beneficiaries and potential final target groups. For beneficiaries, it mentions universities, colleges, training and education providers, strategic research centres, SMEs, non-profit organisations, innovation clusters, public agencies, and business representatives. Final target groups are defined as SMEs, employees, jobseekers, students, and trainees.

5 Skills for smart specialisation, industrial transition and entrepreneurship in the EU-27 Recovery and Resilience Plans

5.1 Skills for S3 investment under the RRF

The total value of RRF funding categorised as directly relevant to Skills for S3 is EUR 60.55 billion (12.2%), with a further EUR 28.12 billion (5.72%) allocated to activity that could possibly include or be relevant for S3 skills, suggesting a potential total of up to EUR 88.3 billion (around 18% of the total EUR 491.51 billion)[63].

At MS level, nearly 85% of the total RRF investment in Skills for S3 across the EU-27 RRF was allocated in Italy (EUR 28.85 billion)[64], Spain (EUR 17.53 billion) and France (EUR 4.71 billion). On average, MS have allocated 12.20% of their RRF allocations to investments relevant to S3 skills. Spain allocates the greatest relative amount (25.21%), followed by Lithuania (16.37%), and Italy (15.07%). Nevertheless, if the potential investment identified is, in fact, relevant then Cyprus (32.66%) would be the highest relative spender on Skills for S3, followed by France (29.33%), Spain (29.1%), Malta (28.04%) and Lithuania (27.45%).

Several MS have low funding allocations, both nominally and relatively, for Skills for S3 related activity, such as Ireland and Malta (0), Luxembourg (EUR 0.01 billion), Germany, and Estonia (EUR 0.02 billion each) and Greece (0.55%).[65] Figures 11-16 and Table 8 show the total amounts of RRF funding allocated to Skills for S3 activity per MS, both definite and possible investment.

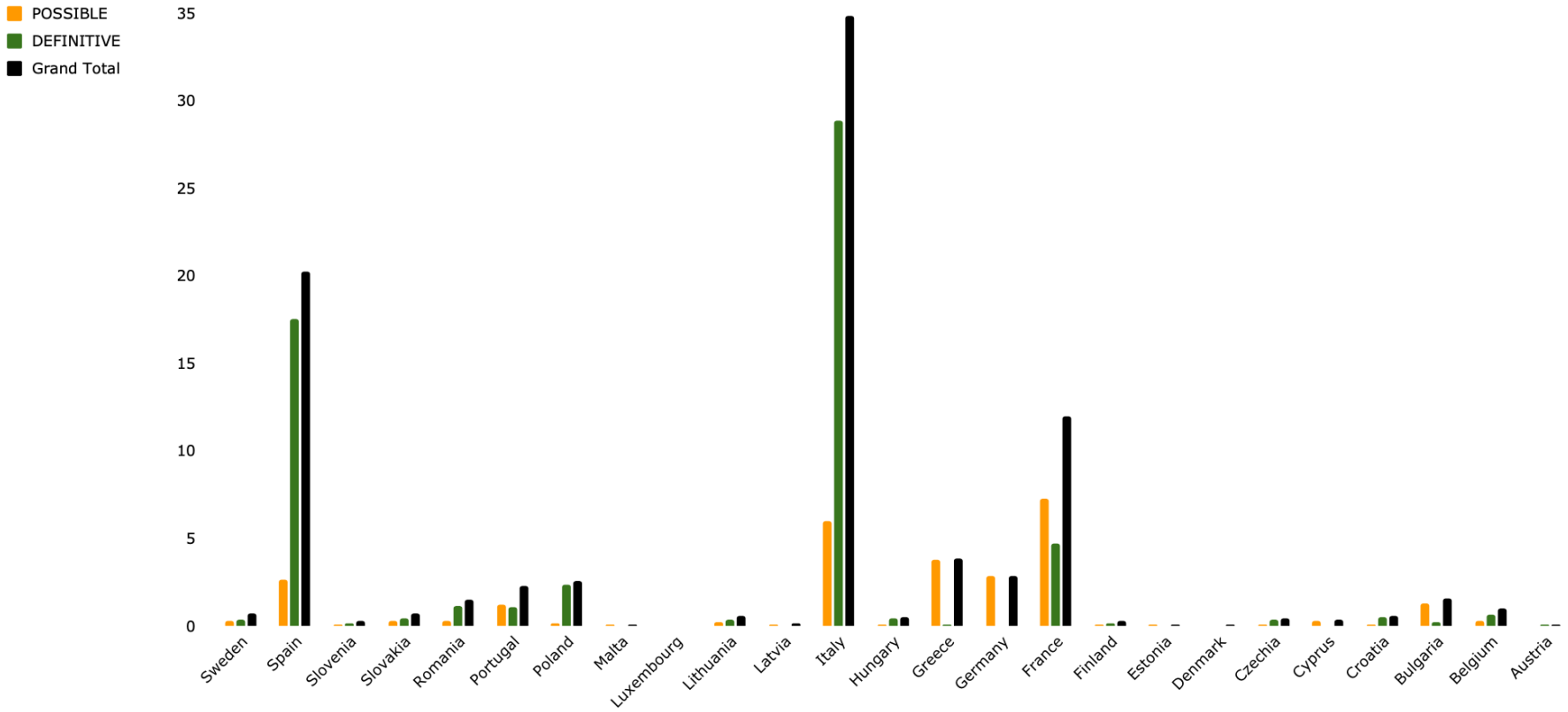
The majority of the Skills for S3 funding (76.2% of the definite and possible amounts) concerns investment planned within Pillars 2 (Digital transformation) and 3 (Smart, sustainable and inclusive growth) of the RRF, and to a lesser extent (15%) investments within Pillar 6 (Policies for the next generation). Around half of the Pillar 3 allocation is S3 Skills activity, as well as one third of Pillars 2 and 6 allocations (see Figure 16).

[63] Utilising the Bruegel database, ibid.

[64] The Italian RRP is the largest in the EU, with Italy activating both the grant and loan component of NextGenerationEU, and programming in an array of other funding resources[64] in order to increase the size of the envelope (Prota & Viesti, 2022).

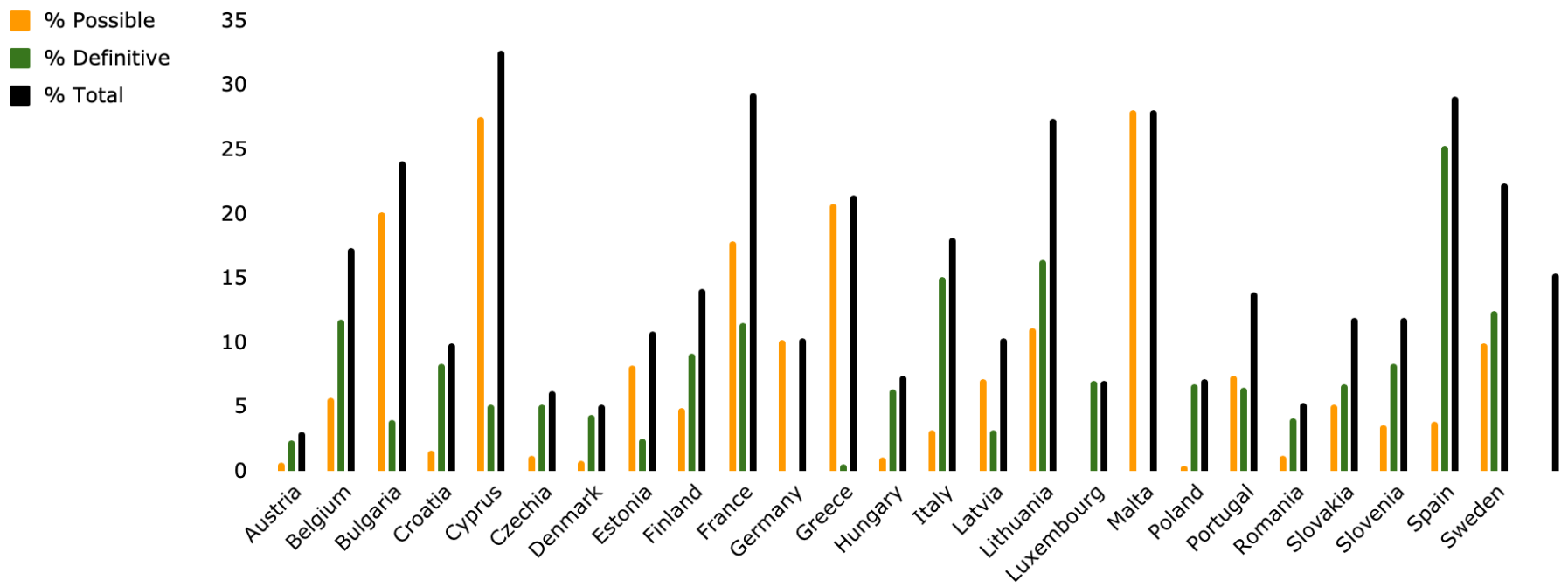
[65] Ireland has no RRF investment in the Bruegel database identified as clearly relating to Skills for S3, although in a validation exercise 0.23 bn EUR was identified.

Figure 11. Total RRF amount allocated to Skills for S3 per Member State (EUR billion)



(Source: authors' elaboration)

Figure 12. Total RRF amount allocated to Skills for S3 per Member State (% of total RRF amount per Member State)



(Source: authors' elaboration)

Table 8. RRF allocations by MS for Skills for S3 (S4S3) (EUR bn and %)

Country	Definite S4S3	Possible S4S3	Total Skills for S3	Total RRF	% Definite	% Possible	% Total
Austria	0.11	0.03	0.14	4.50	2.38	0.71	3.09
Belgium	0.69	0.33	1.03	5.93	11.72	5.64	17.36
Bulgaria	0.26	1.33	1.59	6.61	3.99	20.12	24.11
Croatia	0.54	0.10	0.64	6.40	8.40	1.54	9.94
Cyprus	0.06	0.34	0.40	1.23	5.19	27.47	32.66
Czechia	0.36	0.08	0.44	7.07	5.11	1.18	6.29
Denmark	0.07	0.01	0.08	1.56	4.31	0.86	5.17
Estonia	0.02	0.08	0.11	0.98	2.54	8.28	10.82
Finland	0.19	0.10	0.30	2.10	9.16	4.96	14.11
France	4.71	7.30	12.01	40.95	11.50	17.84	29.33
Germany	0.02	2.87	2.89	27.95	0.07	10.26	10.33
Greece	0.10	3.79	3.89	18.19	0.55	20.84	21.39
Hungary	0.46	0.07	0.54	7.20	6.42	1.02	7.44
Ireland	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Italy	28.85	6.00	34.85	191.50	15.07	3.13	18.20
Latvia	0.06	0.13	0.19	1.83	3.14	7.16	10.30
Lithuania	0.36	0.25	0.61	2.22	16.37	11.07	27.45
Luxembourg	0.01	0	0.01	0.09	6.97	0.00	6.97
Malta	0	0.10	0.10	0.34	0.00	28.04	28.04
Poland	2.41	0.16	2.58	35.97	6.71	0.46	7.17
Portugal	1.08	1.24	2.32	16.64	6.51	7.42	13.93
Romania	1.20	0.35	1.55	29.39	4.09	1.18	5.27
Slovakia	0.44	0.34	0.78	6.55	6.77	5.11	11.89
Slovenia	0.21	0.09	0.30	2.48	8.39	3.53	11.92
Spain	17.53	2.70	20.23	69.53	25.22	3.88	29.10
Sweden	0.41	0.33	0.74	3.30	12.44	9.94	22.37
Total	**60.17**	**28.12**	**88.30**	**490.52**	**12.27**	**5.73**	**18.00**

(Source: authors' elaboration)

Figure 13. Map of RRF allocations (definite) by MS to Skills for S3 (EUR bn)

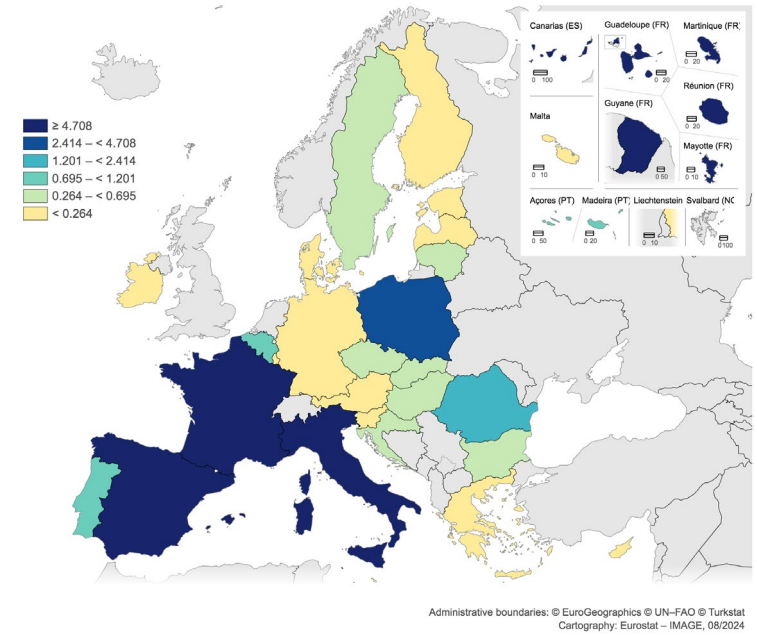


Figure 14. Map of RRF allocations (definite) by MS to Skills for S3 (%)

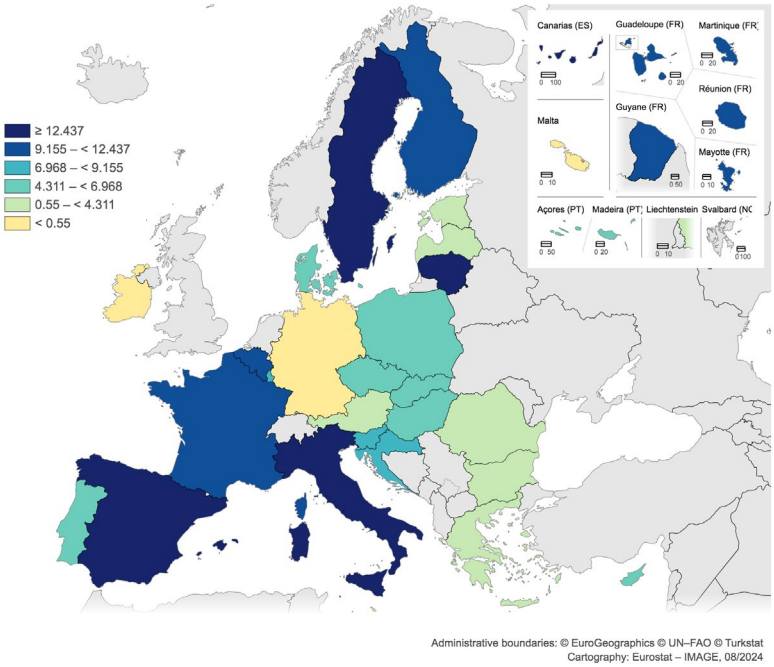


Figure 15. Map of RRF allocations (definite and possible) by MS to Skills for S3 (EUR bn)

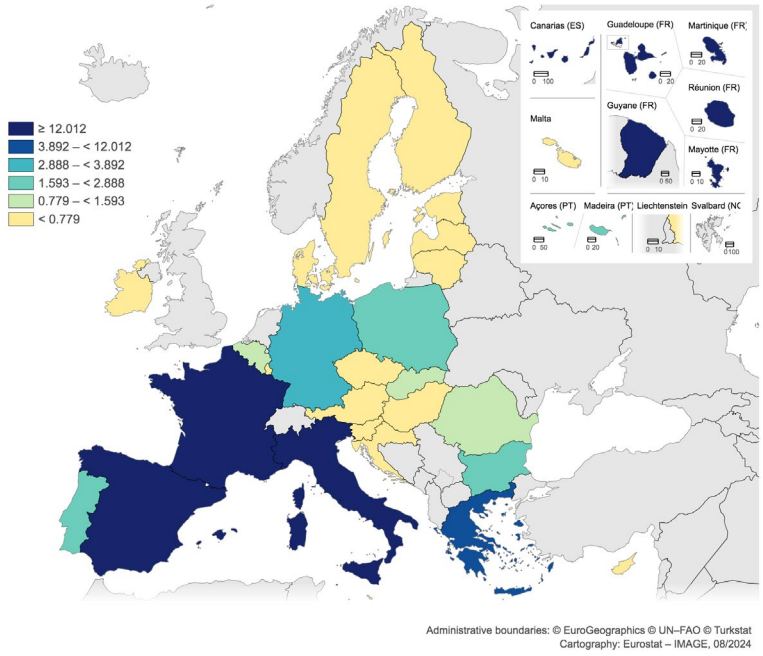
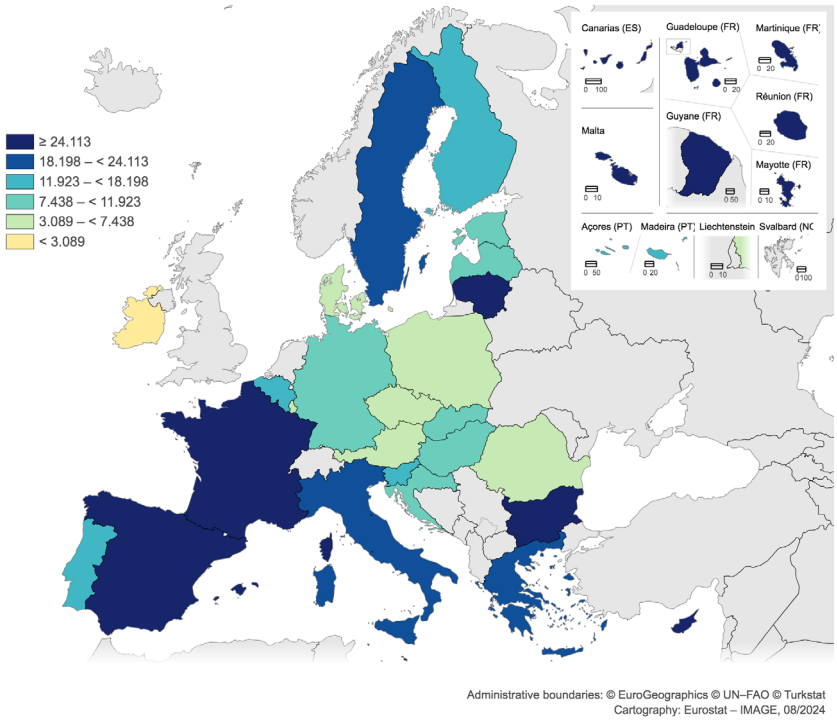


Figure 16. Map of RRF allocations (definite and possible) by MS to Skills for S3 (%)



The majority of activities planned for funding can be categorized as:

- training to increase workers' digital skills (Pillar 2),
- initiatives aimed at strengthening and developing research and innovation ecosystems (Pillar 3), or
- modernising and aligning educational systems (especially Vocational Education and Higher Education Institutions) with the needs of local markets (Pillar 6).

The remaining 9% corresponds to funding under Pillars 1 (Green transition) and 4 (Social and territorial cohesion) and is focused upon aiding SMEs to undertake green and digital transitions (purchase of energy efficient equipment, funding for innovation etc.).[66]

Figure 17. Total RRF amount allocated to Skills for S3 (definite and possible) per RRF Pillar (% of total RRF amount allocated to Skills for S3)

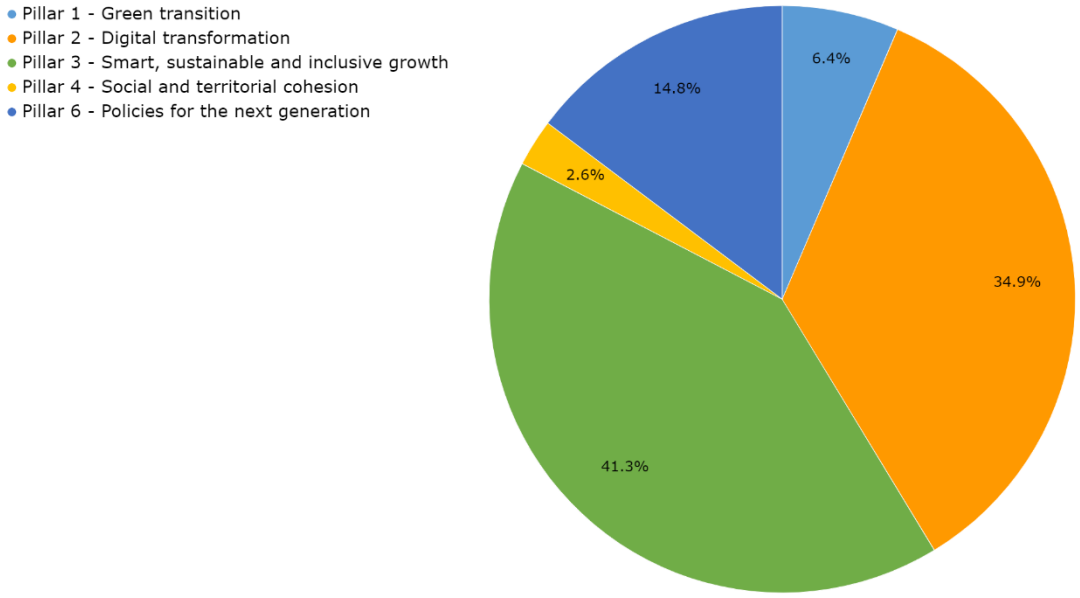
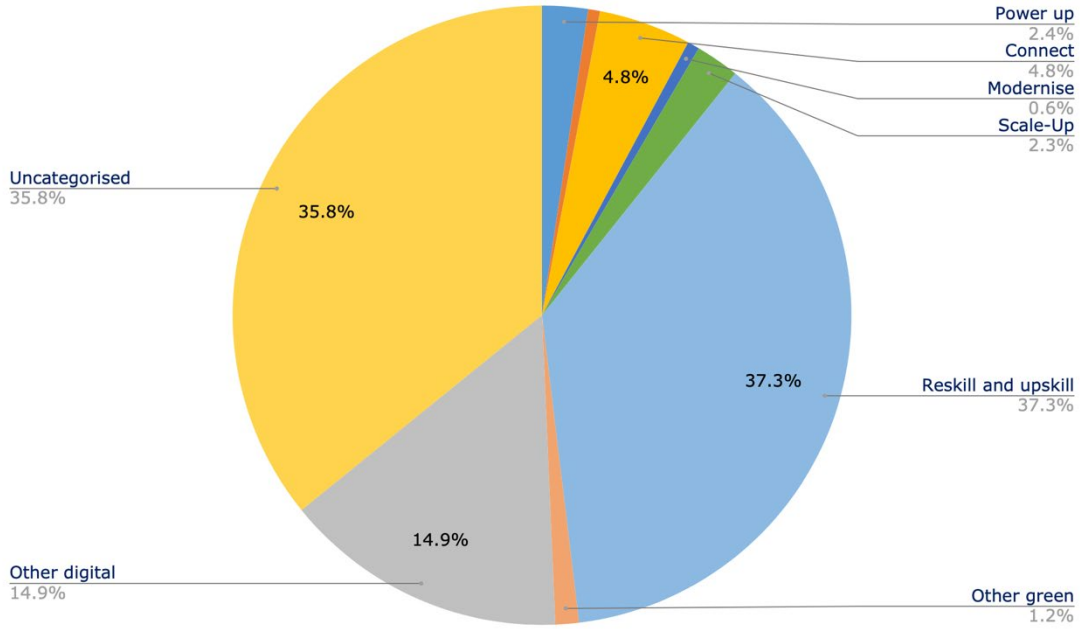


Figure 18 shows that the majority of the allocation related to Skills for S3 (37%) can be categorised under Flagship 7 *Reskill and upskill*, and Flagship 9 *Other digital* (15%). However, 36% of the funding allocations are uncategorised, mostly those under Pillar 3 which does not clearly correspond to the flagships. The remaining flagships, related to material and infrastructural adaptations for the twin transitions, are allocated smaller amounts of funding (around 12%); Flagship 4 *Connect* (4.8%) and Flagship 6 *Scale-Up* (2.3%).

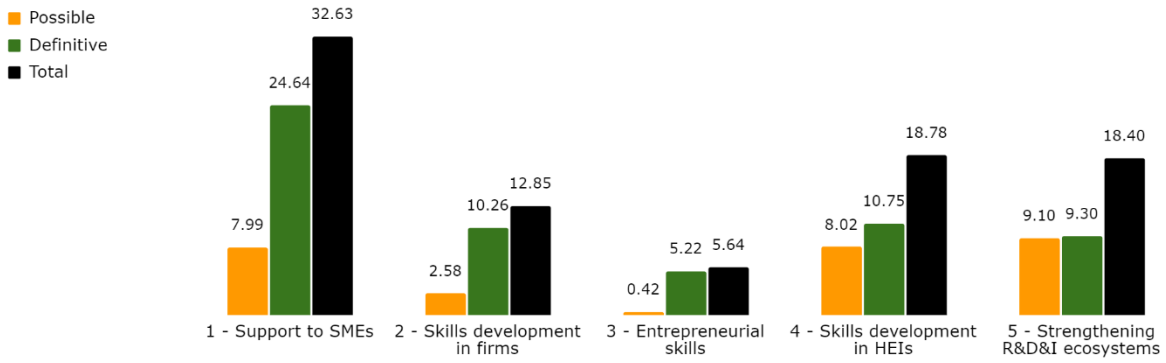
[66] Investments related to pillar 5 (*Health and economic, social and institutional resilience, with the aim of, inter alia, increasing crisis preparedness and crisis response capacity*) were not included in the analysis.

Figure 18. Total RRF amount allocated to Skills for S3 (definite and possible) per RRF Flagship (% of total RRF amount allocated)



Mapped against the five sub-categories of Skills for S3 investment, the majority of the funding (37% overall, and more than 40% of the definite allocations) relates to Support to SMEs (see Figure 20). The allocation to entrepreneurial skills is the lowest of all the categories (5.21bn EUR definite; 8.76% of the total), with few investments foreseen. Both skills development in HEIs and in firms tended to be included as complementary activity and not the primary focus of the investment (see Table 9). Annex 5 provides an overview of RRF investment in Skills for S3 in each MS[67].

Figure 19. Total RRF amount allocated across EU27 to each Skills for S3 activity (EUR billion)



[67] Except for Netherlands and Ireland. Netherlands does not appear, and Ireland has no relevant measures in the Bruegel database..

Figure 20. Percentage allocation to Skills for S3 activities (% of total RRF amount allocated)

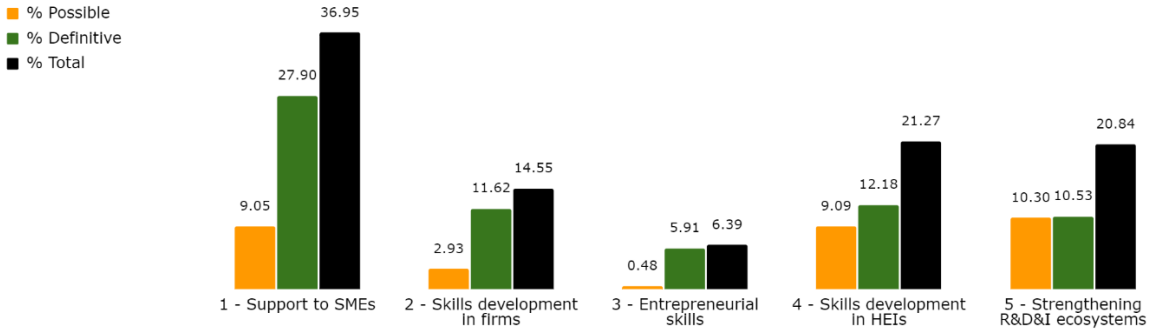


Table 9. Number of RRF measures per Skills for S3 activity (definite and possible) across the EU-27

Sub-category	**1. Support to SMEs**	**2. Skills development in firms**	**3. Entrepreneurial skills**	**4. Skills development in HEIs**	**5. Strengthening R&D&I ecosystems**
Investments where dominant activity	55	57	6	59	60
Investments where complementary activity	65	74	12	75	73
Average value of investments where dominant activity (billion EUR)	0.61	0.22	1.36	0.32	0.32

The Italian RRP is the largest in the EU, with **Italy** activating both the grant and loan component of NextGenerationEU, and programming in an array of other funding resources[68] in order to increase the size of the envelope (Prota & Viesti, 2022). Unsurprisingly therefore, Italy allocated the highest amount of total funding to activities related to Skills for S3 (34.9 bn eur) although not the highest percentage (18.2% of the country's total RRF funding). Italy's RRP is one of the few that allocates funding to all five sub-categories of Skills for S3. It includes the highest allocation dedicated to Support to SMEs and the greatest number of investments in Skills development in HEIs and Strengthening

[68] European funds from the REACT-EU programme and a Complementary Fund from national budget resources

the R&D&I ecosystem, with nine and twelve investments respectively (see Italy fact sheet in Annex 5 and Box 10).

Box 10: Italy's RRP: examples of Skills for S3 investments

- Support to SMEs: Investment 1: **Transition 4.0** (13.97 EUR billions) Creates push for businesses' digital transition and increased innovation rate 'of the country's industrial and entrepreneurial fabric', encouraging investments in technologies, research, development and innovation; digitalisation training and skills development focused on digital upskilling in SMEs.
- Skills development for firms: Investment 3.1: **Film industry development** (Project Cinecittà) (0.30 EUR billions) Aims to improve competitiveness of Italian film and audio-visual sector, including with digitalisation and modernisation support with training to improve professional skills and competencies.
- Entrepreneurial skills: Investment 1.2: **Creation of women's enterprises** (0.40 EUR billions) Objectives include promoting female entrepreneurship by standardizing and redesigning support instruments to be more responsive to women's needs, support the launch of women's entrepreneurial activities, provide financial support to innovative start-ups and SMEs and to the new Women's Entrepreneurship Fund.
- Skills development in HEIs: Reform 1.2: **Reform of the vocational training system** (no cost) Strengthening of the organisational and teaching model (i.e., expanding pathways for the development of enabling technological skills), strengthening the presence of ITS (Tertiary Vocational Training System) in regions' entrepreneurial fabric, coordination between vocational schools, ITS, and businesses.
- Strengthening R&D&I ecosystem: Investment 1.5: **Creation and strengthening of "ecosystems of innovation", construction of "territorial leaders of R&D"** (1.30 EUR billions). Funding of projects that present elements of: innovative training activities carried out in synergy by universities and enterprises aimed at reducing the mismatch between skills required by businesses and skills provided by universities, research activities carried out jointly by universities and businesses, support for start-ups, and involvement of local communities in innovation and sustainability issues.

(*Source: Bruegel RRP Dataset*)

Spain has the second-highest amount of total funding allocated to Skills for S3, with a total amount of EUR 20.2 billion allocated (17.5bn definite, 2.7bn possible). It allocates the highest (EUR 5.22 billion) of any MS to sub-category 3 (Entrepreneurial skills), which was overall the least funded sub-category across the EU-27 RRPs. The greatest proportion of funding (46.03%) is included under Pillar 2 (Digital transformation) and under Flagship 9 (Other digital) (54.56%) suggesting a clear focus upon digital skills. Whilst skills development in HEIs and firms account for nearly 50% of funding, overall little activity is targeted at HEIs, with only one component clearly targeting HEIs (see Box 11 below and Spain fact sheet in Annex 5).

Box 11: Spain's RRP: examples of Skills for S3 investments

- Support to SMEs / Entrepreneurial skills: **Boost to SMEs** (4.89 EUR billions) Component including 2 reforms (one of which is 'Spain as an Entrepreneurial Nation Strategy' which includes networks of support for entrepreneurship, innovation and digitalization) and 5 investments (including entrepreneurship capacities, programmes for SME growth, subsidies for the adoption of digital solutions and digital transformation)
- Skills development for firms / Strengthening R&D&I ecosystem / Support for SMEs: **National AI strategy** (0.50 EUR billions) Calls for grants to finance industrial research or experimental development projects in the field of Artificial Intelligence, SpAIn Talent Hub to attract talent, programme of support to SMEs for the integration of AI and roboticization of their value chains
- Skills development in HEIs / Strengthening R&D&I ecosystems: **Modernisation and digitalization of the education system** (1.65 EUR billions) Component including 3 reforms (including new education

curriculum for sustainable development and development of digital competencies for students at all stages of education, reforms in university system to encourage research) and 5 related investments.

(Source: Bruegel RRP Dataset)

Hungary's RRP funding is mostly concentrated under pillar 6 (Policies for the next generation) (6 out of 7 measures[69]) and Flagship 7 (Reskill and upskill) (6 out of 7 measures) (see Annex 6 for Hungary factsheet and Box 12). The measures nearly all target skills development in HEIs and all feature HEIs and Vocational Training institutions as primary beneficiaries. This demonstrates strong alignment with the national S3, which prioritises 'Public sector and university innovation' and 'Training, education'[70]. Hungary's S3 Strategy outlines key challenges including weaknesses in knowledge flows in the innovation ecosystem and a low level of business-academia cooperation, with research-enterprise cooperation in Hungary below EU average due to the traditional separation of research, education, and innovation organisations. It specifically notes that 'more experience is needed in activities related to the third mission of higher education' and 'strengthening the service character of higher education knowledge bases' including to increase business-academia links and SMEs' innovation. In the digital field, "Hungary's adoption of productivity-enhancing digital technologies is among the lowest in the EU" (European Commission, Country Report Hungary 2020). RRP investments look to strengthen the link between training provided in HEIs and economic needs, improve digital skills capacities in HEIs, and establish national research and development laboratories to boost Hungary's innovation ecosystem.

Box 12: Hungary's RRP: examples of investments in skills development in HEIs

- B.1 Reform 1 – **Sectoral modernization of higher education** (no cost) Objectives include transforming the higher education training system in Hungary with a practical focus, establishing training and regulatory cooperation with VET and innovation, upskilling and reskilling specifically related to higher education in alignment with labour market requirements and the context of the green and digital transition.
- B.2 Investment 1 – **Infrastructure and skills development of practice-oriented tertiary education** (0.18 EUR billion) Objectives include supporting HEI's development projects through infrastructure development and training and skills development, improving students' labour market competencies (particularly through adaptation to industrial transformation and digitalization).
- B.3 Investment 2 – **Institutional innovation of higher education courses and services adapted to the core activity of the higher education institution and strengthening the adult education activities of higher education** (0.09 EUR billion). The development of digital training materials, improving the digital skills of students and staff at HEIs (i.e., through a 'digital literacy programme'), with possible training themes such as sustainability, the circular economy and climate neutrality.
- B.5 Investment 4 – **Digital curriculum development for vocational training** (0.05 EUR billion) Development of digital skills in vocational education institutions.
- C.3 Reform - **Work socialization and skills development based on local specificities** (no cost). Creates employment workshops to 'activate' the local population by improving their skills and qualifications to fit local labour market needs, targeting groups of long-term unemployed and women, geographic focus on the 300 poorest municipalities in Hungary

[69] The remaining investment falls under Pillar 3 (Smart, sustainable and inclusive growth).

[70] National Research, Development and Innovation Office (2020) *National Smart Specialisation Strategy 2021-2027*, https://nkfih.gov.hu/english/national-smart-specialisation-strategy/s3-2021-2027

(Source: Bruegel RRP Dataset)

The majority of **Finland**'s RRP Skills for S3 investment is concentrated on strengthening R&D&I ecosystems) (4 out of 6 investments)[71]. Most investments fall under Pillar 3 (Smart, sustainable and inclusive growth) (see Annex 5 and box 13). The concentration of investment in Pillar 3 (Smart, sustainable and inclusive growth) reflects an emphasis on clean technologies, sustainability, and climate neutrality found in Finland's national and regional-level strategies, including, for example, a focus upon industrial development in accordance with the green transition (South Finland S3)[72] and being carbon-neutral by 2035 (Helsinki-Uusimaa). The Commission's 2019 and 2020 Country Specific Recommendations called for Finland to "focus investment-related economic policy on research and innovation, low carbon and energy transition and sustainable transport"[73] and specifically "on the green and digital transitions, in particular on clean and efficient production and use of energy, sustainable and efficient infrastructure"[74]. RRP investments include the objective of addressing "global and societal challenges" and reflect the country's strong tradition of science-industry collaboration and cooperation across triple helix actors (public-academia-business), with a focus on "multidisciplinary innovation ecosystems that are based on the idea of evolving and integrating key players according to the market demand" (Leino, 2020). The share of innovative companies in Finland cooperating with academia is above the EU average (36.1% compared to 31.3% in 2012) and Finland has the highest figures among the EU-27 in terms of percentage of innovative companies working with HEIs (26%) or public or private research institutes (23%) (Halme et al. 2019).[75]

Box 13: Finland's RRP: example of investments in strengthening RD&I ecosystems

— **R&D funding for the green transition:** Research accelerator project (0.10 EUR billion); Accelerating innovation and strengthening skills (0.07 EUR billion); Support for innovative growth companies (0.02 EUR billion) Funding for HEIs and SMEs to produce expertise and research findings relevant for business and society needs.

(Source: Bruegel RRP Dataset)

Lithuania has one of the highest percentages (27%) of total RRF funding dedicated to Skills for S3 investments, and its RRP draws significant links to the country's smart specialisation strategy and to the HEI mission to contribute to regional development. Lithuania has investments related to all the Skills for S3 sub-categories, but the majority (c.73%) is allocated to skills development in firms (67%) and HEIs, and categorised as Pillar 6 (Policies for the next generation) and Pillar 3 (Smart, sustainable and inclusive growth) (see Annex 5 for Lithuania fact sheet). The Smart Specialisation Strategy of Lithuania[76] includes a General Action Plan for the Implementation of the Policy Measures of Higher

[71] Other investment targets support to SMEs and skills development in firms.

[72] South Finland Region page, Smart Specialisation Platform. Joint Research Centre (JRC), European Commission. https://s3platform.jrc.ec.europa.eu/region-page-test/-/regions/FI1C

[73] European Commission (2019). *2019 European Semester: Country Specific Recommendation - Finland,* https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1560258806189&uri=CELEX%3A52019DC0526

[74] European Commission (2020). 2020 European Semester: Country Specific Recommendation – Finland, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1591720698631&uri=CELEX%3A52020DC0526

[75] Halme et al. (2019), *Case study on the policy mix for science-industry knowledge transfer in Finland: Contribution to the OECD TIP Knowledge Transfer and Policies project*, OECD, https://stip.oecd.org/assets/TKKT/CaseStudies/2.pdf

[76] Lithuania's Smart Specialisation Strategy (2014-2020), last updated 2021, Ministry of Education, Science and Sport, https://smsm.lrv.lt/en/science1/smart-specialization

Education and R&D, which focuses on major national challenges and future trends, creating and commercialising knowledge applicable to businesses and economic sectors, as well as modernization of HE and R&D infrastructure and internationalization. The 2019 country report referred to the need for Lithuania to "develop a coherent policy framework to support science-business cooperation and consolidate research and innovation implementing agencies"[77], and investments reflect that goal. Reform 5.5. Effective implementation of innovation policies and increased demand for innovation, development of the start-up ecosystem and green innovation (see Box 14), for example, aims to increase innovation efficiency and demand by setting up an innovation promotion agency, developing a policy framework to foster science-business cooperation, and expanding the innovation promotion fund.

Box 14: Lithuania's RRP: example of Skills for S3 investments

- Support for SMEs / Strengthening RD&I ecosystems: **Reform 5.5. Effective implementation of innovation policies and increase demand for innovation, development of the start-up ecosystem and green innovation** (0.06 EUR billion) Increasing the efficiency of innovation policy implementation, boosting demand for innovation (i.e., fostering the development of the start-up ecosystem, prioritising smart specialisation), promoting the development of green innovation, setting up a single innovation promotion agency to foster science-business cooperation.
- Skills development in firms: **Reform 4.5. Accessible opportunities for the development of competences and recognition of qualifications for adults** (0.02 EUR billion). Reform of the Life Long Learning system, development of competences, essentially digital competences, skills development for SME staff in the areas of Smart Specialisation.
- Entrepreneurship skills: **Reform 7.4. Client-oriented employment support** (0.11 EUR billion). Aims to increase employment and ensure the sustainable integration of people into the labour market, including enabling vocational training, capacity building, and entrepreneurship.
- Skills development in HEIs: **Reform 4.7. Competences for green and digital transformation in vocational training** (0.04 EUR billion) Aims to increase the attractiveness of vocational education, including upskilling of teachers, and access to practical and digital skills in sectoral practical training.
- Strengthening RD&I ecosystems: **Reform 5.4. Quality higher education and strong science and research institutions** (0.04 EUR billion) Objective of improving HE system competitiveness, reforms including refining the missions of universities and colleges, strengthening cooperation between businesses and universities ("joint Missions for Science and Innovation in Smart Specialisation), aspects of training and digital skills development.
- Strengthening RD&I ecosystems: **Reform 5.6. Joint science and innovation missions in Smart Specialisation Areas (Common science and innovation missions in the areas of smart specialisation)** (0.10 EUR billion) Aims to support business-science cooperation in R&I activities through joint science and innovation missions and programmes focused on smart specialisation domains.

(Source: Bruegel RRP Dataset)

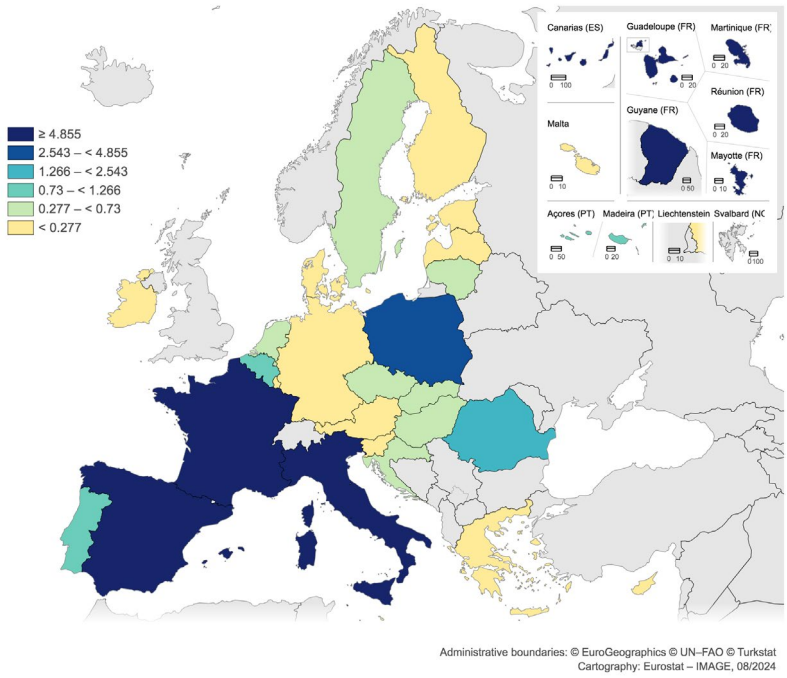
[77] European Commission (2019), 2019 European Semester: Country Specific Recommendation / Commission Recommendation - Lithuania, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1560258494533&uri=CELEX%3A52019DC0515

6 ERDF and RRF complementarity in the context of the European Semester

The amounts allocated under the RRF across the EU-27 (EUR 60.55 billion) dwarf those available under ERDF (2.093 billion). The dominance of Italy, Spain and France in terms of total allocation to Skills for S3 across the two funding instruments (in nominal and percentage terms) reflects the large sums allocated under the RRF. Italy allocates significantly greater funding to Skills for S3 than any other EU MS (EUR 29.42 billion) but in terms of percentage Spain allocates more (19.12%) and Sweden also demonstrates a high percentage allocation (11.24%). Some of the smallest MS (Luxembourg, Estonia, Cyprus) unsurprisingly allocate the lowest total amounts, reflecting lower allocations. (see Table 10 and Figures 21 and 22. *NB the figures used here include only the definite amounts under the RRF, figures for possible relevant investments have been removed*).

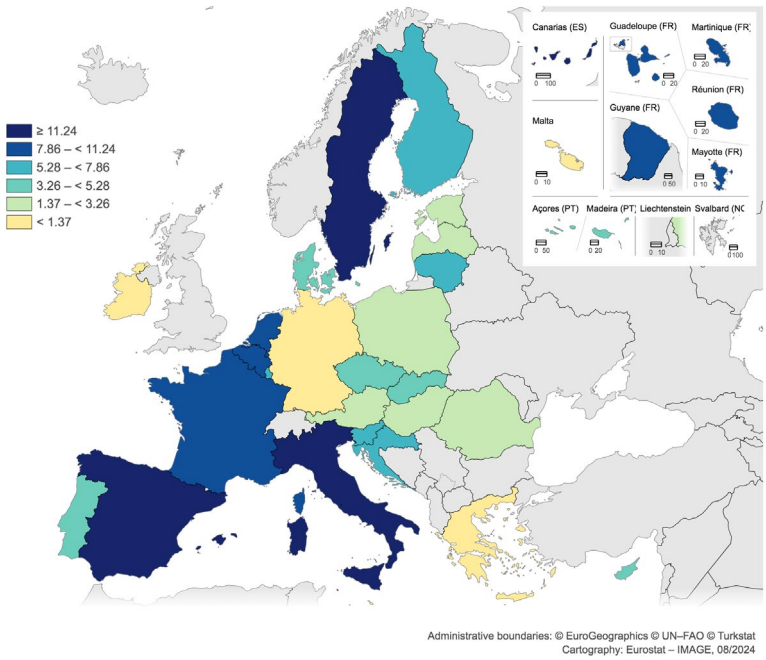
In their 2019 Annex D recommendations all EU27 MS received a recommendation related to Skills for S3, industrial transition and entrepreneurship (see Annex 7). Table 11 plots these recommendations against the five sub-categories utilised in the research (from the DG REGIO policy paper) and the allocations from each MS under the two funding streams (including only definite funding under the RRF). Skills development for firms is the category against which the most MS received recommendations (25 MS), followed by support for SMEs (17 MS). Thirteen MS received recommendations related to entrepreneurial skills and skills development in HEIs, whilst only 10 MS had a recommendation related to strengthening regional innovation ecosystems. The only MS to receive a recommendation under each category was Czechia, with Denmark, Estonia, Finland, Germany, Malta, Sweden and Romania all receiving recommendations under 4 of the different categories.

Figure 21. Total RRF and ERDF allocations to Skills for S3, industrial transition and entrepreneurship (EUR bn)



(Source: authors' elaboration)

Figure 22. Total RRF and ERDF allocations to Skills for S3, industrial transition and entrepreneurship (% of total allocation at national level)



(Source: authors' elaboration)

Many of the smaller MS have chosen to use their RRF allocations to address skills for S3 needs, rather than ERDF (e.g. Austria, Cyprus, Denmark). There tends to be little correlation however between the number of skills needs identified in the country reports and the allocations at national level. Italy allocates the highest amount to skills for S3 yet has a low number of relevant recommendations (against two skills categories), whereas Malta received recommendations against four of the categories yet allocates no RRF funding and very small amounts of ERDF to skills for S3.

Finally, Table 12 attempts to determine whether allocations to each MS under one or both of the funding streams (including only definite funding under the RRF) specifically address the areas covered by country reports' Annex D recommendations. It looks to determine whether MS may have adapted ERDF programming activity in the 2021-2027 programming period following the introduction of the RRF with its larger budgetary envelope. In this exercise, only national ERDF programmes have been analysed to reflect similar geographical coverage and governance and the national focus of the Annex D recommendations.

Table 12 shows some demarcation across the two funding streams: for Czechia for example, strengthening the RD&I ecosystem is allocated funding solely under the RRF; skills for HEIs and entrepreneurial skills only under an ERDF national programme[78], although support for SMEs and skills development for firms are eligible for funding under both. In general, skills for firms and support for

[78] NB. There is a measure under the Czechia RRP that is considered possibly relevant to entrepreneurial skills.

SMEs are the most likely activities to have funding allocated under both initiatives, whilst entrepreneurial skills are more often funded under ERDF (see Box 15), and overlooked under the RRF.

Italy, Romania and Croatia, notably, have allocated funding under the RRF and/or ERDF against all of the five categories. Other MS do not demonstrate high correlation between funding allocations and categories recommended. Austria and Cyprus, who both received a recommendation against skills in firms, according to our analysis, allocated funding against skill development in HEIs and support for SMEs respectively. France has only one recommendation relevant to S3 skills, around entrepreneurial skills and yet funds measures under the other four categories under the RRF (and has no national ERDF programme). Denmark has recommendations against four categories yet allocates funds only to support for SMEs.

Box 15: National ERDF programmes' actions related to entrepreneurial skills.

— Supporting entrepreneurship and increasing the innovation potential of different actors in the innovation ecosystem, including enterprises, start-ups, schools, and the public administration in the **Czechia**.

— The promotion and encouragement of youth entrepreneurial culture at all levels of education, including in higher education and centres for professional excellence in **Croatia.**

— Innovative doctoral courses on topics related to industrial transition, entrepreneurship, and green transition in **Italy**.

— Training/ upskilling of human resources within enterprises in the areas of entrepreneurship and industrial transition in **Romania**.

There are clear examples of complementarity across the different funding instruments in relation to Skills for S3 activity, although some of the activities outlined lack clarification.

- **Bulgarian** ERDF allocations cover schemes for the acquisition of new skills, including specific digital and technological skills, for staff in businesses threatened by the entry of new technologies and competences. The NRRP[79] also includes basic and intermediate digital skills training for employed and unemployed persons. Nearly 2,200 enterprise staff are targeted under ERDF, whilst the NRRP scheme targets 500,000 persons plus the validation of skills and competencies of at least another 100,000, the difference reflected in the scale of support under the two instruments[80].
- Also in **Bulgaria**, the national ERDF programme plans to strengthen the practices of the EDP at regional level and experimentation in the regions, promoting the creation of platforms that work as spaces for the creation, experimentation and testing of ideas and projects led by entrepreneurs and co-designed with the relevant stakeholders. Meanwhile, the Bulgarian NRRP aims at increasing the innovation capacity of the Bulgarian Academy of Sciences in the field of green and digital technologies. Among others, the investment envisages the creation of tools for improving the cooperation between the institution and business actors, as well as

[79] nextgeneration.bg/14

[80] In Bulgaria, EUR 17 million of ERDF support is planned to contribute to various objectives under SO1.4. Under the NRRP, EUR 165 million was allocated to the relevant investment aimed at developing digital skills training and building a national online adult learning platform.

developing skills and qualifications in the field of innovation and the promotion of an interdisciplinary, cross-sectoral, and international approach.

Table 10. ERDF and RRF allocations to Skills for S3.

Allocations to Skills for S3								
MS	**ERDF for Skills for S3**	**ERDF total (EUR bn)**	**% allocation to Skills for S3**	**RRF Skills for S3 (EUR bn)**	**RRF total (EUR bn)**	**% RRF allocation to Skills for S3**	**Total Skills for S3 total (EUR bn)**	**Total Skills for S3 total (%)**
Austria	0.000	0.491	0.00%	0.11	4.50	2.38%	0.11	2.20%
Belgium	0.040	0.959	4.17%	0.69	5.93	11.72%	0.73	10.60%
Bulgaria	0.017	5.541	0.31%	0.26	6.61	3.99%	0.28	2.28%
Croatia	0.074	5.221	1.42%	0.54	6.40	8.40%	0.61	5.28%
Cyprus	0.000	0.467	0.00%	0.06	1.23	5.19%	0.06	3.53%
Czech Republic	0.201	10.203	1.97%	0.36	7.07	5.11%	0.56	3.26%
Denmark	0.000	0.247	0.00%	0.07	1.56	4.31%	0.07	3.72%
Estonia	0.011	1.644	0.67%	0.02	0.98	2.54%	0.04	1.37%
Finland	0.013	0.840	1.55%	0.19	2.10	9.16%	0.20	6.98%
France	0.147	8.735	1.68%	4.71	40.95	11.50%	4.86	9.77%
Germany	0.094	10.455	0.90%	0.02	27.95	0.07%	0.11	0.30%
Greece	0.112	10.439	1.07%	0.10	18.19	0.55%	0.21	0.74%
Hungary	0.047	13.171	0.36%	0.46	7.20	6.42%	0.51	2.50%
Ireland	0.000	0.373	0.00%	0.00	0.99	0.00%	0.00	0.00%
Italy	0.573	25.771	2.22%	28.85	191.50	15.07%	29.42	13.54%
Latvia	0.034	2.476	1.37%	0.06	1.83	3.14%	0.09	2.12%
Lithuania	0.054	3.511	1.54%	0.36	2.22	16.37%	0.42	7.29%
Luxembourg	0.000	0.014	0.00%	0.01	0.09	6.97%	0.01	6.06%
Malta	0.002	0.459	0.44%	0	0.34	0.00%	0.00	0.25%
Netherlands	0.008	0.489	1.64%	0.40	4.7	8.51%	0.41	7.86%
Poland	0.133	46.866	0.28%	2.41	35.97	6.71%	2.55	3.07%
Portugal	0.082	11.328	0.72%	1.08	16.64	6.51%	1.16	4.15%
Romania	0.066	17.721	0.37%	1.20	29.39	4.09%	1.27	2.69%
Slovakia	0.217	7.305	2.97%	0.44	6.55	6.77%	0.66	4.74%
Slovenia	0.034	1.545	2.20%	0.21	2.48	8.39%	0.24	6.06%
Spain	0.080	22.596	0.35%	17.53	69.53	25.22%	17.61	19.12%
Sweden	0.054	0.833	6.48%	0.41	3.30	12.44%	0.46	11.24%
Total	**2.093**	**209.700**	**1.00%**	**60.57**	**496.21**	**12.21%**	**62.667**	**8.87%**

(Source: author's elaboration)

Table 11. EU-27 RRF and ERDF allocations and Annex D recommendations in relation to Skills for S3 activity

	AT	BE	BG	HR	CY	CZ	DK	EE	FI	FR	DE	EL	HU	IE[81]	IT	LV	LT	LU	MT	NL	PL	PT	RO	SK	SI	ES	SE
1.4.1*		x				x	x	x	x		x		x	x	x			x	x		x	x	x		x	x	x
1.4.2	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1.4.3			x			x		x		x	x	x	x			x	x					x		x	x		x
1.4.4		x	x	x		x	x	x	x							x	x		x		x		x				x
1.4.5				x		x	x		x		x			x					x				x	x		x	
ERDF Skills for S3 [bn EUR]	0	0.04	0.017	0.074	0	0.201	0	0.011	0.013	0.147	0.094	0.112	0.047	0	0.573	0.034	0.054	0	0.002	0.008	0.133	0.082	0.066	0.217	0.034	0.08	0.054
ERDF Skills for S3 [%]	0	4.17	0.31	1.42	0	1.97	0	0.67	1.55	1.68	0.9	1.07	0.36	0	2.22	1.37	1.54	0	0.44	1.64	0.28	0.72	0.37	2.97	2.2	0.35	6.48
RRF for Skills (bn EUR)	0.11	0.69	0.26	0.54	0.06	0.36	0.07	0.02	0.19	4.71	0.02	0.1	0.46	0	28.85	0.06	0.36	0.01	0	0.4	2.41	1.08	1.2	0.44	0.21	17.53	0.41
RRF for Skills (%)	2.44	11.64	3.94	8.43	4.86	5.11	4.31	2.54	9.16	11.5	0.07	0.55	6.42	0	15.07	3.14	16.37	6.97	0	8.59	6.7	6.49	4.08	6.71	8.46	25.21	12.44

(Source: author's elaboration; numbering 1.4.1-1.4.5 refers to DG REGIO policy paper, see Box 3)

[81] NB Ireland had relevant measures identified in a validation exercise, but not within the Bruegel database.

Table 12. RRF and ERDF national and multi-regional programmes and allocations against the Annex D recommendations and Skills for S3 for selected Member States.

	AT		BE		BG		HR		CY		CZ		DK		EE	
	CSR	**RRF**	**CSR**	**RRF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF**	**CSR**	**RRF/ERDF**
Support to SMEs			R	RRF		ERDF		RRF/ERDF		RRF	R	RRF/ERDF	R	RRF	R	ERDF
Skills devt in firms	R			RRF	R	ERDF	R	RRF/ERDF	R		R	RRF/ERDF	R		R	RRF
Entrepreneur-ship Skills					R			ERDF			R	ERDF			R	
Skills devt in HEIs		RRF	R	RRF	R	RRF/ERDF	R	RRF			R	ERDF	R		R	
Strengthening RDI ecosystem						ERDF	R	RRF			R	RRF	R			ERDF

	FR		DE		EL		HU		IT		LV	
	CSR	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**
Support to SMEs		RRF	R	RRF		RRF/ERDF	R	ERDF	R	ERDF/ RRF		ERDF
Skills devt in firms		RRF	R	RRF	R	ERDF	R	ERDF	R	ERDF	R	ERDF/RRF
Entrepreneurship Skills	R		R		R		R			ERDF	R	
Skills devt in HEIs		RRF		RRF				ERDF/RRF		ERDF/ RRF	R	
Strengthening RDI ecosystem		RRF	R			RRF		RRF		ERDF/ RRF		RRF

	LU		PL		PT		RO		SK		SI		SE	
	CSR	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**	**CSR**	**RRF/ERDF**
Support to SMEs	R		R	RRF/ERDF	R	RRF	R	ERDF/ RRF		ERDF	R	ERDF	R	
Skills devt in firms	R	RRF	R	ERDF	R	RRF	R	ERDF/RRF	R	ERDF	R	RRF/ERDF	R	RRF
Entrepreneurship Skills					R			ERDF	R		R		R	
Skills devt in HEIs		RRF	R	RRF/ERDF		RRF	R	ERDF/ RRF				RRF/ERDF	R	RRF
Strengthening RDI ecosystem				RRF/ERDF		RRF	R	ERDF/ RRF	R	RRF		RRF		

(Source: author's elaboration; numbering 1.4.1-1.4.5 refers to DG REGIO policy paper, see Box 3; R=recommendation received) NB some MS have no national programmes (eg FR and DE) hence ERDF is not included above, other MS have not included Skills for S3 in their national programmes and hence also show no entry for ERDF (e.g. DK, CY, IE).

- **Estonia** targets ERDF SO1.4 actions on improving innovation capacity in R&D institutions, higher education and the public and private sectors and NRRP investment on skills to support the digital and green transitions in business.
- The national ERDF programme in **Hungary** also includes a focus on EDP development, whilst the NRRP[82] includes specific schemes to strengthen the integration of education and training institutions in their innovation ecosystems through enhancing their relevance to the labour market. It also aims to develop the skills of research institutions through the establishment of national research and development laboratories.
- In **Latvia**, the ERDF mainly focuses on skills development in high-level digital skills and innovation management in S3 areas, as well as support for skills development for enterprises and their employees in specialised digitisation[83]. The establishment of a European Digital Innovation Centre and regional contact points under the NRRP is expected to provide tailor-made support to entrepreneurs and enterprises.
- In **Romania**, there are plans for the ERDF national programme to provide training for enterprises focusing on a broad range of skills, including innovation management and smart specialisation specific skills, green skills, IPR and industrial property. On the other hand, the NRRP[84] includes an investment scheme focused specifically on digital skills in enterprises, especially emerging technologies. Also in this case, the scale of the support planned is widely different, in that over 1,900 SMEs staff are expected to complete training based on ERDF resources, while nearly 250,000 employees are expected to benefit from RRF training.
- Development of skills for strengthening competitiveness and economic growth and capacity building for S3 are planned under the national ERDF programme in **Slovakia**. The approach covers study programmes for all levels of higher education, scholarships, short (non-degree) courses in tertiary education, professional qualifications, practical learning for pupils in S3 domains, vocational education and training courses and apprenticeships. On the other hand, the NRRP[85] includes more focused support for cooperation between companies, academia and research and development organizations through, among other things, internships for doctoral students and staff between enterprises and academic research organisations, including joint management between universities and enterprises.

[82] www.palyazat.gov.hu/helyreallitasi-es-ellenallokepessegi-eszkoz-rrf

[83] www.esfondi.lv

[84] mfe.gov.ro/pnrr

[85] www.planobnovy.sk

7 Conclusions

In terms of ERDF, the research shows that the majority of MS have funded skills for S3 related activity under their 2021-2027 programmes, although the allocation at EU-27 level is quite low comparatively (1.01% of the total ERDF, or EUR 2.1 bn). A stronger appraisal of funding allocations in relation to expected results would be possible if the programming process enabled indicators and targets to be matched to the categories of expenditure ex-ante.

At programme level, skills for S3 activity is incorporated under different specific objectives and categorised as different types of expenditure: SO1.4 and CoE23 allocations are not coterminous in many instances. Skills for S3 activity seems to be often complementary within a broader policy response, potentially reflecting the fact that skills investment is not a traditional ERDF focus, but also suggesting a strongly synergistic programming approach. Allocations for skills for S3 related activity at regional level do however demonstrate some correlation with the regions identified as being in or at risk of being in a talent development trap[86], with high allocations and wide ranges of activity incorporated across Italian and Romanian ERDF programmes. The absence of skills related allocations in five MS' ERDF programming also suggests that the introduction of the RRF did in fact influence and lead to the adaptation of funding priorities under cohesion policy.

Under the RRF, more than 75% of the Skills for S3 funding concerns investment planned within Pillars 2 (Digital transformation) and 3 (Smart, sustainable and inclusive growth) of the RRF rather than pillar 6 (Policies for the next generation), again suggesting a synergist approach in the design of the plans, whereby skills development is often incorporated as a complementary activity. Most of the allocations related to Skills for S3 were unsurprisingly categorised under Flagship 7 *Reskill and upskill*, and Flagship 9 *Other digital*.

In terms of the type of skills for S3 activity funded under the RRF, the greatest number of investments were found to relate to strengthening R&D&I ecosystems, although the majority of the funding allocation to Skills for S3 (37%) targeted support to SMEs. The lowest volume of funding and number of investments relate to entrepreneurial skills, which was more likely to be included under ERDF programmes. Correlation with the Annex D of the 2019 country reports regarding future investment priorities at MS level was not strong.

The analysis of funding allocations to address place-based skills needs across the EU territory attempts to provide an ex-ante overview of responses and actions across different government levels to the twin transitions and industrial transition in relation to human capital challenges. The introduction of specific objective 1.4 recognised that prioritising investment on skills relevant to a limited number of smart specialisation domains and the twin transitions would be likely to improve regional resilience in transformation, providing learners with the relevant entrepreneurial and innovation related skills and competences. The *Harnessing Talent* Communication looked, not only to cohesion policy, but also to the newly introduced RRF to design and implement place-based policy responses to stimulate talent better matched to evolving territorial needs and labour market demands. This research, perhaps unsurprisingly, shows a mixed response across the EU territory: as the impact of the transitions will vary across regions and sectors, in magnitude and scope, and territories have different socio-economic and industrial characteristics from which to evolve, hence varying policy responses result. Territories have allocated funding from different instruments, to

[86] https://ec.europa.eu/regional_policy/sources/communication/harnessing-talents/harnessing-talents-regions_en.pdf

different types of skills-related activity reflecting their needs and challenges and territory-specific conditions.

Nevertheless, an accurate understanding of support from these two instruments is problematic. Conte and Santos (2023) discuss "how complex and challenging an accurate territorial monitoring of public support – especially through European Union (EU) funding targeted to R&D and innovation activities – can be for policymakers". A specific complication in this case relates to the lack of detail provided in the programmes and the difficulty in determining the exact focus of the investment but also demarcation and synergies between the different instruments, which potentially become apparent only as actual projects come forward for funding. Similarly, the focus on the two funding streams neglects to take other funding opportunities or options into account, such as national funding, the Just Transition Fund etc. as well as other models of support, for example, financial engineering models for funding skills investment, which to date have been funded under ESF+ but not ERDF and RRF.

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List of abbreviations and definitions

Abbreviations	Definitions
CoE	Category of Expenditure
CSRs	Country Specific Recommendations
EC	European Commission
EDP	Entrepreneurial Discovery Process
ERDF	European Regional and Development Fund
ESF+	European Social Fund +
HE(I)	Higher Education (Institution)
HESS	Higher Education for Smart Specialisation
JRC	Joint Research Centre
MFF	Multi annual Financial Framework
MS	Member State
NRRP	National Recovery and Resilience Plan(s)
PSI	Programme Specific Indicator
RRF	Recovery and Resilience Facility
S3	Smart Specialisation Strategy
SO	Specific Objective

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Annexes

Annex 1. List of 2021-2027 ERDF programmes containing Specific Objective 1.4 and /or CoE 23

All lists are organised by alphabetical order of MS abbreviation and within each MS the programmes are listed in alphabetical order by programme title.

Programmes with both SO1.4 and CoE23 (67):

Flanders (BE)

Smart Transformation (BG)

Johannes–Amos Comenius (CZ)

Baden-Württemberg (DE)

Hamburg (DE)

Nordrhein-Westfalen (DE)

Cohesion Policy Funding (EE)

Competitiveness (EL)

Canarias (ES)

Murcia (ES)

Centre-Val de Loire (FR)

Nouvelle-Aquitaine (FR)

Réunion (FR)

Competitiveness and cohesion (HR)

Integrated territorial programme (HR)

Economic–Development and Innovation Plus (HU)

Abruzzo (IT)

AP Trento (IT)

Basilicata (IT)

Calabria (IT)

Campania (IT)

Emilia-Romagna (IT)

Friuli-Venezia Giulia (IT)

Lazio (IT)

Liguria (IT)

Lombardia (IT)

Molise (IT)

Piemonte (IT)

Puglia (IT)

Research, innovation and competitiveness (IT)

Sardegna (IT)

Sicilia (IT)

Umbria (IT)

Veneto (IT)

EU Funds Investments (LT)

Cohesion–policy funding (LV)

Noord-Nederland (NL)

Lubelskie (PL)

Lubuskie (PL)

Opolskie (PL)

Podkarpacie (PL)

Warmia i Mazury (PL)

Alentejo (PT)

Algarve (PT)

Centro (PT)

Lisbon (PT)

Madeira (PT)

Norte (PT)

Bucharest-Ilfov (RO)

Central Region (RO)

North East (RO)

North-West (RO)

Smart growth (RO)

South East (RO)

South Muntenia (RO)

South-West Oltenia (RO)

West (RO)

Central Norrland (SE)

East-Central Sweden (SE)

North-Central Sweden (SE)

Småland and the islands (SE)

South Sweden (SE)

Stockholm (SE)

Upper Norrland (SE)

West Sweden (SE)

EU Cohesion Policy (SI)

Programme Slovakia (SK)

Programmes with SO1.4 but not CoE23 (1):

Castilla-La Mancha (ES)

Programmes with CoE23 but not SO1.4 (27):

Competitiveness Programme (CZ)

Berlin (DE)

Hessen (DE)

Niedersachsen (DE)

Rheinland-Pfalz (DE)

Thessalia (EL)

Andalucìa (ES)

Extremadura (ES)

Galicia (ES)

La Rioja (ES)

Innovation and skills (FI)

Bretagne (FR)

Grand Est (FR)

Guadeloupe (FR)

Hauts de France (FR)

Pays de la Loire (FR)

Investment in jobs and development (MT)

Dolnośląska (PL)

Kujawy i Pomorze (PL)

Łódzkie (PL)

Małopolska (PL)

Podlaskie (PL)

Pomorze (PL)

Śląskie (PL)

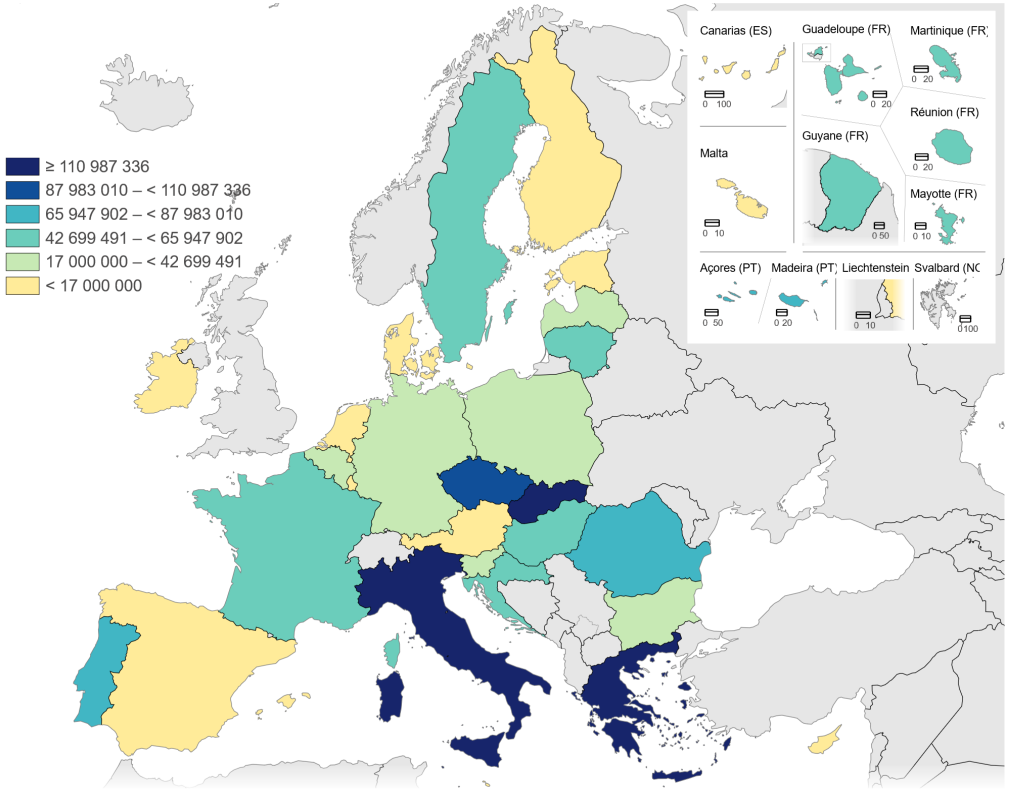
Świętokrzyskie (PL)

Smart Economy (PL)

Wielkopolska (PL)

Annex 2. Maps of nominal and percentage allocations to SO1.4 at national and regional level

Figure A1. Maps of nominal (left) and percentage (right) allocations to SO1.4 at MS level



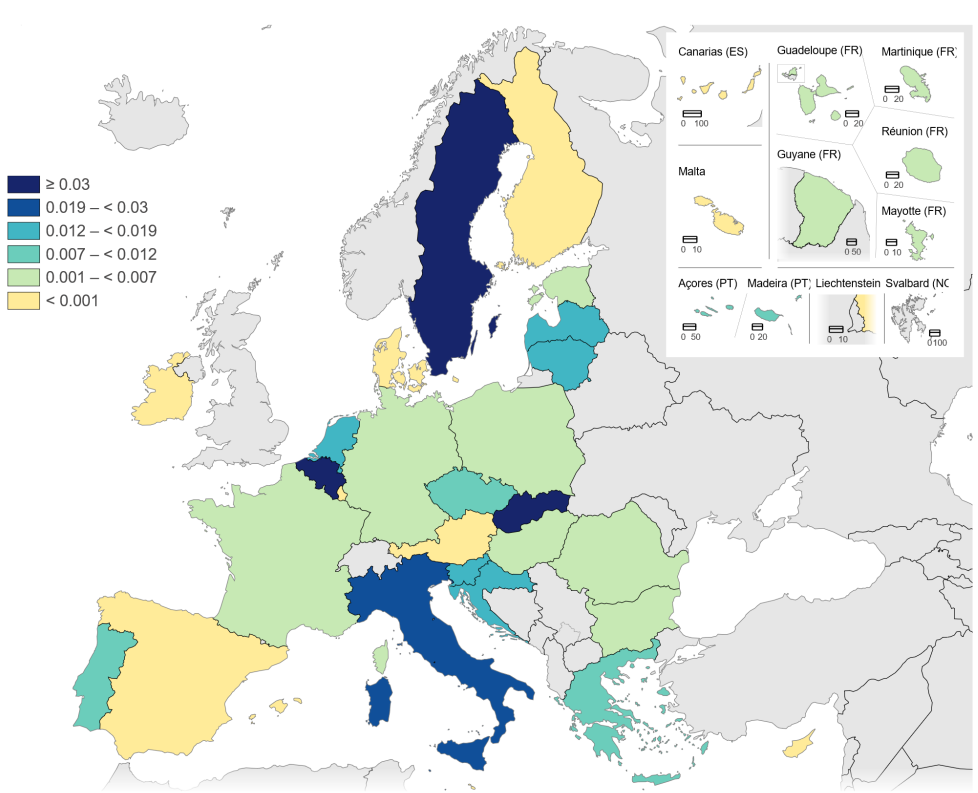
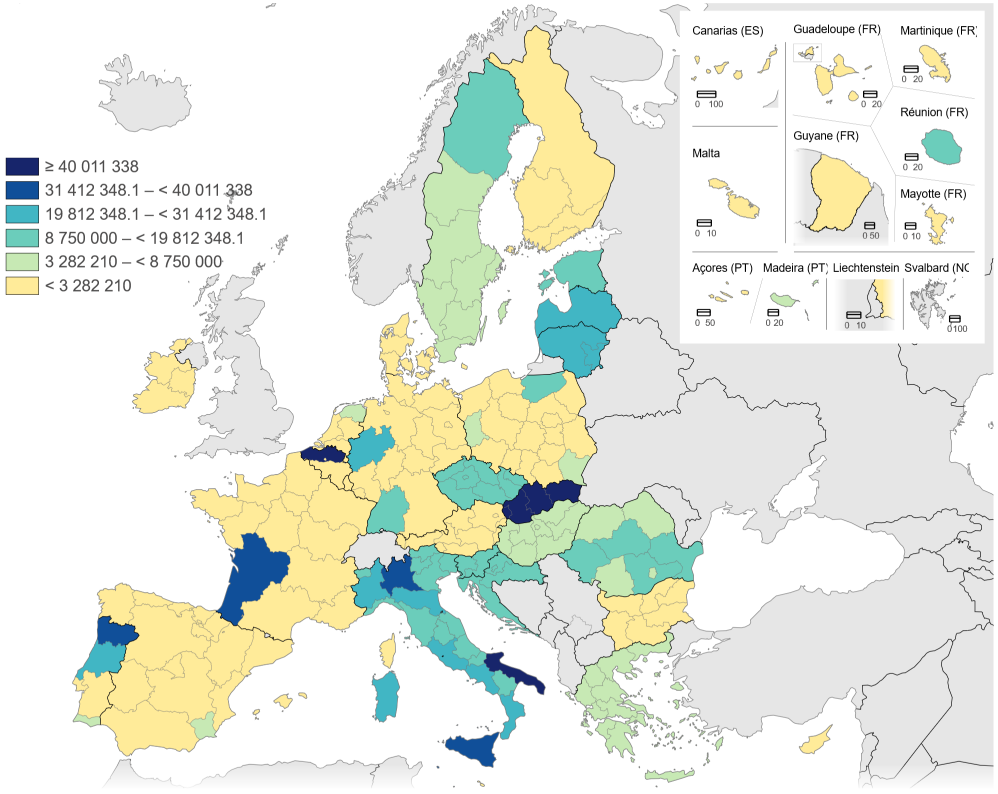
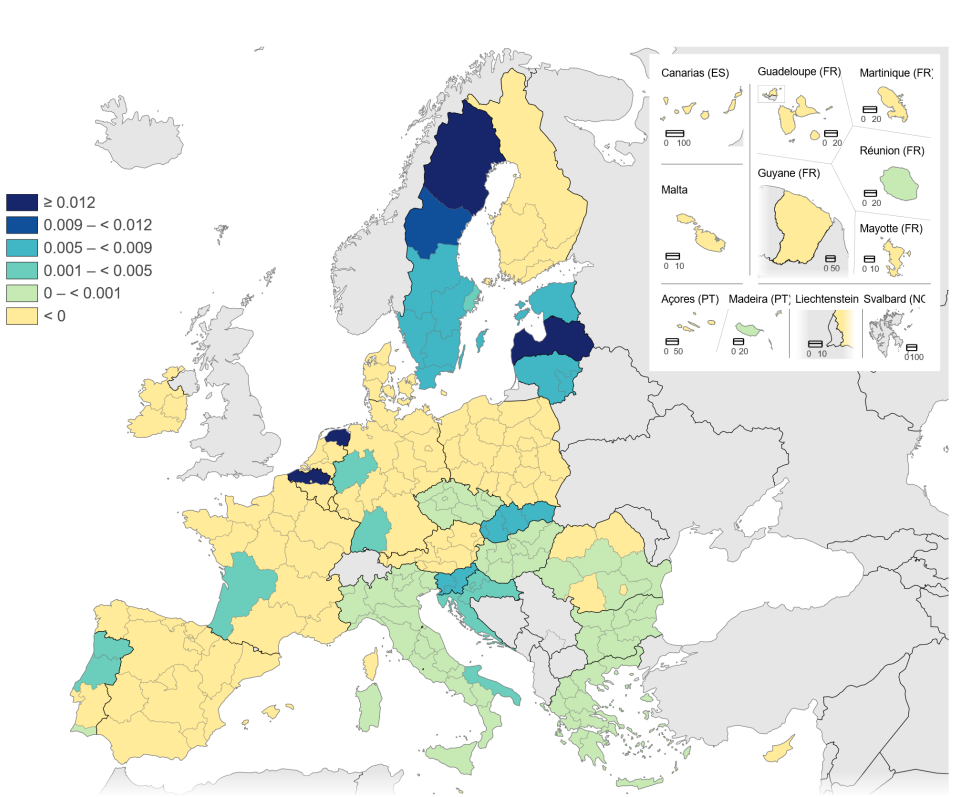


Figure A2. Maps of nominal (left) and percentage (right) allocations to S01.4 at regional level



National and multi-regional programmes' amounts split equally between regions.

Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 06/2024

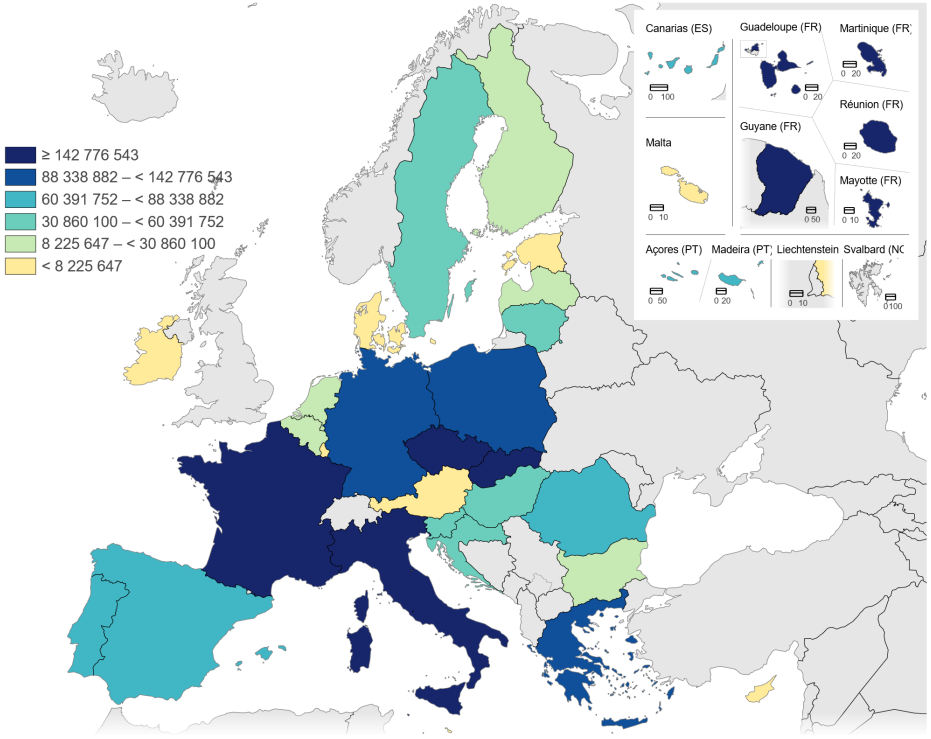


National and multi-regional programmes' amounts split equally between regions.

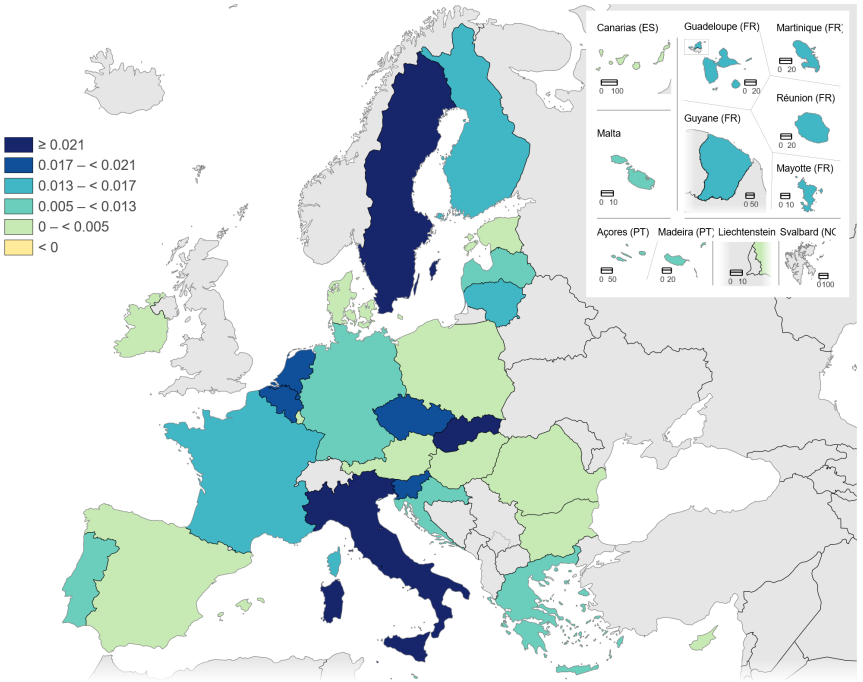
Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 06/2024

Annex 3. Maps of nominal and percentage allocations to CoE23 at national and regional level

Figure A3. Maps of nominal (left) and percentage (right) allocations to CoE23 at MS level

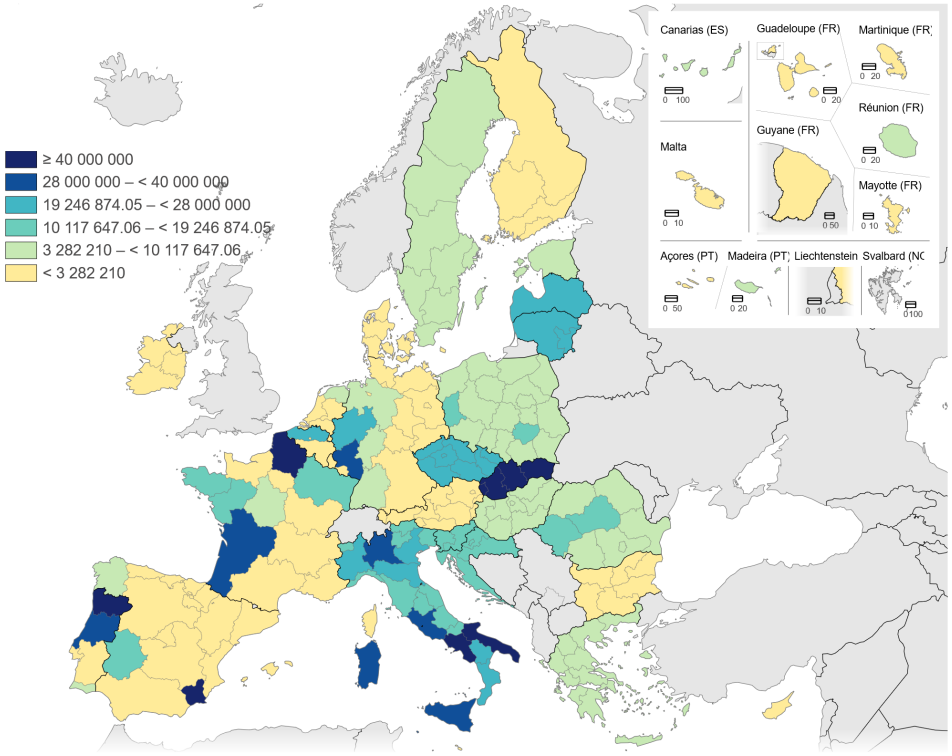


Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 06/2024



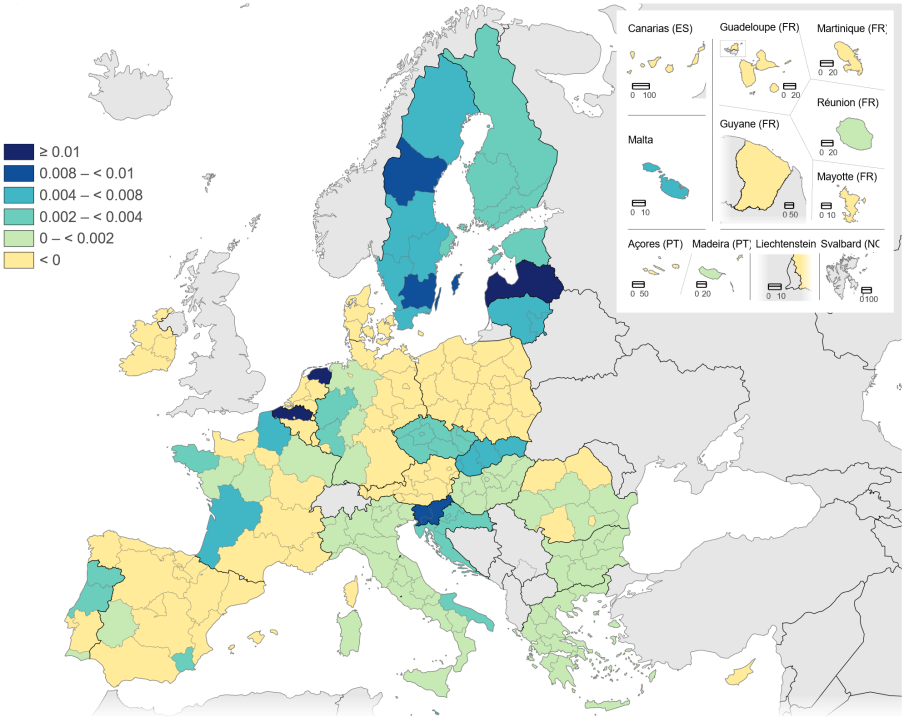
Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 06/2024

Figure A4. Maps of nominal (left) and percentage (right) allocations to CoE23 at regional level



National and multi-regional programmes' amounts split equally between regions.

Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 06/2024

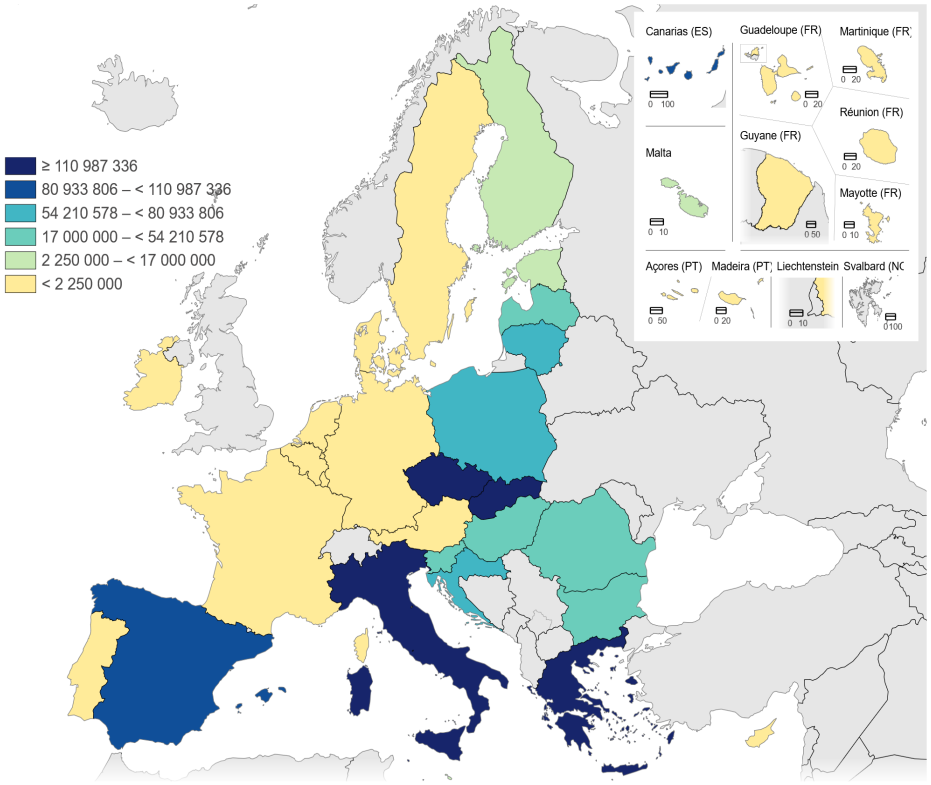


National and multi-regional programmes' amounts split equally btween regions.

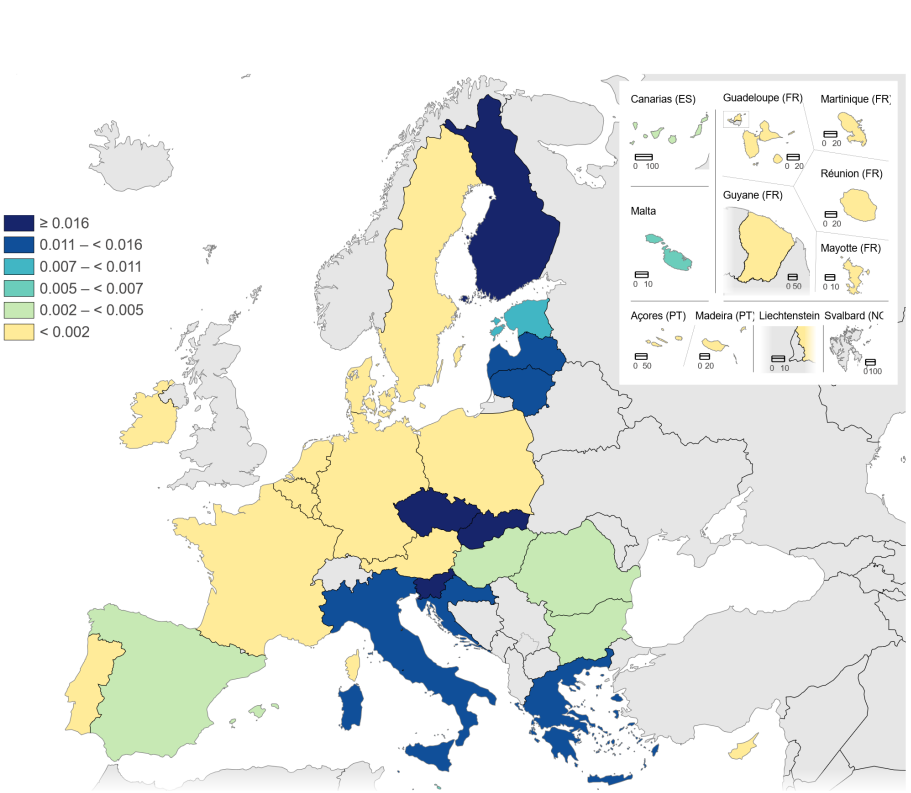
Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 06/2024

Annex 4. Maps of nominal and percentage allocations to Skills for S3 in national and multi-regional OPs

Figure A5. Maps of nominal (left) and percentage (right) allocations to SO1.4 and CoE23 in national or multiregional programmes only



Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 07/2024



Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 07/2024

Annex 5. RRF Skills for S3 investment – EU27 MS factsheets

Austria

Table A1. Austria RRP overview

Total RRF funding	EUR 4.5 billion
Total number of investments related to Skills for S3 definite + possible	2
Total funding allocated to these investments: (total definite + possible)	EUR 0.11 billion (EUR 0.14 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	2.4% (3.1%)

Table A2. Distribution of funding per Skills for S3 activity, Austria (EUR billion)

Sub-category	**# of in-vestments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	1	0	0.00	0.03	100.00	0.03	21.43
Skills develop-ment in firms	0	0	0.00	0	0.00	0	0.00
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills develop-ment in HEIs	1	0.11	100.00	0	0.00	0.11	78.57
Strengthening R&D&I ecosys-tems	0	0	0.00	0	0.00	0	0.00
Total	**2**	**0.11**	**100.00**	**0.03**	**100**	**0.14**	**100**

Figure A6. RRF amount allocated to Skills for S3 categories, Austria (%)

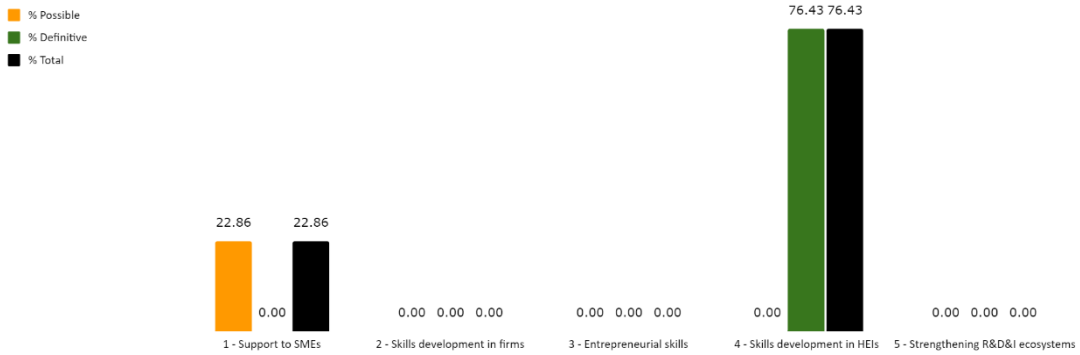


Figure A7. RRF amount allocated to Skills for S3 per RRF pillar, Austria (%)

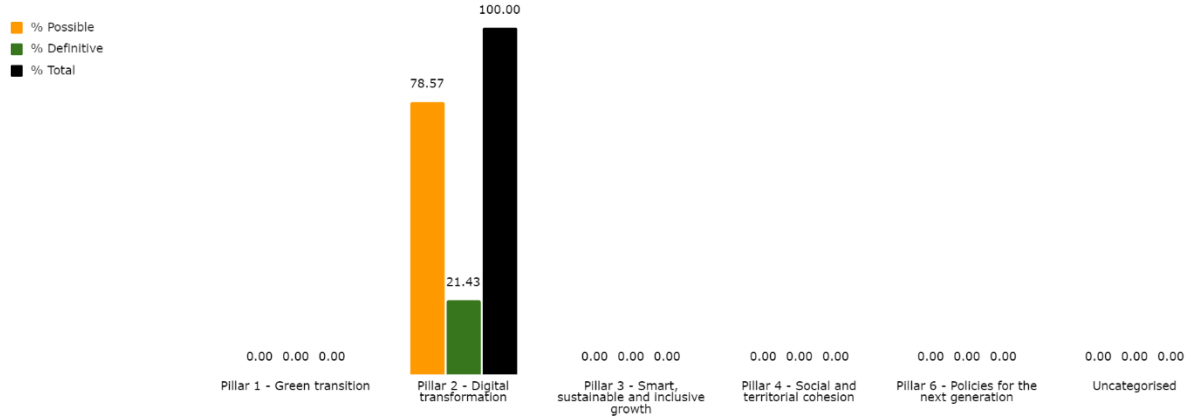
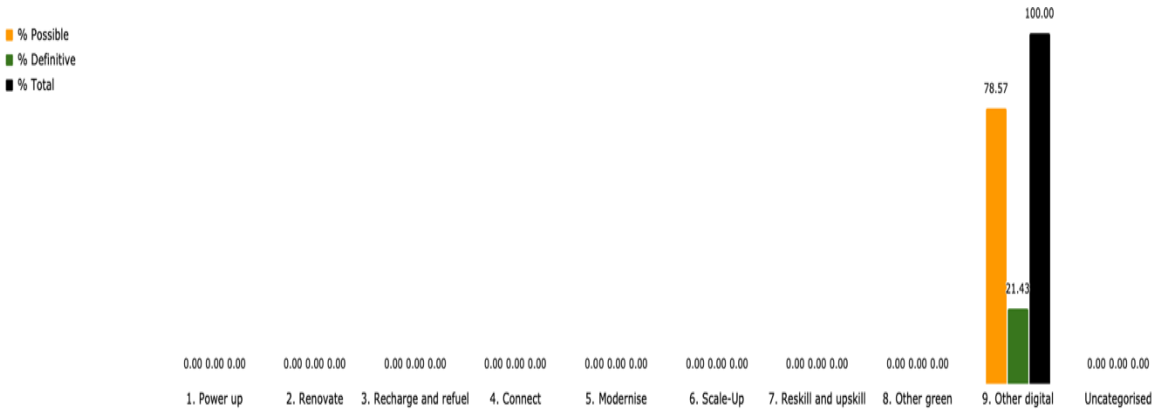


Figure A8. RRF amount allocated to Skills for S3 activities per flagship, Austria (%)



Belgium

Table A3. Belgium RRP Overview

Total RRF funding	EUR 5.9 billion
Total number of investments related to Skills for S3 definite + possible	17
Total funding allocated to these investments: (total definite + possible)	EUR 0.69 bn (EUR 1 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	11.7% (17.4%)

Table A4. Distribution of funding per Skills for S3 activity, Belgium (EUR billion)

Sub-category	**# of investments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	4	0.16	23.19	0	0.00	0.16	15.69
Skills development in firms	7	0.14	20.29	0.25	75.76	0.39	38.24
Entrepreneurial skills	1	0	0.00	0	0.00	0	0.00
Skills development in HEIs	5	0.39	56.52	0.08	24.24	0.47	46.08
Strengthening R&D&I ecosystems	0	0	0.00	0	0.00	0	0.00
Total	**17**	**0.69**	**100**	**0.33**	**100**	**1.02**	**100**

Figure A9. RRF amount allocated to Skills for S3 per sub-category, Belgium (%)

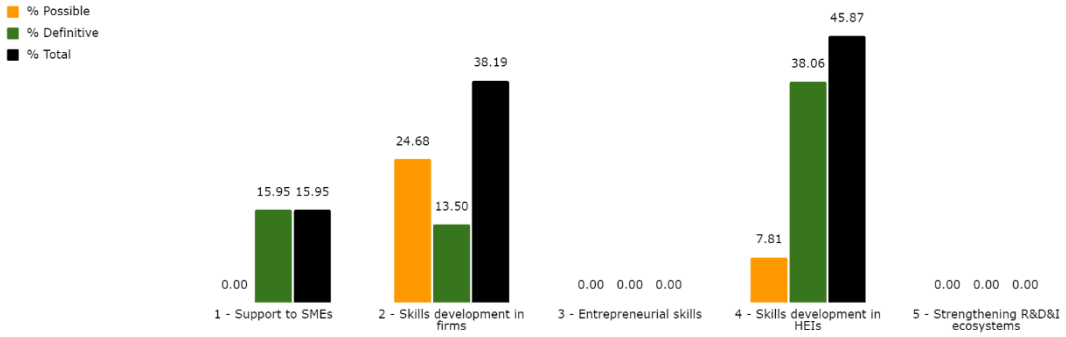


Figure A10. RRF amount allocated to Skills for S3 activities per RRF pillar, Belgium (%)

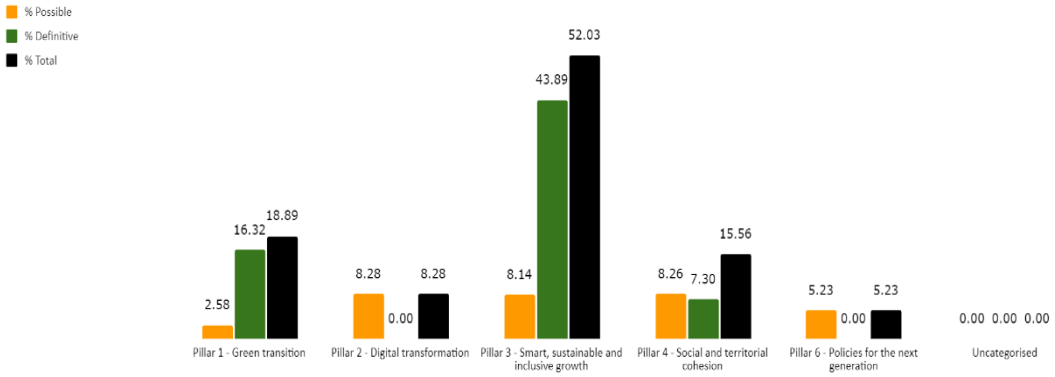
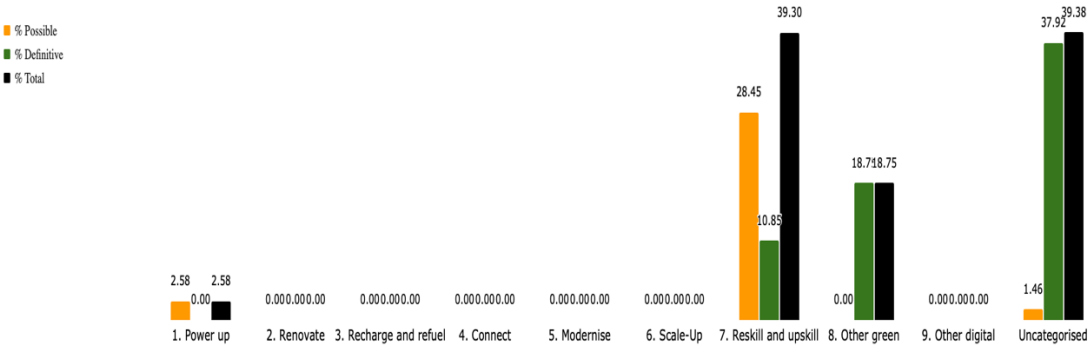


Figure A11. RRF amount allocated to Skills for S3 activities per flagship, Belgium (%)



Bulgaria

Table A5. Bulgaria RRP overview

Total RRF funding	EUR 6.6 billion
Total number of investments related to Skills for S3 definite + possible	9
Total funding allocated to these investments: (total definite + possible)	EUR 0.3 bn (EUR 1.6 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	20.1% (24.1%)

Table A6. Distribution of funding per Skills for S3 activity, Bulgaria (EUR billion)

Sub-category	**# of in-vest-ments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	4	0	0.00	0.63	60.58	0.63	48.46
Skills develop-ment in firms	3	0	0.00	0.41	39.42	0.41	31.54
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills develop-ment in HEIs	4	0.26	100.00	0	0.00	0.26	20.00
Strengthening R&D&I ecosys-tems	2	0	0.00	0	0.00	0	0.00
Total	**13**	**0.26**	**100**	**1.04**	**100**	**1.3**	**100**

Figure A12. RRF amount allocated to Skills for S3 per sub-category, Bulgaria (%)

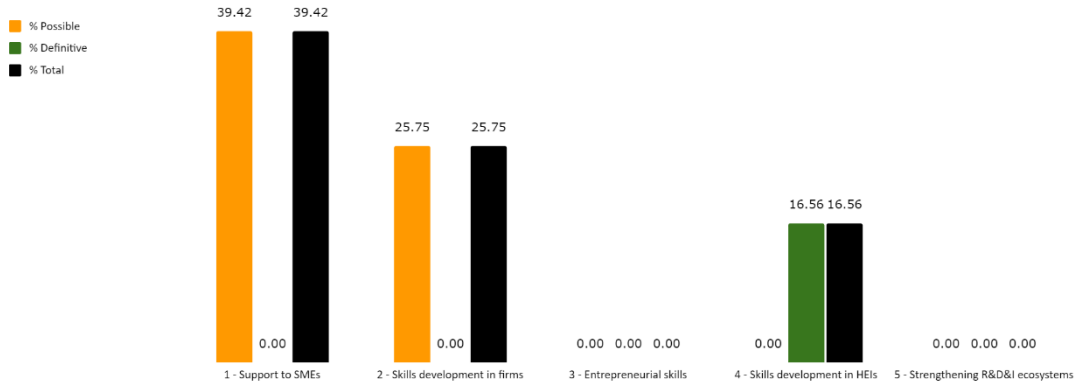


Figure A13. RRF amount allocated to Skills for S3 per RRF pillar, Bulgaria (%)

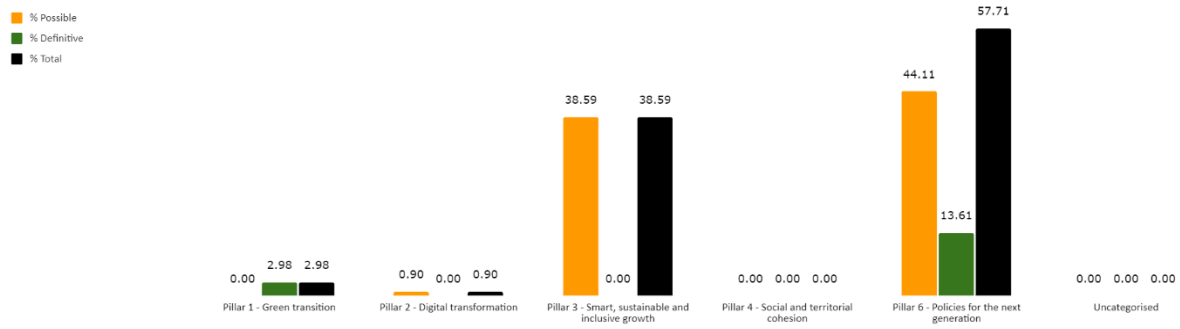
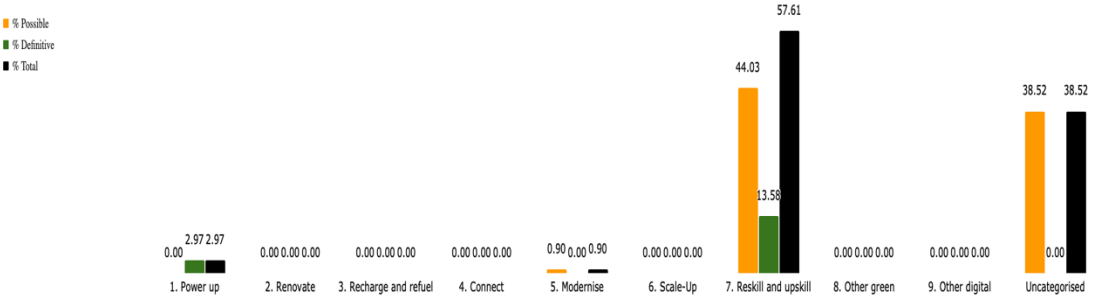


Figure A14. RRF amount allocated to Skills for S3 activities per flagship, Bulgaria (%)



Croatia

Table A7. Croatia RRP overview

Total RRF funding	EUR 6.4 billion
Total number of investments related to Skills for S3 definite + possible	15
Total funding allocated to these investments: (total definite + possible)	EUR 0.54 billion (EUR 0.6 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	8.4% (9.9%)

Table A8. Distribution of funding per Skills for S3 activity, Croatia (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	5	0.2	34.48	0.04	40.00	0.24	35.29
Skills development in firms	4	0.15	25.86	0	0.00	0.15	22.06
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	1	0.05	8.62	0	0.00	0.05	7.35
Strengthening R&D&I ecosystems	5	0.18	31.03	0.06	60.00	0.24	35.29
Total	**15**	**0.58**	**100**	**0.1**	**100**	**0.68**	**100**

Figure A15. RRF amount allocated to Skills for S3 per sub-category, Croatia (%)

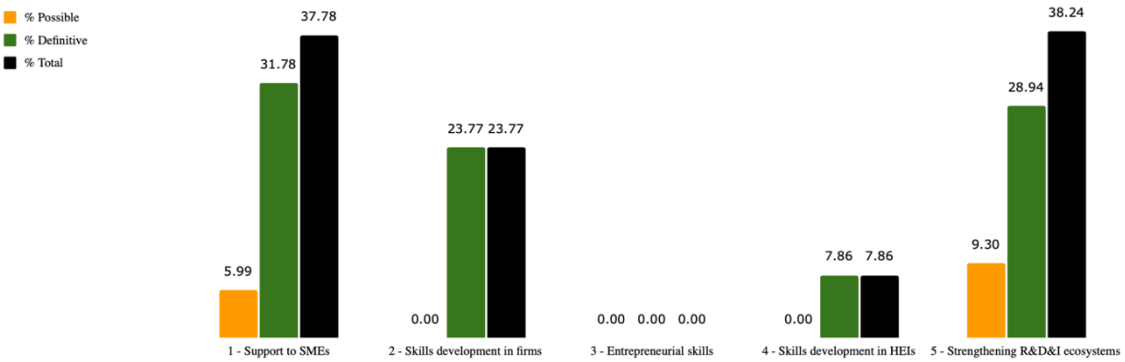


Figure A16. RRF amount allocated to Skills for S3 activities per RRF pillar, Croatia (%)

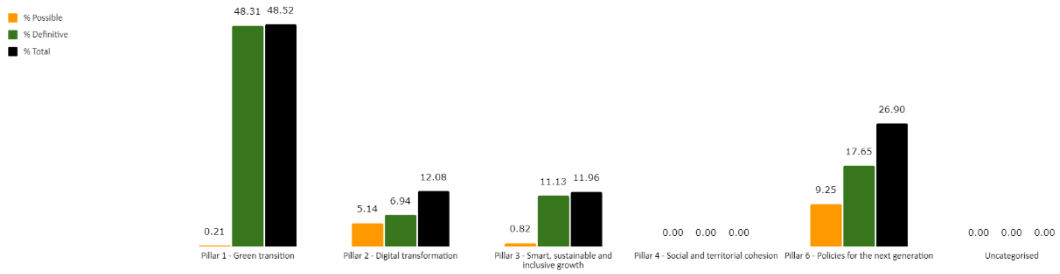
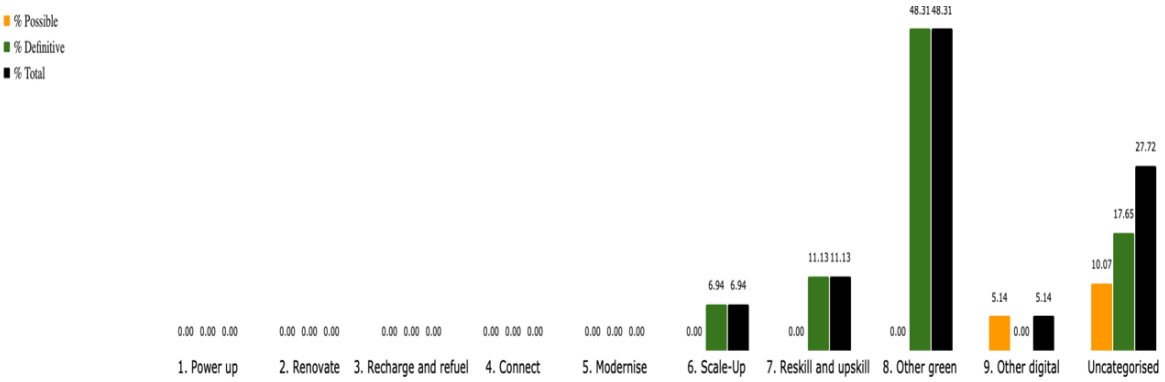


Figure A17. RRF amount allocated to Skills for S3 activities per flagship, Croatia (%)



Cyprus

Table A9. Cyprus RRP overview

Total RRF funding	EUR 1.2 billion
Total number of investments related to Skills for S3 definite + possible	6
Total funding allocated to these investments: (total definite + possible)	EUR 0.06 bn (EUR 0.4 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	5.19% (32.7%)

Table A10. Distribution of funding per Skills for S3 activity, Cyprus (EUR billion)

Sub-category	**# of invest-ments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	2	0.06	100.00	0.08	23.53	0.14	35.00
Skills develop-ment in firms	1	0	0.00	0.09	26.47	0.09	22.50
Entrepreneurial skills	1	0	0.00	0	0.00	0	0.00
Skills develop-ment in HEIs	2	0	0.00	0.17	50.00	0.17	42.50
Strengthening R&D&I ecosys-tems	0	0	0.00	0	0.00	0	0.00
Total	**6**	**0.06**	**100**	**0.34**	**100**	**0.4**	**100**

Figure A18. RRF amount allocated to Skills for S3 activities per sub-category, Cyprus (%)

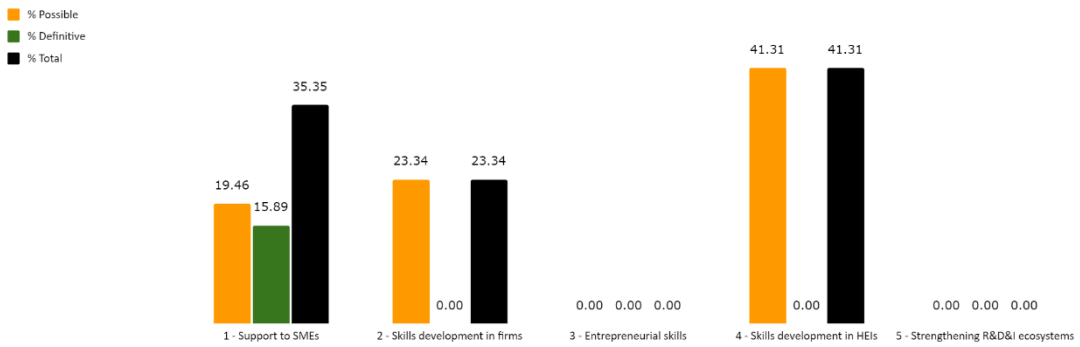


Figure A19. RRF amount allocated to Skills for S3 activities per RRF pillar, Cyprus (%)

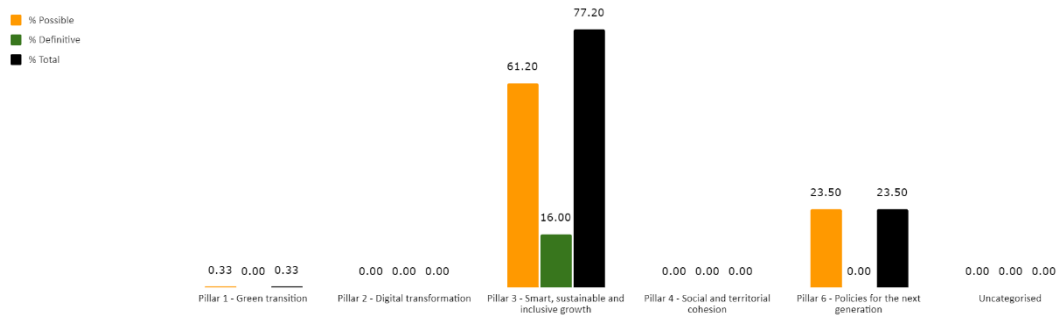
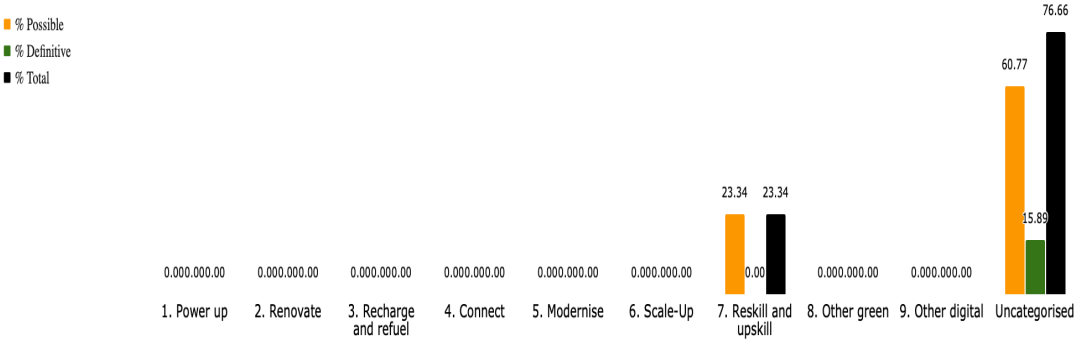


Figure A20. RRF amount allocated to Skills for S3 activities per flagship, Cyprus (%)



Czechia

Table A11. Czechia RRP overview

Total RRF funding	EUR 7.1 billion
Total number of investments related to Skills for S3	12
Total funding allocated to these investments	EUR 0.4 billion
Percentage this represents of total RRF funding	6.3%

Table A12. Distribution of funding per Skills for S3 activity, Czechia (EUR billion)

Sub-category	**# of invest-ments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	2	0.04	10.81	0	0.00	0.04	9.09
Skills develop-ment in firms	3	0.26	70.27	0	0.00	0.26	59.09
Entrepreneurial skills	2	0	0.00	0.01	14.29	0.01	2.27
Skills develop-ment in HEIs	0	0	0.00	0	0.00	0	0.00
Strengthening R&D&I ecosys-tems	5	0.07	18.92	0.06	85.71	0.13	29.55
Total	**12**	**0.37**	**100**	**0.07**	**100**	**0.44**	**100**

Figure A21. RRF amount allocated to Skills for S3 activities per sub-category, Czechia (%)

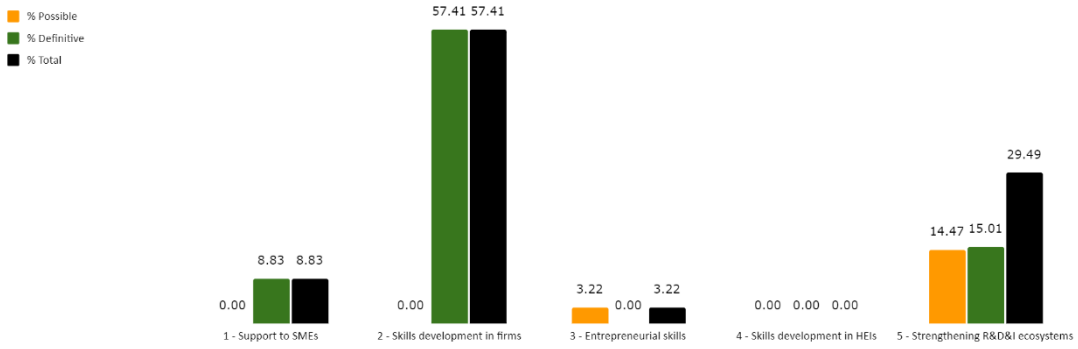


Figure A22. RRF amount allocated to Skills for S3 activities per RRF pillar, Czechia (%)

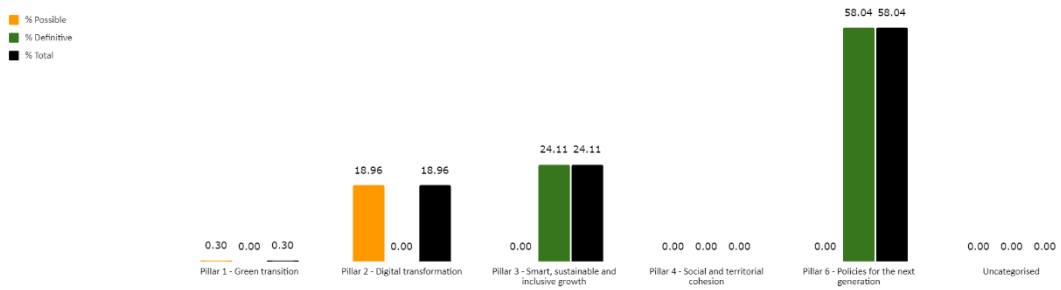
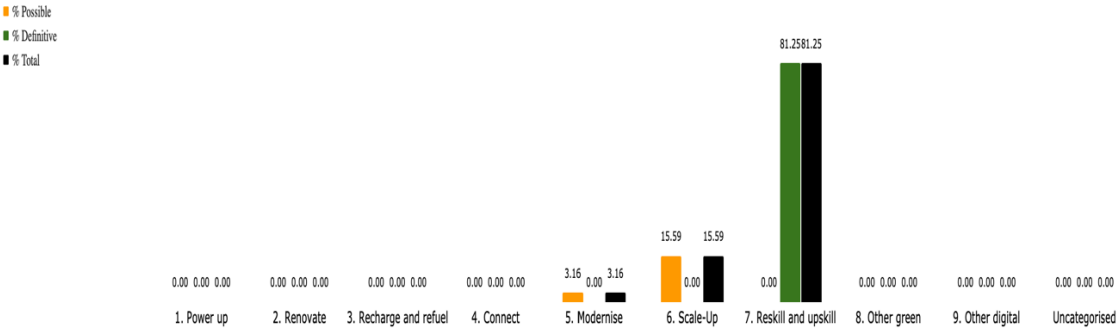


Figure A23. RRF amount allocated to Skills for S3 activities per flagship, Czechia (%)



Denmark

Table A13. Denmark RRP overview

Total RRF funding	EUR 1.6 billion
Total number of investments related to Skills for S3 definite + possible	3
Total funding allocated to these investments: (total definite + possible)	EUR 0.07 bn (EUR 0.08 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	0.9% (5.2%)

Table A14. Distribution of funding per Skills for S3 activity, Denmark (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	2	0.07	100.00	0.01	50.00	0.08	88.89
Skills development in firms	0	0	0.00	0	0.00	0	0.00
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	1	0	0.00	0.01	50.00	0.01	11.11
Strengthening R&D&I ecosystems	0	0	0.00	0	0.00	0	0.00
Total	**3**	**0.07**	**100**	**0.02**	**100**	**0.09**	**100**

Figure A24. RRF amount allocated to Skills for S3 per sub-category, Denmark (%)

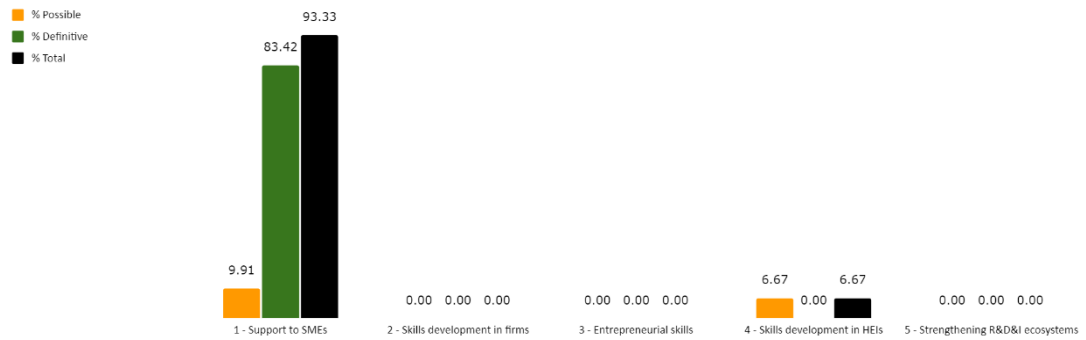


Figure A25. RRF amount allocated to Skills for S3 activities per RRF pillar, Denmark (%)

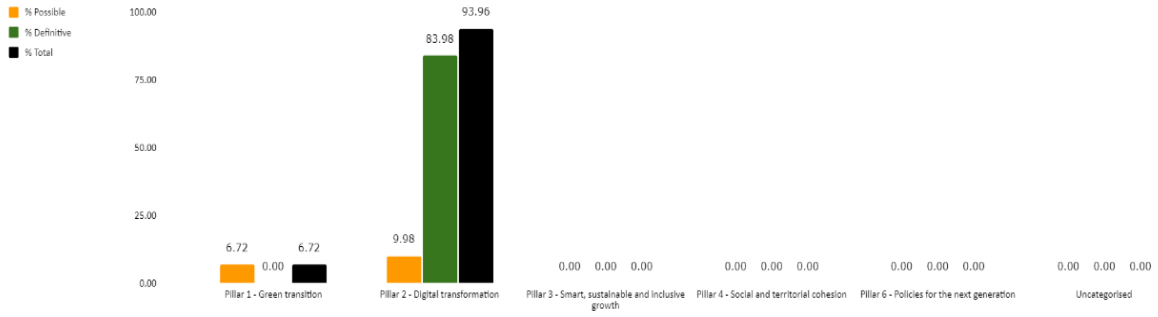
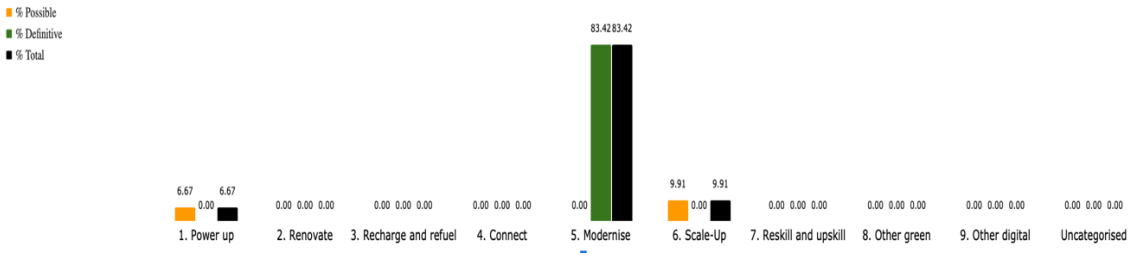


Figure A26. RRF amount allocated to Skills for S3 activities per flagship, Denmark (%)



Estonia

Table A15. Estonia RRP overview

Total RRF funding	EUR 1 billion
Total number of investments related to Skills for S3 definite + possible	6
Total funding allocated to these investments: (total definite + possible)	EUR 0.02 bn (EUR 0.1 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	2.5% (10.8%)

Table A16. Distribution of funding per Skills for S3 activity, Estonia (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	2	0	0.00	0.07	87.50	0.07	70.00
Skills development in firms	2	0.02	100.00	0	0.00	0.02	20.00
Entrepreneurial skills	1	0	0.00	0.01	12.50	0.01	10.00
Skills development in HEIs	1	0	0.00	0	0.00	0	0.00
Strengthening R&D&I ecosystems	0	0	0.00	0	0.00	0	0.00
Total	**6**	**0.02**	**100**	**0.08**	**100**	**0.1**	**100**

Figure A27. RRF amount allocated to Skills for S3 per sub-category, Estonia (%)

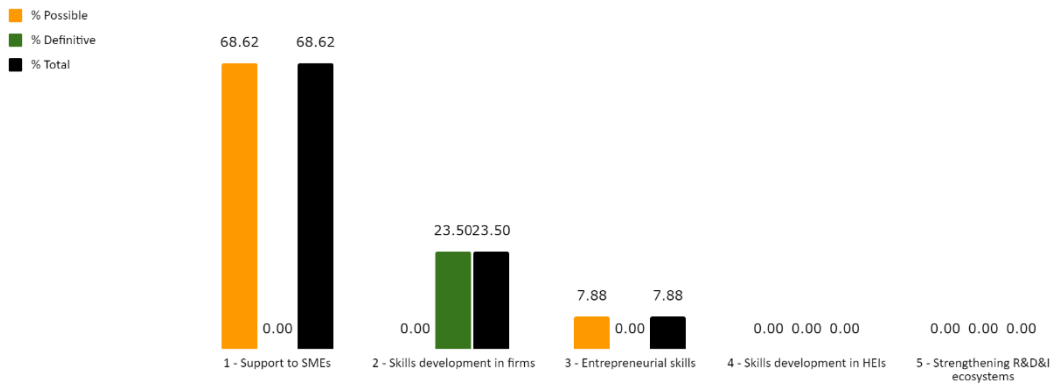


Figure A28. RRF amount allocated to Skills for S3 activities per RRF pillar, Estonia (%)

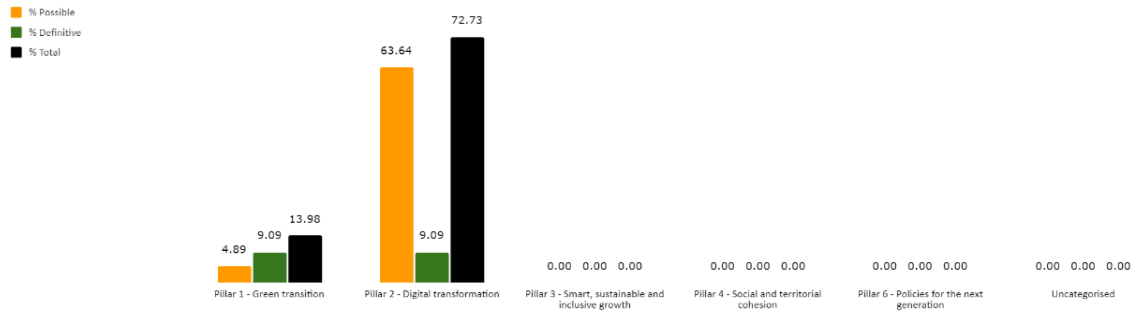
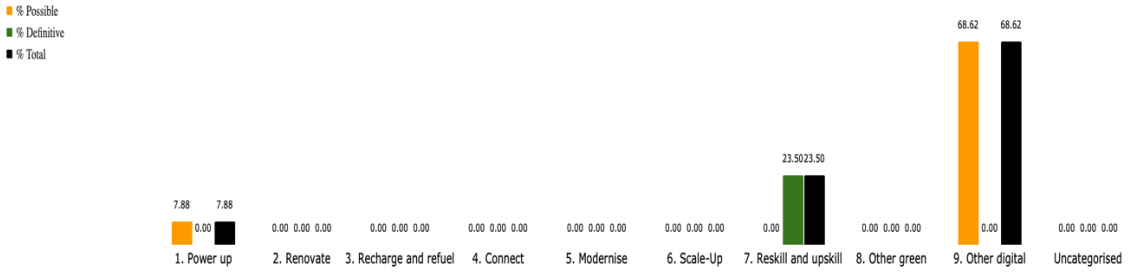


Figure A29. RRF amount allocated to Skills for S3 activities per flagship, Estonia (%)



Finland

Table A17. Finland RRP overview

Total RRF funding	EUR 2.1 billion
Total number of investments related to Skills for S3 definite + possible	6
Total funding allocated to these investments: (total definite + possible)	EUR 0.2 bn (EUR 0.3 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	9.16% (14.1%)

Table A18. Distribution of funding per Skills for S3 activity, Finland (EUR billion)

Sub-category	**# of investments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	1	0	0.00	0.04	40.00	0.07	70.00
Skills development in firms	1	0	0.00	0.04	40.00	0.02	20.00
Entrepreneurial skills	0	0	0.00	0	0.00	0.01	10.00
Skills development in HEIs	0	0	0.00	0	0.00	0	0.00
Strengthening R&D&I ecosystems	4	0.19	100.00	0.02	20.00	0	0.00
Total	**6**	**0.19**	**100**	**0.1**	**100**	**0.1**	**100**

Figure A30. RRF amount allocated to Skills for S3 per sub-category, Finland (%)

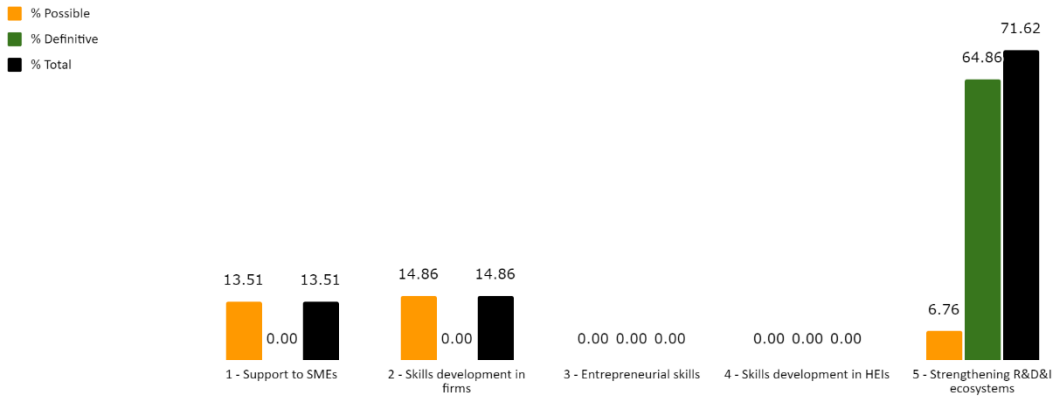


Figure A31. RRF amount allocated to Skills for S3 activities per RRF pillar, Finland (%)

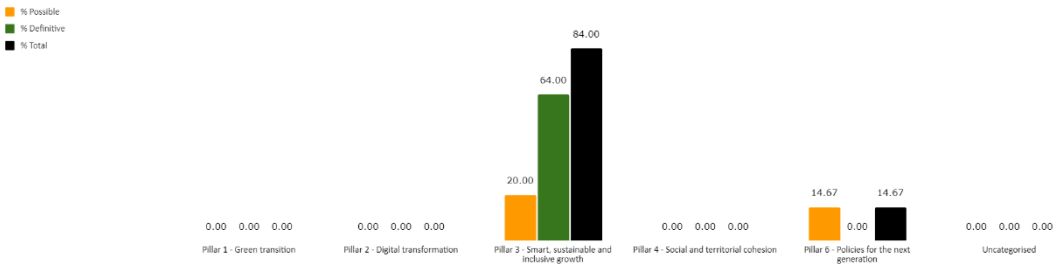
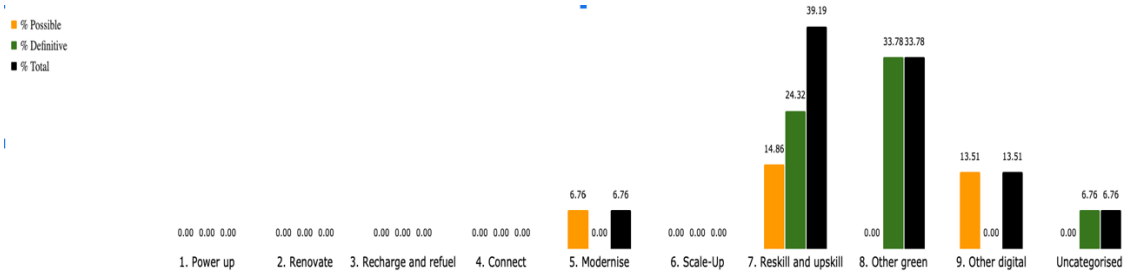


Figure A32. RRF amount allocated to Skills for S3 activities per flagship, Finland (%)



France

Table A19. France RRP overview

Total RRF funding	EUR 41 billion
Total number of investments related to Skills for S3 definite + possible	21
Total funding allocated to these investments: (total definite + possible)	EUR 4.7 bn (EUR 12 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	11.5% (29.3%)

Table A20. Distribution of RRF funding per Skills for S3 activity, France (EUR billion)

Sub-category	**# of investments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	6	1.38	29.30	3.74	51.16	5.12	42.60
Skills development in firms	4	1.1	23.35	0.1	1.37	1.2	9.98
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	7	0.75	15.92	1.67	22.85	2.42	20.13
Strengthening R&D&I ecosystems	4	1.48	31.42	1.8	24.62	3.28	27.29
Total	**21**	**4.71**	**100**	**7.31**	**100**	**12.02**	**100**

Figure A33. RRF amount allocated to Skills for S3 per sub-category, France (%)

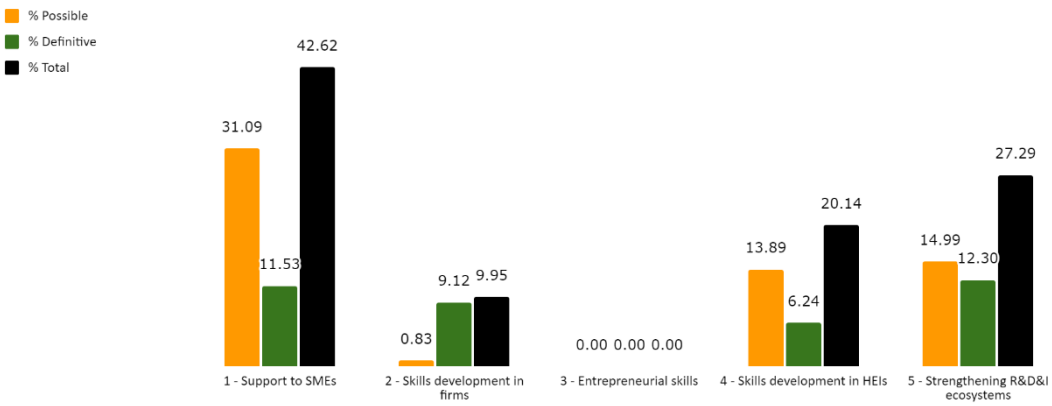


Figure A34. RRF amount allocated to Skills for S3 activities per RRF pillar, France (%)

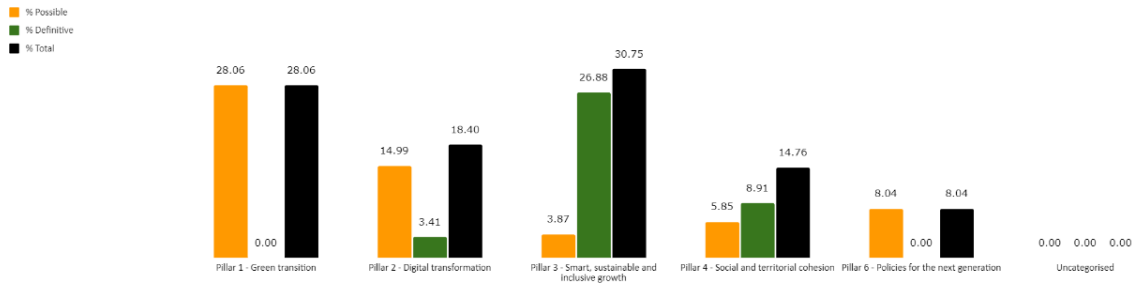
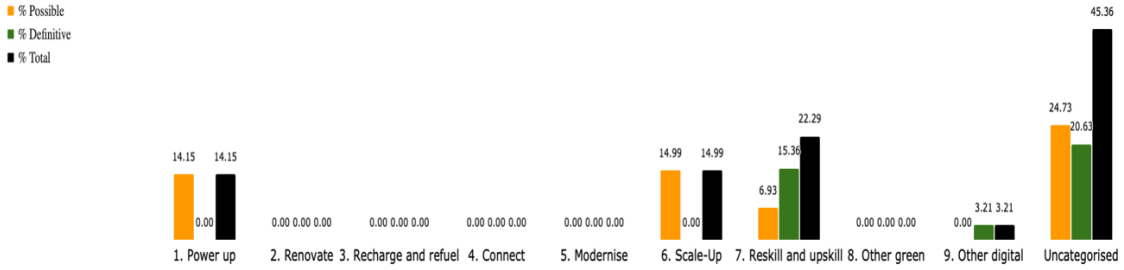


Figure A35. RRF amount allocated to Skills for S3 activities per flagship, France (%)



Germany

Table A21. Germany RRP overview

Total RRF funding	EUR 28 billion
Total number of investments related to Skills for S3 definite + possible	7
Total funding allocated to these investments: (total definite + possible)	EUR 0.02 bn (EUR 2.9 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	0.07% (10.3%)

Table A22. Distribution of funding per Skills for S3 activity, Germany (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	1	0.02	33.33	0	0.00	0.02	0.68
Skills development in firms	1	0.02	33.33	0	0.00	0.02	0.68
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	4	0.02	33.33	2.17	75.61	2.19	74.74
Strengthening R&D&I ecosystems	1	0	0.00	0.7	24.39	0.7	23.89
Total	**7**	**0.06**	**100**	**2.87**	**100**	**2.93**	**100**

Figure A36. RRF amount allocated to Skills for S3 activities per sub-category, Germany (%)

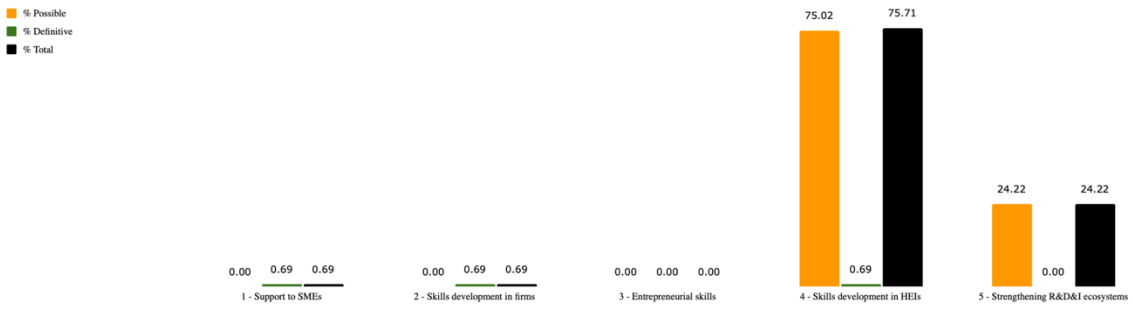


Figure A37. RRF amount allocated to Skills for S3 activities per RRF pillar, Germany (%)

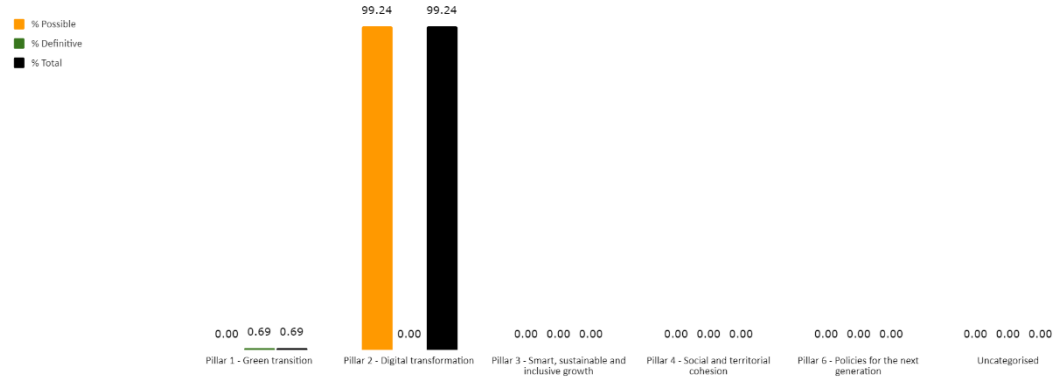
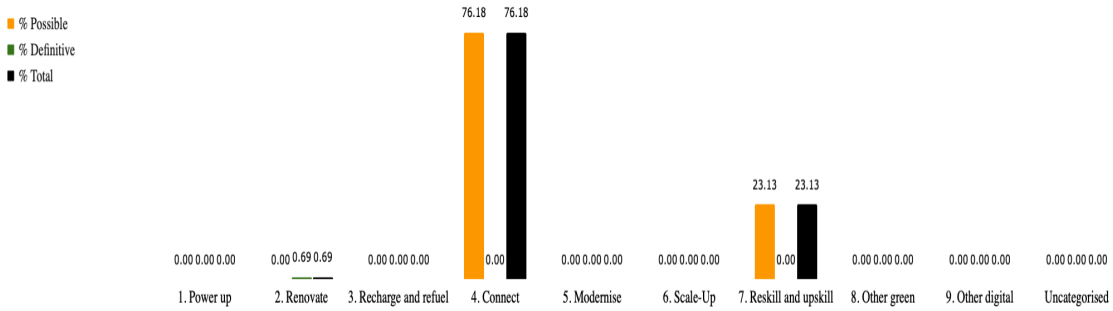


Figure A38. RRF amount allocated to Skills for S3 activities per flagship, Germany (%)



Greece

Table A23. Greece RRP overview

Total RRF funding	EUR 18.2 billion
Total number of investments related to Skills for S3 definite + possible	23
Total funding allocated to these investments: (total definite + possible)	EUR 0.1 bn (EUR 3.9 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	0.6% (21.4%)

Table A24. Distribution of funding per Skills for S3 activity, Greece (EUR billion)

Sub-category	**# of investments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	7	0.08	72.73	0.73	19.26	0.8	20.57
Skills development in firms	7	0	0.00	0.84	22.16	0.84	21.59
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	2	0	0.00	1.04	27.44	1.04	26.74
Strengthening R&D&I ecosystems	7	0.03	27.27	1.18	31.13	1.21	31.11
Total	**23**	**0.11**	**100**	**3.79**	**100**	**3.89**	**100**

Figure A39. RRF amount allocated to Skills for S3 per sub-category, Greece (%)

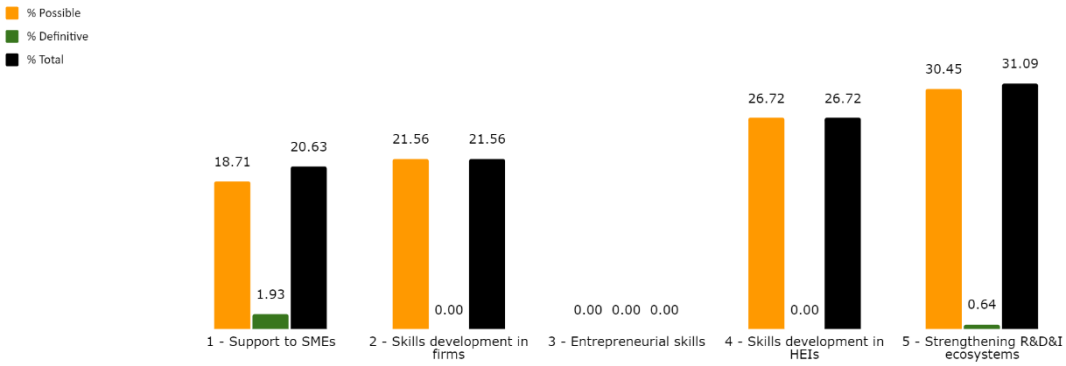


Figure A40. RRF amount allocated to Skills for S3 activities per RRF pillar, Greece (%)

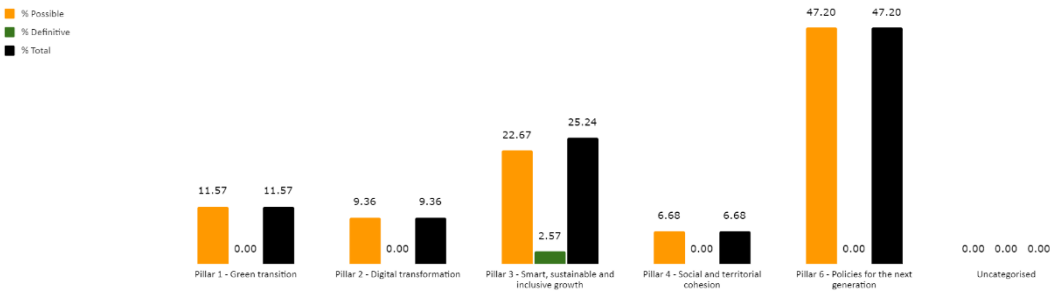
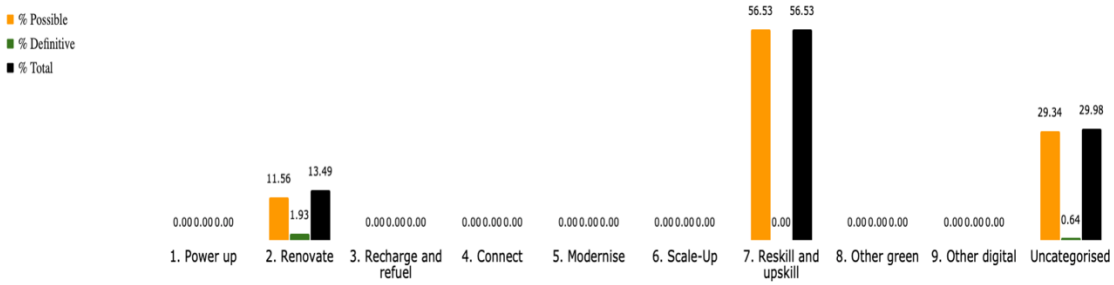


Figure A41. RRF amount allocated to Skills for S3 activities per flagship, Greece (%)



Hungary

Table A25. Hungary RRP overview

Total RRF funding	EUR 7.2 billion
Total number of investments related to Skills for S3 definite + possible	7
Total funding allocated to these investments: (total definite + possible)	EUR 0.46 bn (EUR 0.54 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	6.4% (7.4%)

Table A26. Distribution of funding per Skills for S3 activity, Hungary (EUR billion)

Sub-category	# of invest-ments	Definite	%	Possible	%	Total	%
Support for SMEs	0	0	0.00	0	0.00	0	0.00
Skills develop-ment in firms	0	0	0.00	0	0.00	0	0.00
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills develop-ment in HEIs	6	0.28	60.87	0.07	100.00	1.65	100.00
Strengthening R&D&I ecosys-tems	1	0.18	39.13	0	0.00	0	0.00
Total	**7**	**0.46**	**100**	**0.07**	**100**	**1.65**	**100**

Figure A42. RRF amount allocated to Skills for S3 per sub-category, Hungary (%)

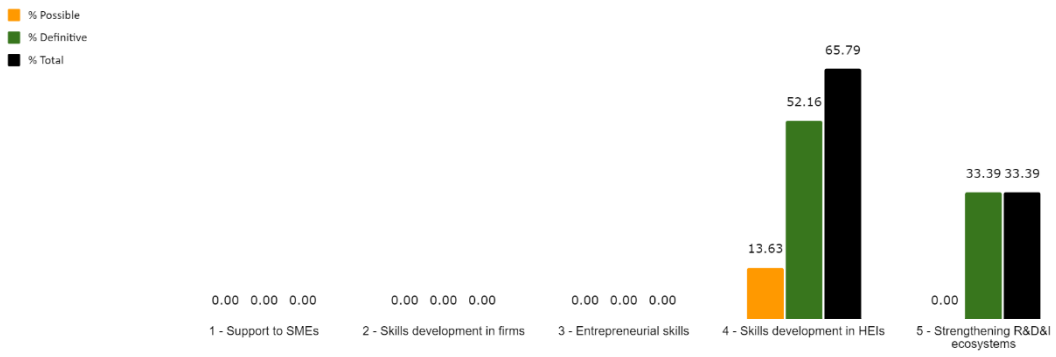


Figure A43. RRF amount allocated to Skills for S3 activities per RRF pillar, Hungary (%)

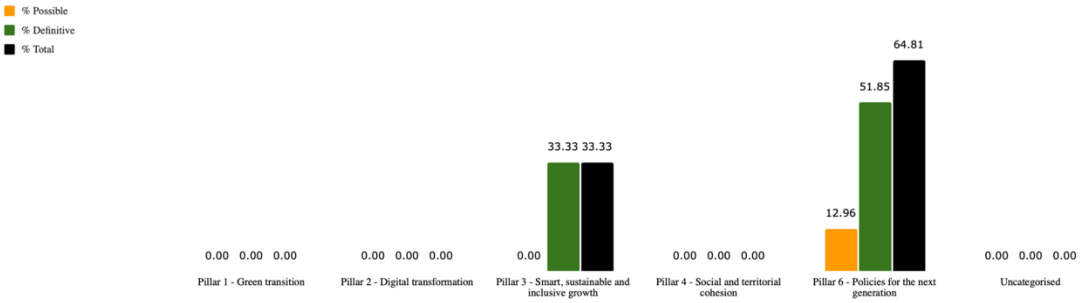
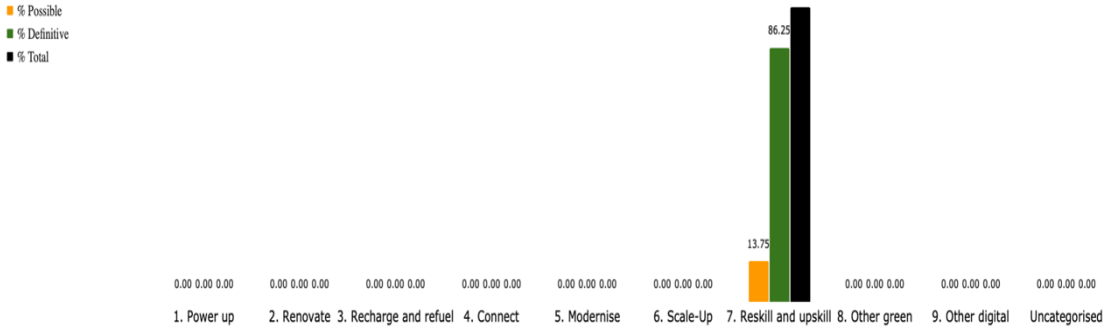


Figure A44. RRF amount allocated to Skills for S3 activities per flagship, Hungary (%)



Italy

Table A27. Italy RRP overview

Total RRF funding	EUR 191.5 billion
Total number of investments related to Skills for S3 definite + possible	31
Total funding allocated to these investments: (total definite + possible)	EUR 28.85 bn (EUR 34.9 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	15.1% (18.2%)

Table A28. Distribution of funding per Skills for S3 activity, Italy (EUR billion)

Sub-category	**# of in-vestments**	**Defi-nite**	**%**	**Possi-ble**	**%**	**Total**	**%**
Support for SMEs	4	16.22	56.22	0.1	1.67	16.32	46.83
Skills development in firms	5	0	0.00	0.46	7.67	0.46	1.32
Entrepreneurial skills	1	0	0.00	0.4	6.67	0.4	1.15
Skills development in HEIs	9	7	24.26	0.6	10.00	7.6	21.81
Strengthening R&D&I ecosystems	12	5.63	19.51	4.44	74.00	10.07	28.90
Total	**31**	**28.85**	100	**6**	**100.00**	**34.85**	**100.00**

Figure A45. RRF amount allocated to Skills for S3 activities, Italy (%)

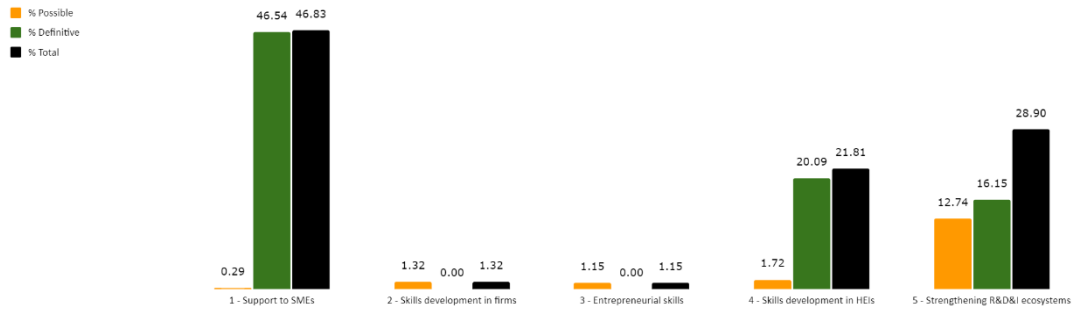


Figure A46. RRF amount allocated to Skills for S3 activities per RRF pillar, Italy (%)

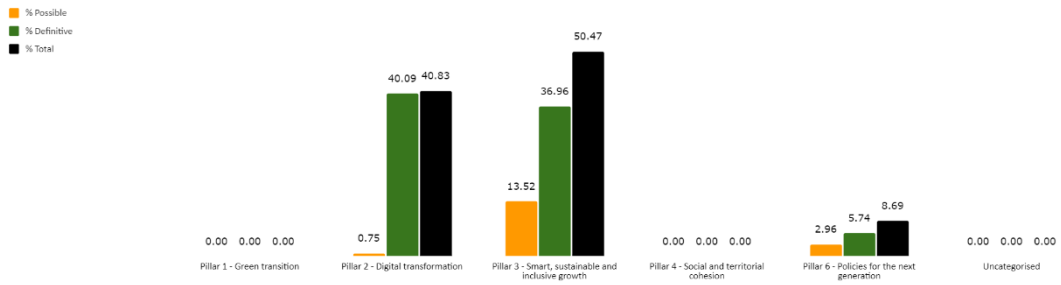
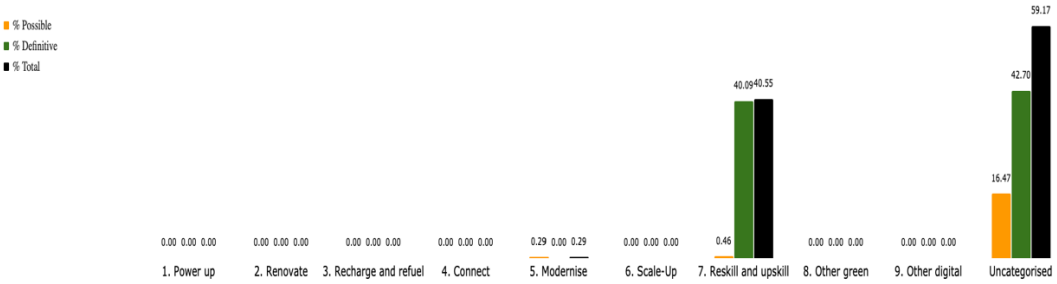


Figure A47. RRF amount allocated to Skills for S3 activities per flagship, Italy (%)



Latvia

Table A29. Latvia RRP overview

Total RRF funding	EUR 1.8 billion
Total number of investments related to Skills for S3 definite + possible	10
Total funding allocated to these investments: (total definite + possible)	EUR 0.1 bn (EUR 0.2 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	3.1% (10.3%)

Table A30. Distribution of funding for Skills for S3 activity, Latvia (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	1	0	0.00	0.11	84.62	0.11	57.89
Skills development in firms	5	0.04	66.67	0.01	7.69	0.05	26.32
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	3	0	0.00	0.01	7.69	0.01	5.26
Strengthening R&D&I ecosystems	1	0.02	33.33	0	0.00	0.02	10.53
Total	**10**	**0.06**	**100**	**0.13**	**100**	**0.19**	**100**

Figure A48. RRF amount allocated to Skills for S3 per sub-category, Latvia (%)

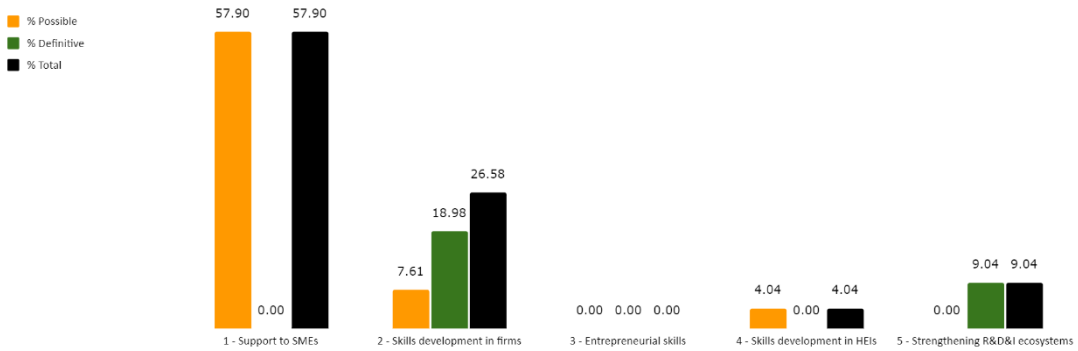


Figure A49. RRF amount allocated to Skills for S3 activities per RRF pillar, Latvia (%)

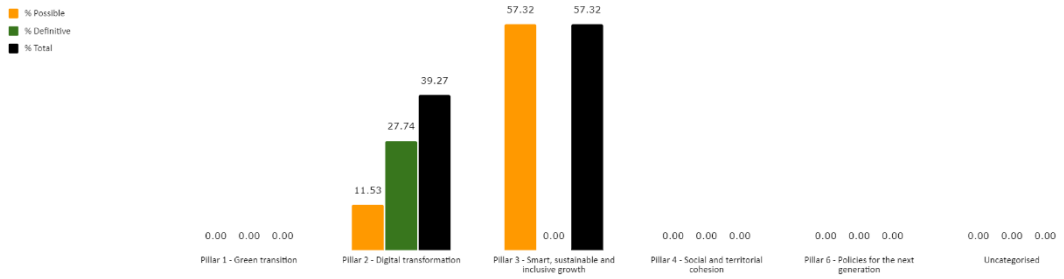
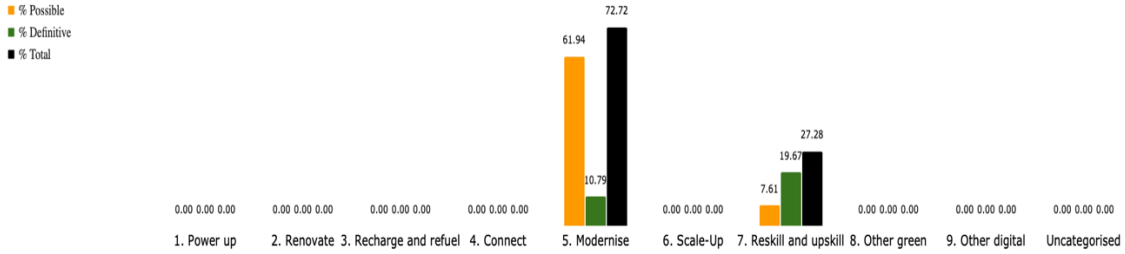


Figure A50. RRF amount allocated to Skills for S3 activities per flagship, Latvia (%)



Lithuania

Table A31. Lithuania RRP overview

Total RRF funding	EUR 2.2 billion
Total number of investments related to Skills for S3 definite + possible	12
Total funding allocated to these investments: (total definite + possible)	EUR 0.4 bn (EUR 0.6 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	16.4% (27.4%)

Table A32. Distribution of funding per Skills for S3 activity, Lithuania (EUR billion)

Sub-category	**# of invest-ments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	1	0.06	16.67	0	0.00	0.06	9.84
Skills develop-ment in firms	4	0.16	44.44	0.25	100.00	0.41	67.21
Entrepreneurial skills	1	0	0.00	0	0.00	0	0.00
Skills develop-ment in HEIs	3	0.04	11.11	0	0.00	0.04	6.56
Strengthening R&D&I ecosys-tems	3	0.1	27.78	0	0.00	0.1	16.39
Total	**12**	**0.36**	**100**	**0.25**	**100**	**0.61**	**100**

Figure A51. RRF amount allocated to Skills for S3 per sub-category, Lithuania (%)

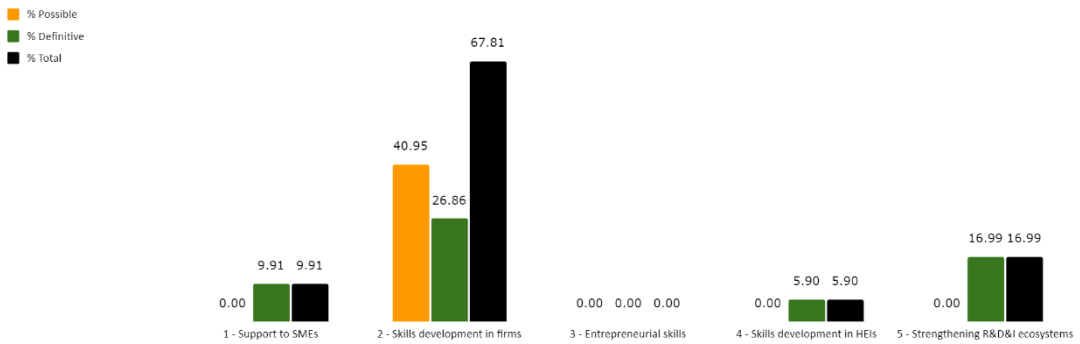


Figure A52. RRF amount allocated to Skills for S3 activities per RRF pillar, Lithuania (%)

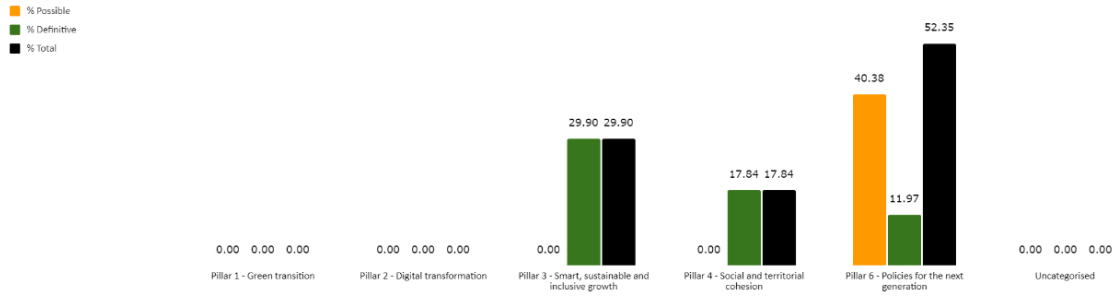
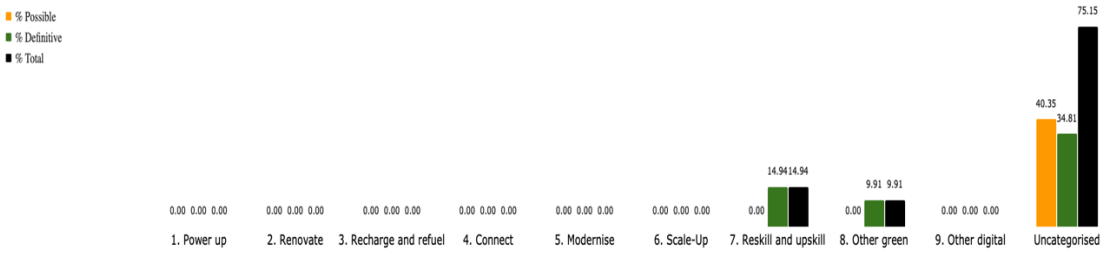


Figure A53. RRF amount allocated to Skills for S3 activities per flagship, Lithuania (%)



Luxembourg

Table A33. Luxembourg RRP Overview

Total RRF funding	EUR 0.1 billion
Total number of investments related to Skills for S3 definite + possible	2
Total funding allocated to these investments: (total definite + possible)	EUR 0.01 billion (EUR 0.01 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	7% (7%)

Table A34. Distribution of funding per Skills for S3 activity, Luxembourg (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	0	0	0.00	0	0.00	0	0.00
Skills development in firms	1	0.01	86.96	0	0.00	0.01	86.96
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	1	0.0015	13.04	0	0.00	0.0015	13.04
Strengthening R&D&I ecosystems	0	0	0.00	0	0.00	0	0.00
Total	**2**	**0.0115**	**100**	**0**	**0.00**	**0.0115**	**100**

Figure A54. RRF amount allocated to Skills for S3 per sub-category, Luxembourg (%)

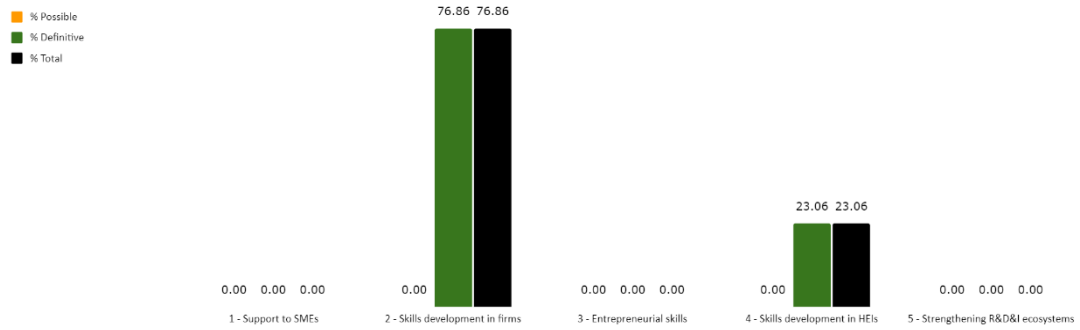


Figure A55. RRF amount allocated to Skills for S3 activities per RRF pillar, Luxembourg (%)

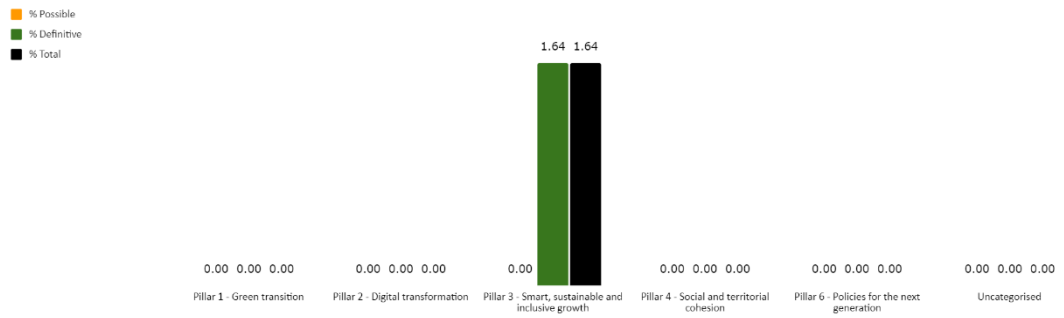
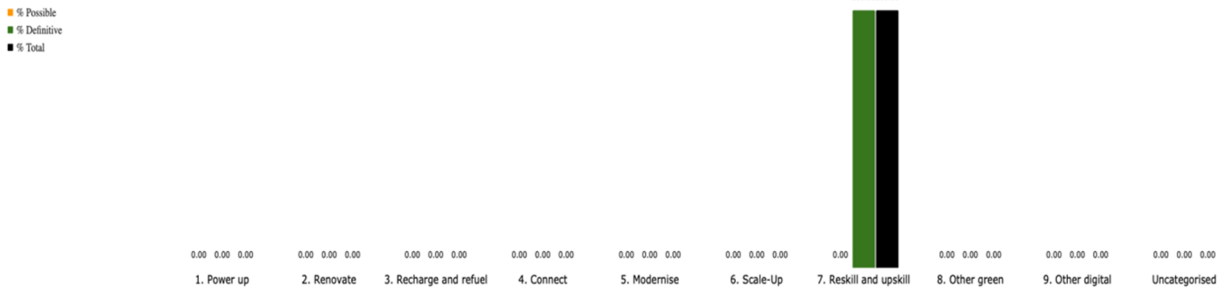


Figure A56. RRF amount allocated to Skills for S3 activities per flagship, Luxembourg (%)



Malta

Table A35. Malta RRP Overview

Total RRF funding	EUR 0.3 billion
Total number of investments related to Skills for S3 definite + possible	2
Total funding allocated to these investments: (total definite + possible)	EUR 0 bn (EUR 0.1 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	0 (28%)

Table A36. Distribution of funding per Skills for S3 activity, Malta (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	0	0	0.00	0	0.00	0	0.00
Skills development in firms	1	0	0.00	0.06	60.00	0.06	60.00
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	1	0	0.00	0.04	40.00	0.04	40.00
Strengthening R&D&I ecosystems	1	0	0.00	0	0.00	0	0.00
Total	**3**	**0**	**0.00**	**0.1**	**100**	**0.1**	**100**

Figure A57. RRF amount allocated to Skills for S3 activities per sub-category, Malta (%)

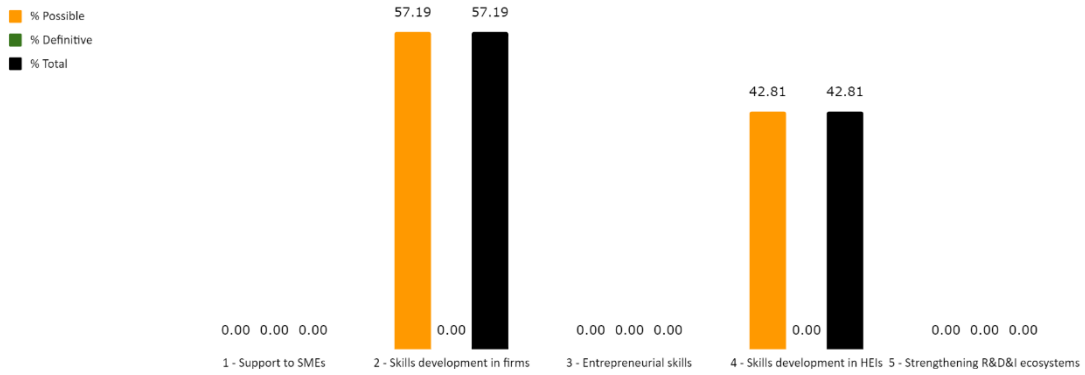


Figure A58. RRF amount allocated to Skills for S3 activities per RRF pillar, Malta (%)

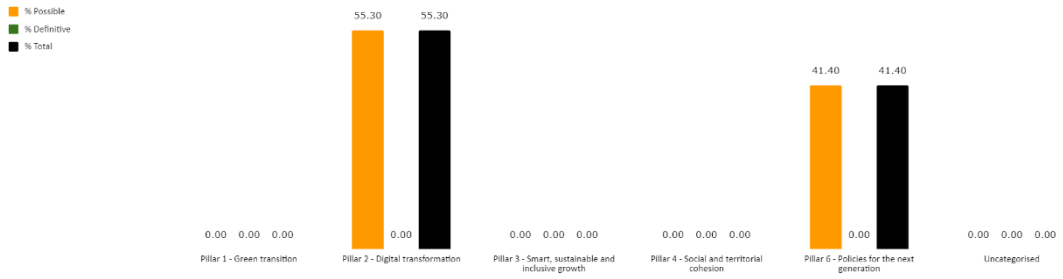
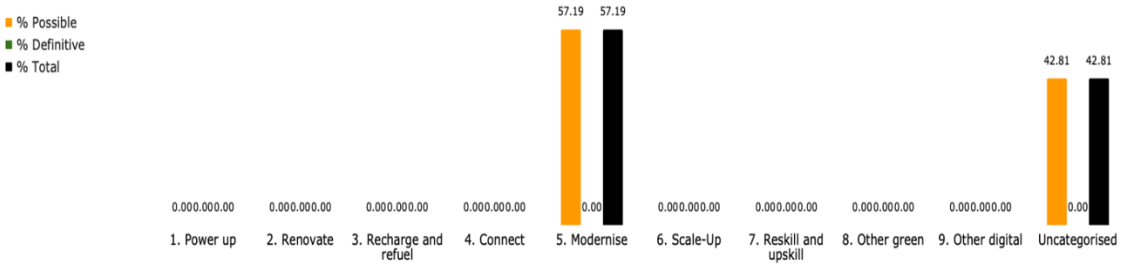


Figure A59. RRF amount allocated to Skills for S3 activities per flagship, Malta (%)



Poland

Table A37. Poland RRP Overview

Total RRF funding	EUR 36 billion
Total number of investments related to Skills for S3 definite + possible	8
Total funding allocated to these investments: (total definite + possible)	EUR 2.4 bn (EUR 2.6 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	6.7% (7.2%)

Table A38. Distribution of funding per Skills for S3 activity, Poland (EUR billion)

Sub-category	**# of investments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	3	1.43	59.09	0	0.00	1.43	55.43
Skills development in firms	1	0	0.00	0	0.00	0	0.00
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	1	0.4	16.53	0	0.00	0.4	15.50
Strengthening R&D&I ecosystems	3	0.59	24.38	0.16	100.00	0.75	29.07
Total	**8**	**2.42**	**100**	**0.16**	**100**	**2.58**	**100**

Figure A60. RRF amount allocated to Skills for S3 activities per sub-category, Poland (%)

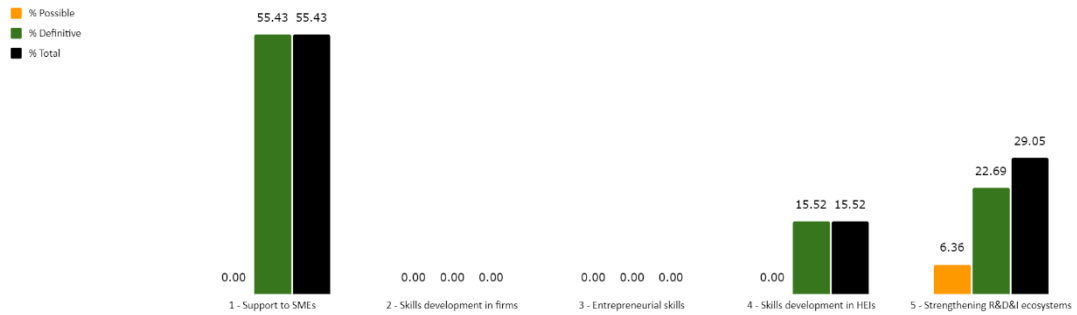


Figure A61. RRF amount allocated to Skills for S3 activities per RRF pillar, Poland (%)

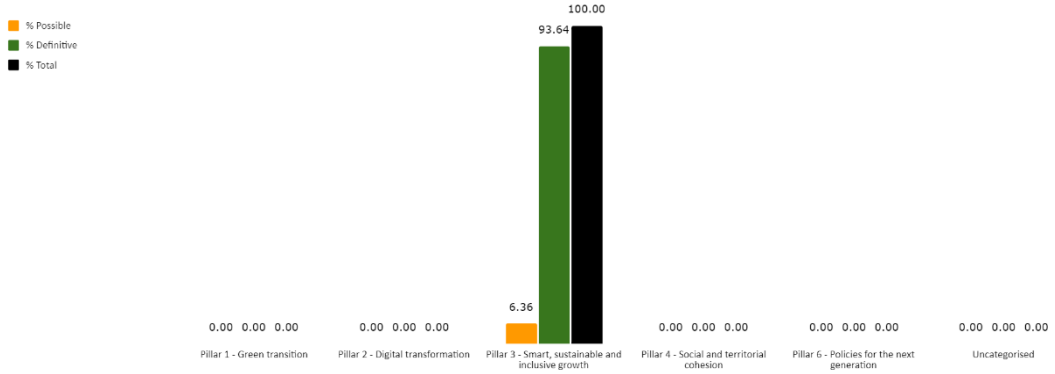
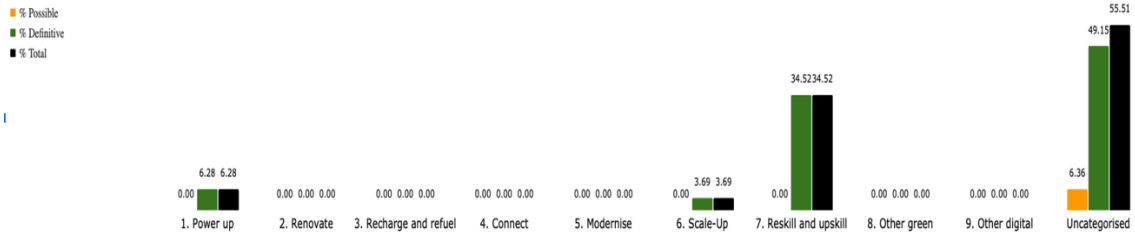


Figure A62. RRF amount allocated to Skills for S3 activities per flagship, Poland (%)



Portugal

Table A39. Portugal RRP Overview

Total RRF funding	EUR 16.6 billion
Total number of investments related to Skills for S3 definite + possible	15
Total funding allocated to these investments: (total definite + possible)	EUR 1.1 bn (EUR 2.3 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	6.5% (13.9%)

Table A40. Distribution of funding per Skills for S3 activity, Portugal (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	6	0.45	41.67	1.19	95.97	1.64	70.69
Skills development in firms	4	0.1	9.26	0	0.00	0.1	4.31
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	3	0.25	23.15	0.05	4.03	0.3	12.93
Strengthening R&D&I ecosystems	2	0.28	25.93	0	0.00	0.28	12.07
Total	**15**	**1.08**	**100**	**1.24**	**100**	**2.32**	**100**

Figure A63. RRF amount allocated to Skills for S3 activities per sub-category, Portugal (%)

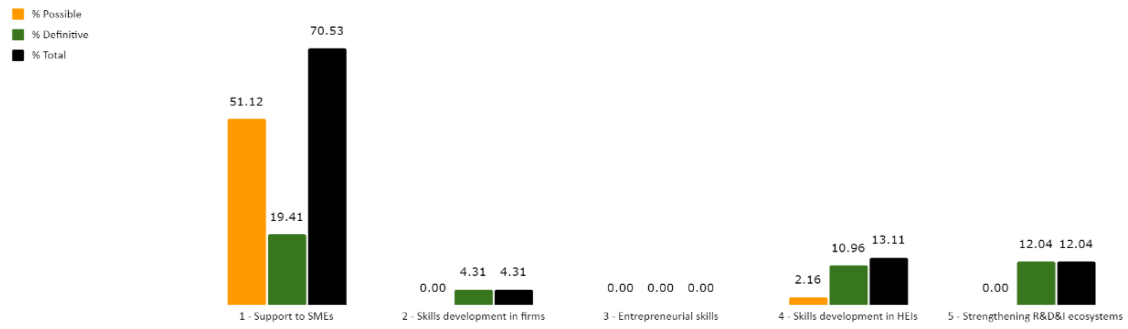


Figure A64. RRF amount allocated to Skills for S3 activities per RRF pillar, Portugal (%)

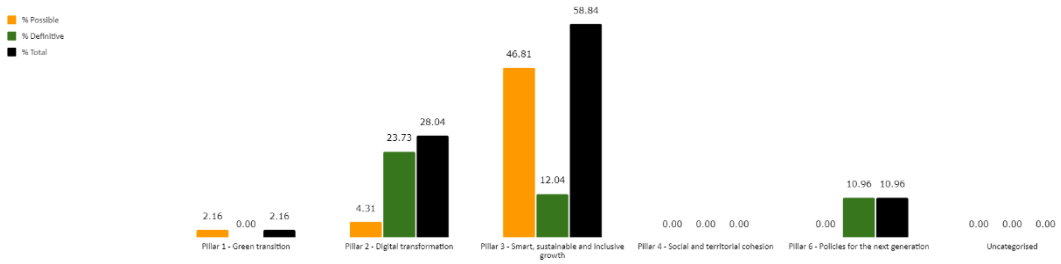
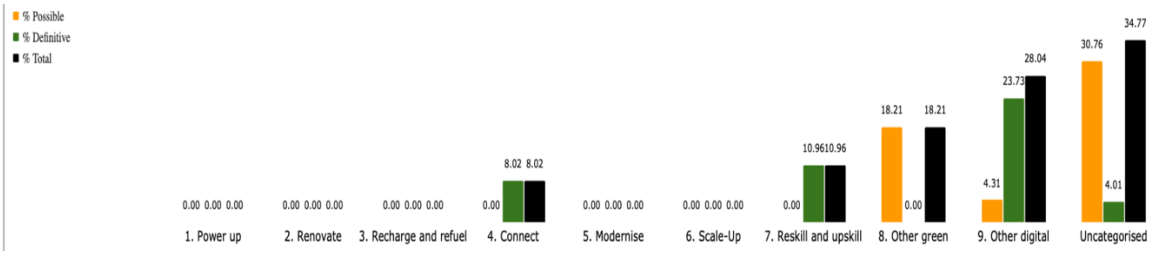


Figure A65. RRF amount allocated to Skills for S3 activities per flagship, Portugal (%)



Romania

Table A41. Romania RRP Overview

Total RRF funding	EUR 29.4 billion
Total number of investments related to Skills for S3 definite + possible	26
Total funding allocated to these investments: (total definite + possible)	EUR 1.2 bn (EUR 1.6 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	4.1% (5.3%)

Table A42. Distribution of funding per Skills for S3 activity, Romania (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	4	0.18	14.88	0.1	29.41	0.28	18.06
Skills development in firms	5	0.09	7.44	0	0.00	0.09	5.81
Entrepreneurial skills	2	0	0.00	0	0.00	0	0.00
Skills development in HEIs	10	0.89	73.55	0.06	17.65	0.95	61.29
Strengthening R&D&I ecosystems	5	0.05	4.13	0.18	52.94	0.23	14.84
Total	**26**	**1.21**	**100**	**0.34**	**100**	**1.55**	**100**

Figure A66. RRF amount allocated to Skills for S3 activities per sub-category, Romania (%)

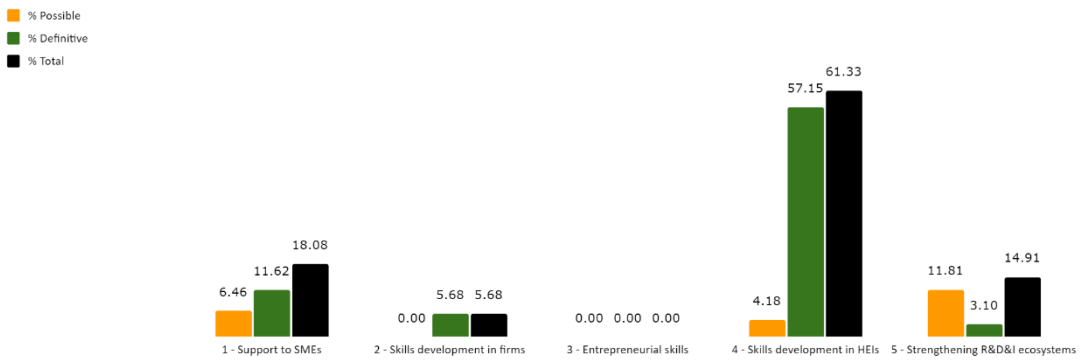


Figure A67. RRF amount allocated to Skills for S3 activities per RRF pillar, Romania (%)

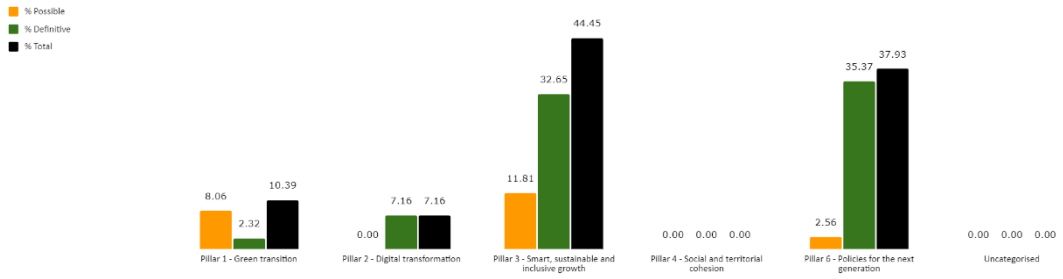
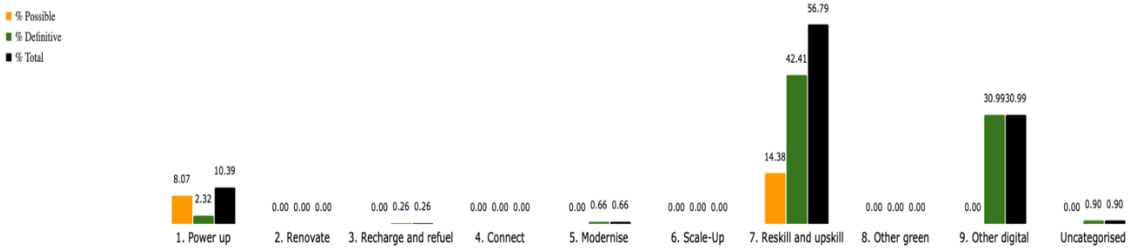


Figure A68. RRF amount allocated to Skills for S3 activities per flagship, Romania (%)



Slovakia

Table A43. Slovakia RRP Overview.

Total RRF funding	EUR 6.6 billion
Total number of investments related to Skills for S3 definite + possible	15
Total funding allocated to these investments: (total definite + possible)	EUR 0.4 bn (EUR 0.8 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	6.8% (11.9%)

Table A44. Distribution of funding per Skills for S3 activity, Slovakia (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	1	0	0.00	0.04	12.12	0.04	5.13
Skills development in firms	3	0	0.00	0.06	18.18	0.06	7.69
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	2	0	0.00	0	0.00	0	0.00
Strengthening R&D&I ecosystems	9	0.44	100.00	0.23	69.70	0.68	87.18
Total	**15**	**0.44**	**100**	**0.33**	**100**	**0.78**	**100**

Figure A69. RRF amount allocated to Skills for S3 activities per sub-category, Slovakia (%)

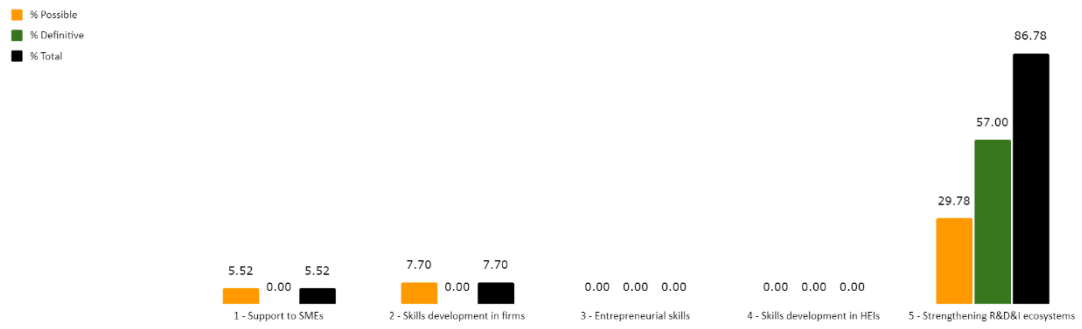


Figure A70. RRF amount allocated to Skills for S3 activities per RRF pillar, Slovakia (%)

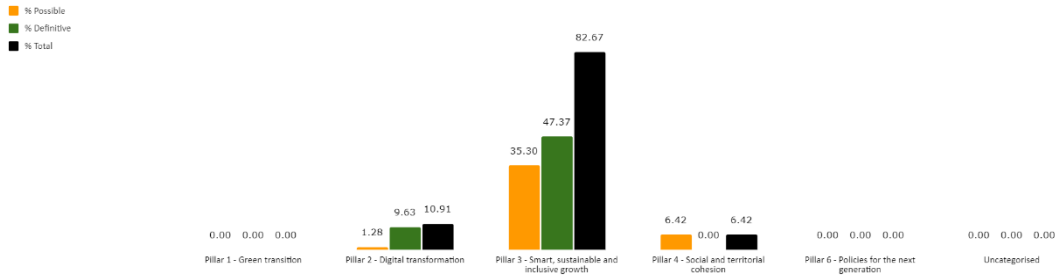
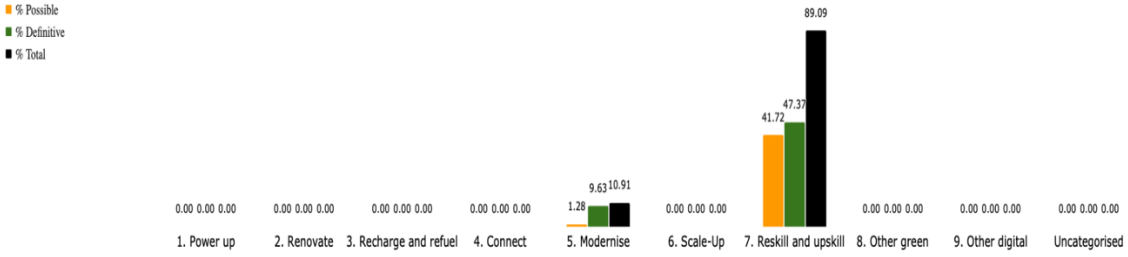


Figure A71. RRF amount allocated to Skills for S3 activities per flagship, Slovakia (%)



Slovenia

Table A45. Slovenia RRP Overview

Total RRF funding	EUR 2.5 billion
Total number of investments related to Skills for S3 definite + possible	17
Total funding allocated to these investments: (total definite + possible)	EUR 0.2 bn (EUR 0.3 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	8.4% (11.9%)

Table A46. Distribution of funding per Skills for S3 activity, Slovenia (EUR billion)

Sub-category	**# of invest-ments**	**Definite**	**%**	**Possible**	**%**	**Total**	**%**
Support for SMEs	4	0	0.00	0.05	55.56	0.05	16.67
Skills develop-ment in firms	4	0.07	33.33	0	0.00	0.07	23.33
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills develop-ment in HEIs	5	0.07	33.33	0.03	33.33	0.1	33.33
Strengthening R&D&I ecosys-tems	4	0.07	33.33	0.01	11.11	0.08	26.67
Total	**17**	**0.21**	**100**	**0.09**	**100**	**0.3**	**100**

Figure A72. RRF amount allocated to Skills for S3 activities per sub-category, Slovenia (%)

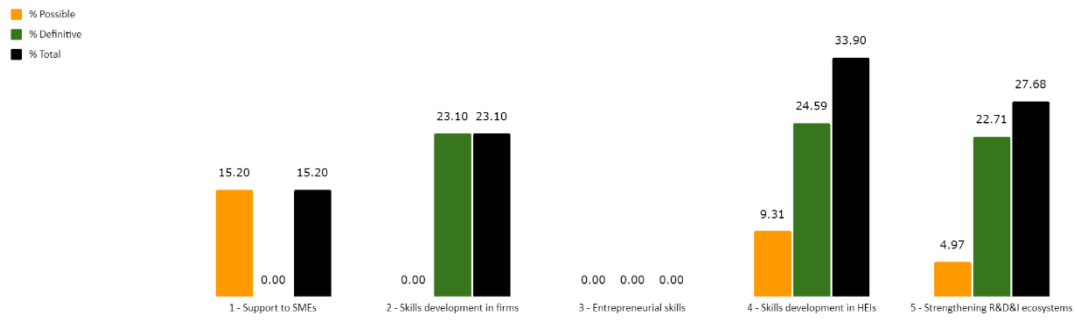


Figure A73. RRF amount allocated to Skills for S3 activities per RRF pillar, Slovenia (%)

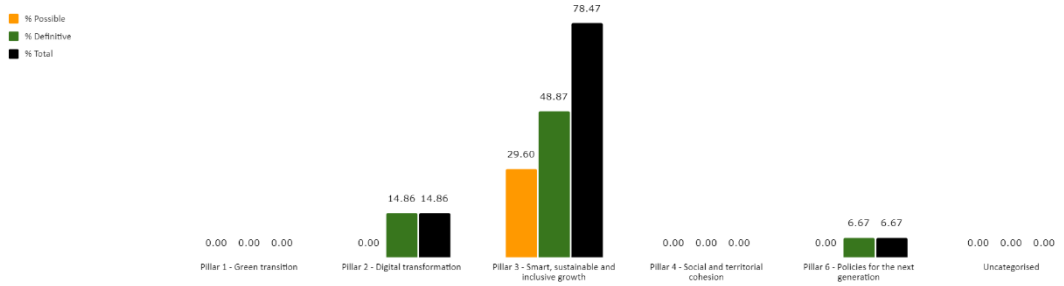
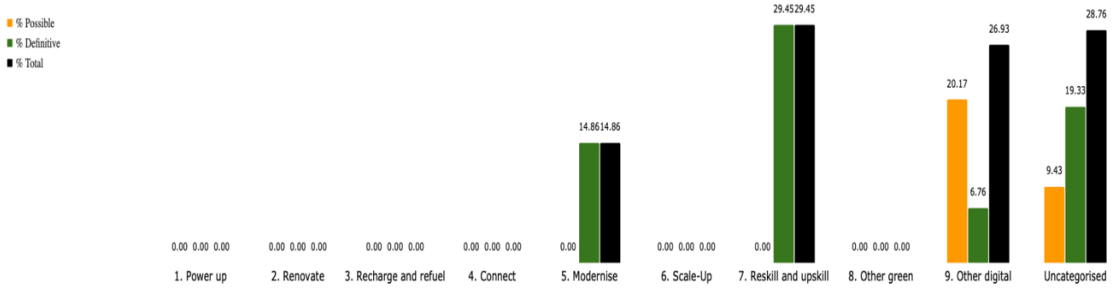


Figure A74. RRF amount allocated to Skills for S3 activities per flagship, Slovenia (%)



Spain

Table A47. Spain RRP overview

Total RRF funding	EUR 69.5 billion
Total number of investments related to Skills for S3 definite + possible	17
Total funding allocated to these investments: (total definite + possible)	EUR 17.5 bn (EUR 20.2 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	25.2% (29.1%)

Table A48. Distribution of funding per Skills for S3 activity, Spain (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	4	4.28	24.42	1.05	38.89	5.33	26.35
Skills development in firms	6	8.03	45.81	0	0.00	8.03	39.69
Entrepreneurial skills	3	5.22	29.78	0	0.00	5.22	25.80
Skills development in HEIs	1	0	0.00	1.65	61.11	1.65	8.16
Strengthening R&D&I ecosystems	3	0	0.00	0	0.00	0	0.00
Total	**17**	**17.53**	**100**	**2.7**	**100**	**20.23**	**100**

Figure A75. RRF amount allocated to Skills for S3 activities per sub-category, Spain (%)

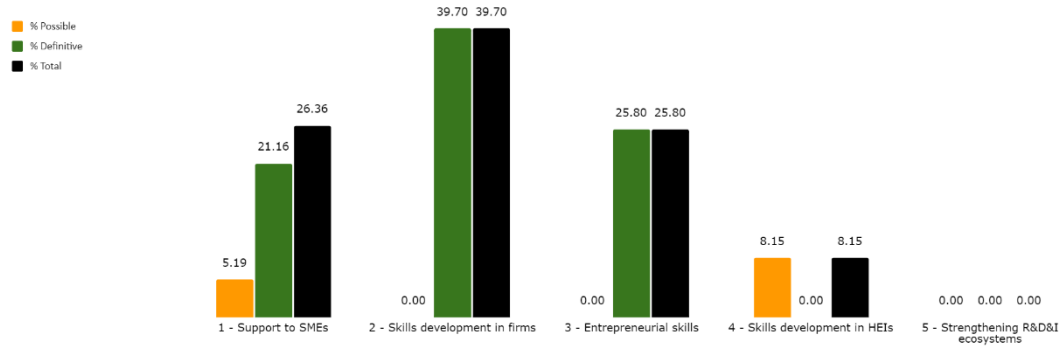


Figure A76. RRF amount allocated to Skills for S3 activities per RRF pillar, Spain (%)

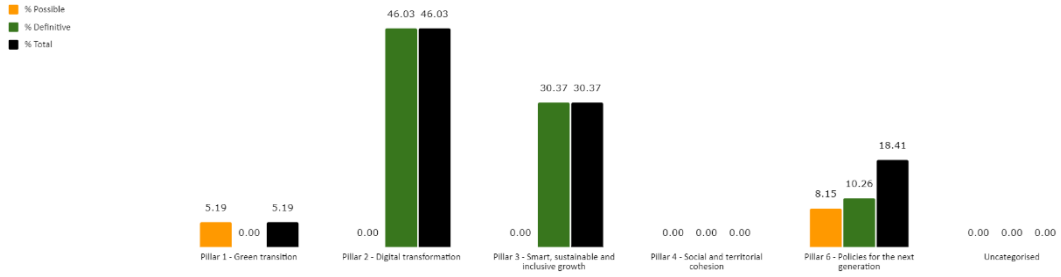
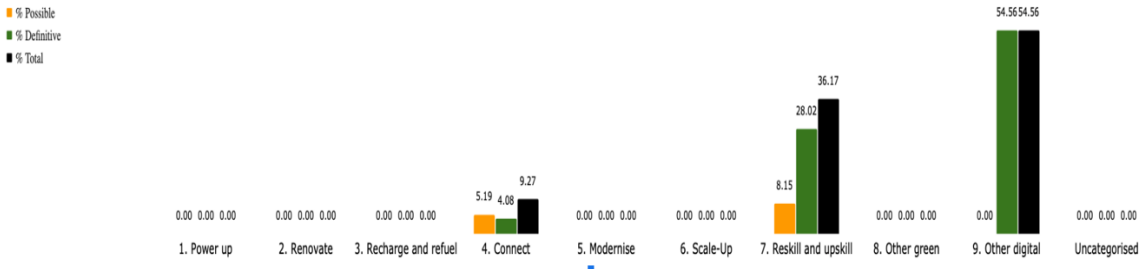


Figure A77. RRF amount allocated to Skills for S3 activities per flagship, Spain (%)



Sweden

Table A49. Sweden RRP Overview

Total RRF funding	EUR 3.3 billion
Total number of investments related to Skills for S3 definite + possible	5
Total funding allocated to these investments: (total definite + possible)	EUR 0.4 bn (EUR 0.7 billion)
Percentage this represents of total RRF funding: (total definite plus possible)	12.4% (22.4%)

Table A50. Distribution of funding per Skills for S3 activity, Sweden (EUR billion)

Sub-category	# of investments	Definite	%	Possible	%	Total	%
Support for SMEs	0	0	0.00	0	0.00	0	0.00
Skills development in firms	2	0.1	24.39	0	0.00	0.1	13.51
Entrepreneurial skills	0	0	0.00	0	0.00	0	0.00
Skills development in HEIs	2	0.31	75.61	0.09	27.27	0.4	54.05
Strengthening R&D&I ecosystems	1	0	0.00	0.24	72.73	0.24	32.43
Total	**5**	**0.41**	**100**	**0.33**	**100**	**0.74**	**100**

Figure A78. RRF amount allocated to Skills for S3 activities per sub-category, Sweden (%)

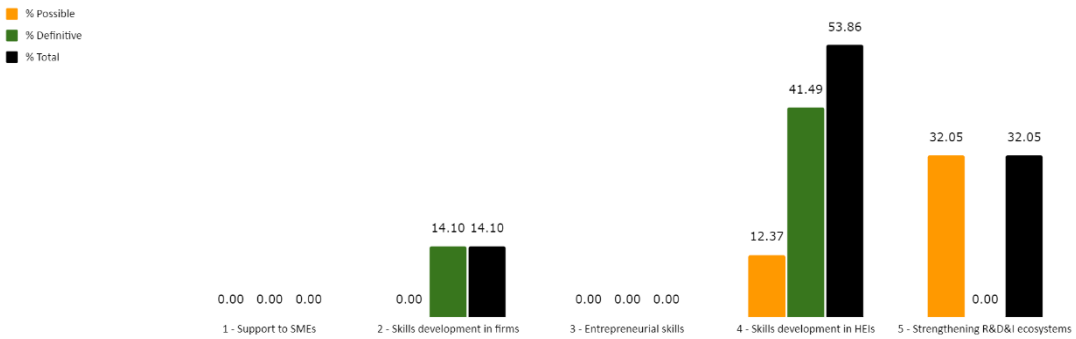


Figure A79. RRF amount allocated to Skills for S3 activities per RRF pillar, Sweden (%)

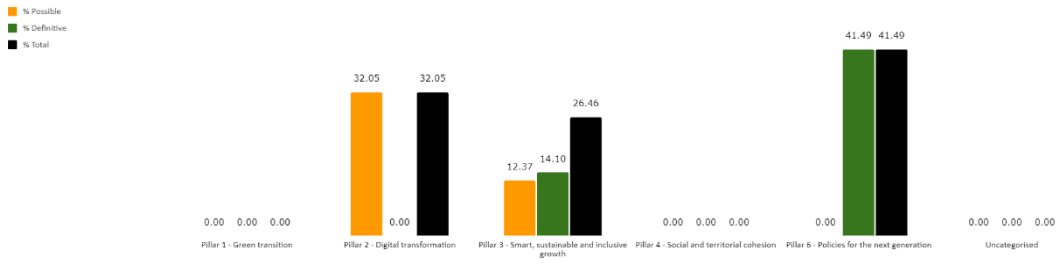
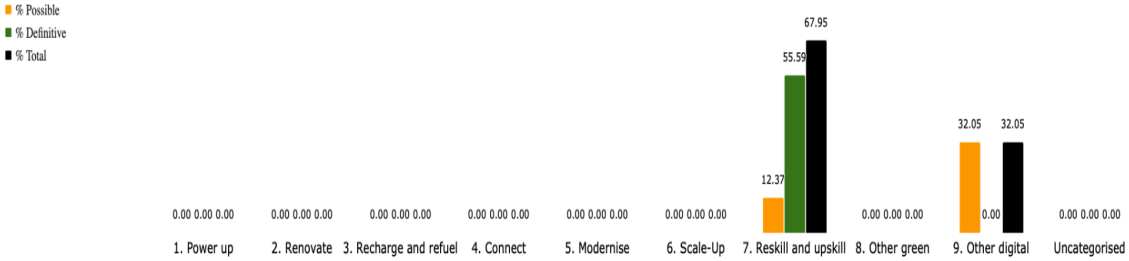


Figure A80. RRF amount allocated to Skills for S3 activities per flagship, Sweden (%)



Annex 6. OPs including SO1.4 by MS and their target groups

	Total	%	BE	BG	CZ	DE	EE	EL	ES	FR	HR	HU	IT	LT	LV	NL	PL	PT	RO	SE	SI	SK
Total programmes	**68**	**100**	**1**	**1**	**1**	**3**	**1**	**1**	**3**	**3**	**2**	**1**	**18**	**1**	**1**	**1**	**5**	**6**	**9**	**8**	**1**	**1**
HEIs	**34**	50%	1	1	1	2	1	1	1	1	1	1	5	1	1	1		3	4	6	1	1
Other education/training	**28**	41%	1	1	1	1		1	1	1	1	1	5			1		1	5	6		1
Research	**37**	54%	1	1	1	2	1		1	1	2	1	7		1		1	4	6	5	1	1
Innovation promoters	**25**	37%	1	1	1	2			1	3	1		2	1			2	4	1	5		
Enterprises	**64**	94%	1	1	1	2	1	1	3	3	2	1	16	1	1	1	4	6	9	8	1	1
Business associations	**32**	47%	1	1	1	1		1	1	2	1	1	4				2	4	3	8		1
Civil society	**12**	18%	1		1					2	1	1	1			1	1	1	1			1
Public agencies	**28**	41%	1		1	1	1		1	2	1		5				2	4	3	4	1	1
EDP	**29**	43%		1			1	1	1	1		1	2				4	6	7	4		

Annex 7. Recommendations for Policy Objective 1 from Annex D of 2019 Country Reports

Country fiches presented in alphabetic order.

Austria
Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation
Despite a very high research and development intensity, Austria is not yet on par with Europe's Innovation Leaders as regards innovation outcomes, which points to a need for improving the efficiency of the research and innovation system and to fully exploit the potential of science-business links. Therefore, priority investment needs(58) have been identified to enhance research and innovation capacities and the uptake of advanced technologies, within the framework of regional smart specialisation strategies that identify priority areas based on regional needs and potential, and in particular to: • strengthen the science-business links, inter alia, by supporting collaborative research, development and innovation and technology transfer. Support investments in research and development infrastructure that allows small and medium-sized enterprises to participate in the research and development process; • encourage cooperation activities on corresponding smart specialisation priorities and new value chains between different Austrian regions and with other countries, including in the context of the EU Strategies for the Alpine and Danube regions; • strengthen eco-innovation and research and development focusing on low-carbon technologies and on making the economy more circular. Scaling up, innovation capacity and the availability of venture capital remain an issue for Austria's smaller firms. Therefore, priority investment needs have been identified to enhance growth and competitiveness of small and medium-sized enterprises, and in particular to: • strengthen the innovation capabilities of small and medium-sized enterprises. Encourage investments in product, process and service development, and upgrading technological capacities; • encourage the entrepreneurial eco-system by providing support for clusters and networks and promote the entrepreneurial spirit; • consolidate the favourable start-up climate and improve the conditions for scaling up innovative businesses, inter alia, by providing support for access to finance, for start-up accelerators and incubators and related consultancy services. Provide support for developing prototypes, demonstrators and proof of concept. Austria lags behind in developing information and communications technology products and services, and in particular the small and medium-sized enterprise sector in adopting new digital technologies and business models. Therefore, priority investment needs have been identified to reap the benefits of digitisation for companies, and in particular to: • increase information and communications technology up-take and the adoption of new business models in small and medium-sized enterprises, inter alia, by improving digital skills and by supporting digital innovation hubs as service-providers to small and medium-sized enterprises; • offer risk-reduced environments for small and medium-sized enterprises to develop digital products and services, for example by supporting test environments for early trials and market adaptation of emerging technologies and digital applications.

Belgium
Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation
The country is a strong innovator thanks to its attractive research centres. However attracting young people in digital/science technology careers remains a challenge. There is scope for strengthening innovation performance and fostering productivity growth by identifying smart specialisation areas based on regional needs and potential. As well there is scope for improvement by increasing the uptake of Research Development and Innovation outcomes in concrete products and marketed items enhancing research and innovation capacities and the uptake of advanced technologies. Territorial specificities in the three regions (Brussels, Flanders and Wallonia with a potential focus on sub-regional dimensions) will be taken into account when developing solutions to sustain Research Development and Innovation in Belgium. Priority needs have therefore identified to: • invest in the growth of firms through support to their activities both in a material aspect e.g. development capacities living-labs test-beds joint interregional and cross-border projects and in a more immaterial aspect (networking, cluster development, transnational cooperation) • develop the capacities of research facilities in the orientation of research and the commercialisation of their outcomes • facilitate the creation of links and collaborations between research centres universities and small and medium-sized enterprises in order to have the same links with small and medium-sized enterprises as the ones existing with large companies • reinforce marketing and product finalisation of research • stimulate integrated cooperation in new value chains across regions and across borders. The potential of Belgian small and medium-sized enterprises and innovation start-ups is not fully exploited and there has been a downward trend in the number of newly created Innovation and Communication Technology start-ups in the last 5 years. Priority investment needs have therefore been identified to enhance growth and competitiveness of small and medium-sized enterprises and in promoting development of skills digitalisation (especially in Wallonia) and new start-ups in line with the smart specialisation strategy to: • reinforce access to finance and advanced business services for small and medium-sized enterprises to create a boost for the establishment of new firms • assist small and medium-sized enterprises and provide support to start-ups in the development of new business models • develop small and medium-sized enterprises' and start-ups' skills and capacities in the exportation of their products and services • develop skills in higher education and research institutions and closer collaboration with small and medium-sized enterprises and start-ups to support their business needs mentioned above.

Bulgaria

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Bulgaria's weak innovation performance is not supporting productivity gains. Synergies with Horizon Europe including its widening instruments can help improve performance. High priority investment needs have therefore been identified to enhance research and innovation capacities and the uptake of advanced technologies and in particular to:

- strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- increase the number of innovative firms (introducing and developing innovations) in high tech and knowledge intensive sectors in line with the smart specialisation strategy
- increase the competitiveness and efficiency of the research system by putting emphasis on performance and by creating incentives for attracting qualified researchers (e.g. improving working conditions, international collaboration and mobility, cooperation with businesses)
- develop skills in universities and research institutions to increase the commercial viability and market relevance of their research projects and ability to participate in research consortia
- support collaboration between research and businesses technology transfer and commercialisation of research outcomes
- promote business investment in research and innovation intangible assets and entrepreneurial universities.

The business environment for small and medium-sized enterprises remains a challenge as Bulgaria is underperforming in the area of entrepreneurship with the lowest score in the EU. High priority investment needs have therefore been identified for growth competitiveness and skills development of small and medium-sized enterprises and in particular to:

- foster the creation of new firms as well as scale-ups in particular through financial instruments and investments in intangibles and also through cooperation networks and consolidation of clusters including coordination with other Danube Region States
- encouraging the entrepreneurial ecosystem in particular outside Sofia and the sustained engagement of small and medium-sized enterprises in the Entrepreneurial Discovery Process
- develop market-driven special Information and Communications Technology skills in small and medium-sized enterprises
- develop entrepreneurship skills including by searching for synergies between governmental and private business initiatives for support of start-ups and entrepreneurship.

The number of digitalised enterprises in 2017 was among the lowest in the EU while the relative improvement of digital public services resulted in an increased number of e-government users. In addition to digital skills cyber-security is an issue. Investment needs have therefore been identified to sustain the relative progress and reap the benefits of digitalisation for citizens companies and governments and in particular to:

- increase Information and Communications Technology uptake in small and medium-sized enterprises including supporting infrastructures and services all with a view to improving the number of enterprises reaching a high digital intensity
- upscale and accelerate e-government including the take-up of EU-wide interoperable services.

Croatia

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

The innovativeness of the Croatian economy is low and progress in improving innovation performance is very limited. High priority investment needs (58) have been identified to enhance research and innovation capacities and the uptake of advanced technologies by taking into account territorial differences and in particular to:

- strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- increase the number of innovative firms in the smart specialisation areas with the highest growth potential
- develop universities' and research institutions' capacity to enhance market relevance of their research projects build critical research mass and attract talent in the strategic smart specialisation areas
- support collaboration between universities and businesses enabling transfer of technology and commercialisation of research outcomes support cross-regional transnational and interregional projects
- strengthen governance of the smart specialisation strategy.

Croatia has made progress in digitalisation but further action is needed to exploit its potential. Priority investment needs have been identified to reap the benefits of digitalisation for citizens companies and governments and in particular to:

- support integration of digital technology in small and medium-sized enterprises including infrastructures and services by taking into account territorial differences
- promote the range of interoperable e-services and their uptake by citizens
- upscale and accelerate Digital Public Services in a systemic way.

Croatia ranks last among peers in business environment Croatian firms are weakly integrated in global value chains. Business investment in research and development is low and concentrated in large companies with low participation of small and medium-sized enterprises. High priority investment needs have been identified to enhance growth and competitiveness of small and medium-sized enterprises and in particular to:

- move up the global value chains
- identify new markets cooperation networks stimulate potential for innovation clusters by looking into emerging trends markets and concentration in high-performing sectors
- enhance quality of business support institutions and business environment.

Skills shortages and mismatches are among the main barriers for further economic development of Croatia. High priority investment needs have been identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- reskill and upskill in smart specialisation areas with a particular attention to supporting acquisition of key competences including digital skills
- strengthen education and training institutions including higher education and centres of vocational excellence to foster skills for innovation and stimulate entrepreneurship culture.

Cyprus
Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation
Cyprus remains a moderate innovator with innovation performance having declined since 2010. Public and private research and development expenditure levels are among the lowest in the EU and interaction between academia and businesses is very limited. In order to strengthen innovation performance and foster productivity growth investments should be geared towards already identified or potential new smart specialisation areas on the basis of national needs and potential. Priority investment needs have been identified to enhance research and innovation capacity of the business sector and increase the uptake of advanced technologies and in particular: • promotion of business investment in research and innovation and entrepreneurial universities and collaboration between research institutions universities and businesses • promotion of business technology transfer networking clusters and open innovation including in cooperation with other countries • support of activities that allow innovations to reach the market including diffusion of digital and other key enabling technologies especially for start-ups and small and medium-sized enterprises • support of the establishment of Living Labs test-beds and ecosystems that bring together the demand and supply sides to promote the development and actual use of innovative solutions for public sector needs. Cyprus has a moderate digital enabling environment and low performance on digital transformation. Priority investments needs have been identified to reap the benefits offered by digitalisation and E-services for citizens businesses and public sector and in particular to: • provide support for the increase of Information and Communications Technology uptake in small and medium-sized enterprises including supporting infrastructures and services • increase the range of e-service provision (e-government, e-procurement, e-inclusion, e-health, e-learning, e-skilling, e-commerce) and their uptake by citizens and businesses. Increasing entrepreneurship and the innovation capacity of the business sector and boosting investments and access to finance are crucial for the country to improve competitiveness of small and medium-sized enterprises. High priority investment needs have been identified to enhance growth and competitiveness and to increase export market shares of small and medium-sized enterprises and in particular to: • foster the creation of new firms growth of start-ups/scale-ups accelerators develop and implement new business models for small and medium-sized enterprises through business advisory services • facilitate access to finance and advanced business services for small and medium-sized enterprises • boost internationalisation of small and medium-sized enterprises through cooperation and clustering identification of and participation in new export markets participation in industry led and research driven inter-regional cooperation networks and clusters • support training and reskilling for smart specialisation areas within firms research institutions advisory services and build the necessary administrative capacity in particular in digital skills.

Czech Republic

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

The Czech Republic is lagging behind as regards the proportion of innovative companies which are crucial drivers of competitiveness. High priority investment needs have been identified to strengthen research and innovation capacities and the uptake of advanced technologies in particular to strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential in order to:

- increase attractiveness and competitiveness of the research system by improving management practices and reducing red tape funding based on the quality of research creating incentives for attracting qualified researchers and upgrading research infrastructures where there is clear evidence of commercial interest and proven links to the smart specialisation
- support cooperation and knowledge transfer between research/academia and businesses in priority sectors
- increase the number of innovative firms and start-ups in the smart specialisation sectors with the highest potential also taking into account regional specialisations
- promote investment in universities and secondary schools reflecting the smart specialisation priorities.

Although the Czech Republic ranks around the EU average in terms of the integration of digital technology households' uptake and companies' use of data-driven technologies remain limited. Priority investment needs have been identified to reap the benefits of digitisation for citizens companies and governments and in particular to:

- upscale and accelerate e-government including the take-up of eHealth and Europe-wide interoperable services
- support integration and uptake of digital technology in small and medium-sized enterprises including infrastructures and services.

Small and medium-sized enterprises lag behind in investment into research development and innovation activities and the upgrade of their position in the global value chains. High priority investment needs have been identified to improve the competitiveness of small and medium-sized enterprises and support technology diffusion and uptake in particular to:

- support companies to move up in global value chains increase productivity and facilitate participation in industry led and research driven international and macro regional clusters
- strengthen the research and innovation capacities of small and medium-sized enterprises by supporting development and implementation of new business models and adoption of new and emerging technologies
- provide support for proof of concept early stage and scale-ups of innovative firms via financial and soft support measures (e.g. business support services, innovation hubs, etc.)
- support small and medium-sized enterprises' internationalisation to grasp new business opportunities related to the digital carbon-neutrality resource efficiency and circular economy transitions.

Digitisation and automation may lead to growing skills mismatches. High priority investment needs have been identified to develop skills for smart specialisation industrial transition and entrepreneurship in particular to:

- provide businesses and research institutions with tools to adapt and develop skills for smart specialisation industrial transition and entrepreneurship

- support growth of small and medium-sized enterprises by specific training and reskilling for smart specialisation areas and innovation management and building administrative capacity (with a special attention to digital skills and industrial transition)
- improve the practise-based approach in vocational education and training higher education system supporting the linkages between schools and companies.

Denmark

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Overall Denmark is an Innovation Leader but private research and development investment is increasingly concentrated on a small number of large businesses. This means that the majority of Danish small and medium-sized enterprises are not sufficiently preparing for the future through innovations in products and processes. Investment needs (35)have been therefore identified to enhance research and innovation capacities and the uptake of advanced technologies in small and medium-sized enterprises and in particular to:

- promote cooperation between small and medium-sized enterprises and academia and encourage universities/research centres to be actively involved in projects whilst developing entrepreneurial ecosystems cooperation could involve stakeholders in other regions and also across borders notably in the framework of the EU Strategy for Baltic Sea Region
- invest in firms' capacity to internalise external knowledge and new technologies strengthen market-oriented research and development including through the establishment of Living Labs and facilitate innovation uptake in small and medium-sized enterprises in order to allow them to participate in global value chains
- strengthen effective connectivity between actors in the innovation ecosystem in order to facilitate a quicker commercialisation of research in the high growth smart specialisation areas
- increase the diffusion of the latest digital developments and other key enabling technologies through the network of digital innovation hubs via science/business collaboration to allow Danish small and medium-sized enterprises to exploit new technologies to generate growth.

Among Danish small and medium-sized enterprises there are relatively few with a high growth rate and employment in fast growing firms is below the European average. Investment needs have therefore been identified to enhance growth and competitiveness of small and medium-sized enterprises which could boost productivity growth and in particular to:

- promote the creation of and broaden the scope of innovative firms among small and medium-sized enterprises (foster growth of start-ups/scale-ups/accelerators) and enable them to sufficiently prepare for the future through innovations in products and processes in the smart specialisation areas with the highest growth potential
- facilitate growth and internationalisation of small and medium-sized enterprises through the use of networks and clusters on a regional interregional and international level. The partnerships and knowledge sharing can be the basis for further innovations and co-operation in line with the EU Strategy for the Baltic Sea Region. This could open up potential for new exports high tech sales and boost employment creation.

The improving economic situation following the financial and economic crisis has led to shortages of skilled labour and firms are facing challenges in recruiting certain types of workers. There is room to improve the matching of supply and demand of relevant digital skills. Investment needs have therefore been identified for the development of skills for smart specialisation industrial transition and entrepreneurship in synergy with lifelong learning actions under Policy Objective 4 and in particular to:

- specific training and reskilling for smart specialisation areas at all levels within firms and building the necessary administrative capacity with a particular attention to digital skills and the need to address industrial transition
- trainings on managing innovations to small and medium-sized enterprises research institutions and to entities that provide support and advisory services
- strengthening the integration of education and training providers including universities and vocational education and training centres within national and regional innovation technology diffusion and skills development ecosystems
- support cooperation on promoting mobility of researchers across borders to better utilise the available human capital.

Estonia

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

The relative strengths of Estonia are in business-friendly environment very good start-up's' ecosystem and well-developed research infrastructure. In contrast the general innovation performance of the country is moderate and rather in decline the industry relies on a narrow base of high-tech companies and the proportion of employment in fast-growing companies in innovative and high value added sectors remains low and holds back productivity growth and competitiveness. High priority investment needs have been identified to enhance research and innovation capacities and the uptake of advanced technologies where appropriate in cooperation with other countries and in line with the EU Strategy for the Baltic Sea Region. This is in particular to:

- strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- increase the number of innovative companies in the smart specialisation sectors
- strengthen the supply side of research and innovation by increasing the attractiveness competitiveness and sustainability of the research system and diversification of the applied research areas
- support collaborative research between universities and businesses making it possible to transfer technologies commercialise research results and increase the capacity and role of clusters and competence centres.

Estonia ranks high in the provision of digital public services however some weaknesses present in areas such cyber security and open data availability. Despite the good performance in public sector companies do not make a full use of digital opportunities. Priority investment needs have been identified to reap the benefits of digitisation for citizens companies and governments and in particular to:

- increase information and communications technology uptake in small and medium-sized enterprises including digitalisation marketing and e-commerce
- increase public sector capacity to analyse and safely manage open and big data
- upscale and improve the user-friendliness of public e-services including in a cross-border context.

Small and medium-sized enterprises are important in terms of overall added-value and employment. However, they are small productivity growth remains relatively slow and they are not sufficiently integrated in domestic and international clusters and relatively low positioning in the global value chains. High priority investment needs have been identified to enhance growth and competitiveness of small and medium-sized enterprises and in particular to:

- internationalise their activities so that they can move up in global value chains
- increase productivity and growth prospects of the small and medium-sized enterprises
- promote entrepreneurship and increase start-ups survival rates

- identify new export markets and promote participation in international cooperation networks and clusters particularly in the Baltic Sea region.

Despite the leading position of Estonia in e-Government the transition of industry and small and medium-sized enterprises to new technologies is held-back by the low capacity of the companies to innovate and insufficient digital skills within companies. Investment needs have been identified to help companies to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- provide small and medium-sized enterprises and research institutions with targeted trainings on management skills innovation technological transfer and on re-skilling in smart specialization areas
- develop the capacity of universities' and research institutions' to improve the commercial viability and market relevance of their research projects including through more researcher mobility between research institutions and companies
- increase the level of digital skills available in companies to boost productivity.

Finland

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Despite the focus on building a well-functioning innovation ecosystem business research and development intensity public research and development support and other innovation expenditure of firms have declined and scope for improvement remains for science-business cooperation and internationalisation. Priority investment needs have therefore been identified to enhance research and innovation capacities and the uptake of advanced technologies where appropriate in line with regional smart specialization strategies and in particular to:

- strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential develop research competence and innovation clusters that draw from regional strengths in all regions notably in northern sparsely populated and other transition regions including making use of piloting testing and demonstration environments advancing development platforms and increasing business-academia cooperation as well as interregional cooperation in new value chains also across borders within the framework of any relevant strategy markedly the EU Strategy for Baltic Sea Region
- strengthen innovation work in companies including promoting the development and commercialization of products services and production methods and introduction of new technologies supporting prototypes piloting and demonstrations of new products materials and production methods developing applied research studies and experiments as well operational and commercialization processes that support businesses enhancing innovations that reduce harmful environmental effects and risks and promoting research and development and innovation activities related to the quality and sustainable use of environment and resources that create important preconditions for businesses as well as corresponding piloting and demonstration actions.

The proportion of fast-growing innovative firms and start-up rates remain below the EU average. Priority investment needs have therefore been identified to enhance the growth and competitiveness of small and medium-sized enterprises in line with the smart specialization strategy and in particular to:

- create new business activities including supporting start-ups and development of new business as well as commercialization and entry into market of small and medium-sized enterprises´ ideas products and services
- promote small and medium-sized enterprises growth and expansion abroad including strengthening the business competence and readiness to expand abroad of growth-oriented companies aiming to international markets supporting investments and development projects by small and medium-sized

enterprises developing company clusters networks and other forms of cooperation involving also large companies and including improving the visibility of the Baltic Sea Region as a cluster of entrepreneurship to attract investment and expertise.

Even though Finland is among the advanced digital economies in the EU digital transformation of public services require a sustained effort digital public services for businesses remain limited significant differences persist among businesses in integration of digital technology e-commerce and selling online cross-border lag behind. Investment needs have therefore been identified to reap the benefits of digitisation for citizens companies and governments and in particular to:

- increase Information and Communications Technology up-take in small and medium-sized enterprises
- enhance e-government and e-services including the take-up of Europe wide and cross-border interoperable services.

Finland's innovation leadership lacks economic impact skills shortages persist and knowledge transfer remains insufficient. Investment needs have therefore been identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- promote innovation management in small and medium-sized enterprises and support reskilling for smart specialization areas within firms regions and smart cities including in cooperation with the Baltic Sea Region
- develop capacities of higher education and research institutions to enhance the commercial viability and market relevance of their research projects as well as to take part and cooperate in interactive and open innovation processes and strengthen the integration of education and training institutions with innovation ecosystems also across borders.

France

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Despite being a strong innovator France's innovation performance remains below that of EU innovation leaders and shows much disparity among regions. France is not on track to meet its total research and development intensity target of 3% for 2020. National and regional needs and potential are to be taken into account as well as regional innovation smart specialisation strategies and synergies with Horizon Europe and InvestEU. Internal disparities will have to be considered when increasing regional investments in research and development to levels closer to the ones of the most advanced French regions (e. g. Ile-de-France and Midi-Pyrénées).

High priority investment needs (75) are identified to enhance research development and innovation capacities in particular to improve collaboration and collaborative schemes (e. g. clusters) between public research institutions and private companies and contribute to increase the competitiveness of the French economy by developing new processes new technologies and new products that can be implemented in the production sector to increase competitiveness.

Priority investment needs have therefore been identified to:

- On the basis of the updated regional innovation smart specialisation strategies increase the attractiveness of French research development and innovation activities at regional level including through recruit of highly qualified and skilled researchers
- support the transformation and the development of new value chains by supporting the development of the necessary skills technologies and infrastructures and by stimulating the integrated cooperation in new value chains across programmes and across borders

- reap the benefits of digitisation for citizens small and medium sized enterprises and governments in particular in inter-regional projects.

France performs below the EU average on entrepreneurial activity and the small and medium sized enterprises regional competitiveness index shows high internal disparities. High priority investment needs have therefore been identified to enhance growth and competitiveness of Small and medium sized enterprises and to implement a smart industrial transformation and induce more connections among actors (clustering) in particular to:

- contribute to the generation of new start-ups through the facilitation of the integration of Research Development & Innovation outcomes into the economic exploitation by new small and medium sized enterprises in the productivity and services sectors
- contribute to the scaling-up of the newly created start-ups assist young heads of Small and medium sized enterprises in the early stage of life of their enterprise (e. g. nurseries)
- contribute to improve the position of French small and medium sized enterprises within EU internal and external markets including through cross-border and transnational cooperation.

Germany

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Germany boasts some of the most innovative regions in the EU however performance varies between regions and the country as a whole has slipped from its former position of 'Innovation Leader' to 'Strong Innovator'. Therefore priority investment needs have been identified to 'enhance research and innovation capacities and the uptake of advanced technologies' and in particular to:

- strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential.
- facilitate the transition towards new technologies based on smart specialisation strategies.
- boost expenditure on research and development and innovation particularly private investment of small and medium-sized enterprises and in the East of Germany. Continue investment in the development of key enabling and emerging technologies.
- enhance technology transfer between the public and private sectors in and across regions and beyond borders especially in new value chains.
- build synergies and joint projects with other Länder regions and Member States.

Widespread adoption of new Information and Communications technology would support productivity growth in Germany leading to more sustainable trajectories. Therefore priority investment needs have been identified to 'reap the benefits of digitisation for citizens companies and governments' and in particular to:

- increase Information and Communications Technology uptake in small and medium-sized enterprises including supporting infrastructures and services supporting the development and implementation of business models based on new technologies with a special focus on digital newcomers and laggards.
- enhance the provision of public e-services including possible cross-border activities when there is a need and improve their uptake by citizens.

Private research and innovation in Germany is concentrated in large enterprises rather than small and medium-sized enterprises the latter having fallen behind their international counterparts which impacts on their competitiveness. Hence priority investment needs have been identified to 'enhance growth and competitiveness of small and medium-sized enterprises' especially in the East of Germany and in particular to:

- support small and medium-sized enterprises to increase their own innovation competence by implementing innovation and fostering cooperation with other small and medium-sized enterprises and research organisations also in other Member States.
- provide support for small and medium-sized enterprises to bridge the critical stages of development (incl. scale-up) especially for innovative start-ups in particular in transition regions. Improve possibilities for small and medium-sized enterprises business succession by providing advice and funding.
- make the economy more circular and resource-efficient for example by supporting eco-innovations and business models for more sustainable products and production systems.

The German economy faces the challenge of a significant shortage in qualified workers the risk of automation and shortcomings in respect of life-long learning outcomes. Investment needs have been identified to 'develop skills for smart specialisation industrial transformation and entrepreneurship' and in particular to:

- provide support for upskilling of the workforce refining and reshaping of skill sets of existing occupations and (re)training workers towards new demands including the cross-border labour market.
- promote the good practises for high-tech leadership skills and develop measures within smart specialisation strategies to overcome the shortage of highly-skilled professionals.
- strengthen the integration of education and training institutions including higher education and centres of vocational excellence within national and regional innovation technology diffusion and skills development ecosystems.
- develop skills in smart specialisation areas for small and medium-sized enterprises in particular in relation to digitalisation industrial transformation and entrepreneurship in cooperation with education and training institutions.

Greece

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

The Greek economy is characterised by very low public and private investments in innovation and a low ranking in the Global Competiveness Index (last of the EU28). Specifically in relation to small and medium sized enterprises innovators performance has fallen since the start of the crisis. In order to strengthen innovation performance and foster productivity growth smart specialisation areas are identified based on national and regional needs and potential. High priority investment needs are identified to enhance research and innovation capacities and the uptake of advanced technologies in particular:

- promote business investment in research and development and foster collaboration between public and private research on targeted smart specialisation areas
- facilitate business technology transfer networking clusters and open innovation
- support activities that allow innovations to reach the market especially for start-ups and small and medium sized enterprises in the digital market
- develop skills related to smart specialisation areas in particular reskilling and digital skills.

Greece ranks very low in the uptake of information technologies and is last of the EU28 on the e-government scoreboard. High priority investment needs are identified to close the gap with respect to the Digital Agenda for Europe to reap the benefits of digitalisation for citizens businesses and the public sector in particular:

- support the increase of information and communication technology uptake in small and medium sized enterprises (business to business, business to consumer, consumer to consumer) including supporting infrastructures and services

- expand and complete the range of e-service provision (e-government, e-procurement, e-inclusion, e-health, e-learning, e-skilling, e-commerce) and their uptake by citizens businesses and the public sector.

Access to finance for small and medium sized enterprises remains a very problematic area and framework conditions for entrepreneurship innovation and start-ups are unfavourable. Credit conditions tightened significantly during the financial crisis and remain very restrictive compared to other EU countries. High priority investment needs are identified to enhance the growth and competitiveness of small and medium sized enterprises in particular:

- foster growth of start-ups / scale-ups and accelerators and develop integrated business advisory services
- promote entrepreneurship and support for new business models
- encourage industrial cluster development and enhanced cooperation between small and medium sized enterprises and universities/research centres.

Hungary

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Hungary's overall innovation performance remains moderate relative to that of the EU while investment in research and development and science-business cooperation are below the EU average. High priority investment needs are identified to enhance research and innovation capacities and the uptake of advanced technologies in the smart specialisation areas and in particular to:

- support the inter-institutional links and cooperation among stakeholders of research/academia and business build critical research mass and attract talent in the strategic smart specialisation areas in order to turn research and development results into business applications especially in cities with university capacity
- build on the existing research capacities as knowledge centres of smart economic transformation support knowledge transfer and strategic partnerships
- support networking cooperation and exchange of experience beyond national boundaries including joint cross-regional transnational and interregional projects.

High speed broadband coverage will be sufficient by 2021 in Hungary however it still belongs to the low-performing countries in terms of Information and Communications Technology uptake and the use of data-driven technologies. Priority investment needs are identified to reap the benefits of digitalisation for citizens and companies by:

- increasing Information and Communications Technology uptake in small and medium-sized enterprises including supporting infrastructures and services taken into account the territorial differences
- improving digital skills special attention needed in the education of both sides – consumers and business.

Hungarian small and medium-sized enterprises suffer from low productivity and innovation activity hindering their involvement in global value chains. High priority investment needs are identified to enhance growth and competitiveness of small and medium-sized enterprises including in rural areas and in particular to:

- raise productivity and the value added of the economy by increasing the number of innovative firms invest in firms' capacity to apply new technologies in order to rank up in global value chains
- encourage the entrepreneurial ecosystem foster the creation of start-ups/scale-ups accelerators develop new business models for small and medium-sized enterprises in particular through investment in intangible

- raise competitiveness and internationalisation of small and medium-sized enterprises also through participation in industry led and research driven international clusters and cooperation among the Central and Eastern European and Danube Strategy countries.

Human capital represents a bottleneck to productivity gains. High priority investment needs are identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular through:

- specific trainings in re- and upskilling in smart specialisation areas innovation management entrepreneurship and innovative business models within firms with attention to the need to address industrial transition and circularity adjust skills development to the business needs.
- Cooperation actions in the context of the EU Strategy for the Danube Region and the Thematic Smart Specialisation Platforms would be beneficial. To strengthen innovation performance and foster productivity growth smart specialisation areas should be identified on the basis of national and regional needs and potential.

Ireland

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Ireland is considered a strong innovator while none of its three regions are innovation leaders. The country continues to lag behind in the level of investment in research and innovation that affects leveraging business investments in research and innovation the linkages between research and enterprises and the creation of patented intellectual assets and innovation outcomes. Business research and innovation investment is concentrated on a small number of foreign multinationals operating in a few sectors only in Ireland. Innovation capacity capability and the ability of Irish-owned firms to fully utilise new technologies is weakened in particular by low research and innovation levels.

To help create a balance in research and innovation between the foreign multinationals and domestic companies high priority investment needs have therefore been identified to provide adequate public funding by new targeted forms of measures that address Irish small and medium-sized enterprises specific needs in research and innovation create a stronger targeted innovation capacity and capability in and for Irish domestic small and medium-sized enterprises based on a reinforced link with cooperation with research centres and large businesses and also based on a reinforced link with evolving Smart Specialisation areas and a more effective and faster innovation diffusion and in particular to:

- enhance Research and Innovation capacities and the uptake of advanced technologies
- enhance Competitiveness and growth of Irish-owned small and medium-sized enterprises
- strengthen innovation performance in all regions and foster productivity growth by prioritising smart specialisation areas on the basis of national and regional needs and potential including green innovation
- encourage cooperation activities on corresponding Smart Specialisation priorities and exchange of experience (inter-regional among the Irish regions and including with neighbouring countries, clusters and in the context of the EU Atlantic Strategy). This would also help to address persisting regional differences in the research and development intensity. Stimulate interregional cooperation in new value chains also with other countries
- strengthen eco-innovation and research development and innovation focusing on green and blue innovation including in the area of water innovation on clean energies climate change mitigation and low-carbon technologies and on making Ireland a more circular economy.

This means in practice in particular to:

- create stronger linkages between multinationals and domestic firms to improve innovation diffusion (technological spill-overs) stronger cooperation between firms and public research centres to strengthen the innovation capacities of domestic small and medium-sized enterprises (improving the relatively weak science-business linkages and capitalise on Ireland's scientific excellence) reinforce Irish small and medium-sized enterprises absorption capacities to successfully apply new technologies in particular in low-carbon and clean energy technologies incentivise domestic small and medium-sized enterprises to engage in knowledge investments (i.e. in research and innovation) and in human capital investments (i.e. lifelong learning to improve managerial and digital skills)
- invest in Irish firms' capacity to internalise external knowledge spill-overs in innovation and new technologies in order to participate at a higher level in global value chains foster public and business investment in research and innovation overcome barriers to research and innovation activity increase the number of innovative indigenous firms enhance cooperation and exchange of experience (inter-regional, including with neighbouring countries, clusters, in the EU Atlantic Strategy context) link regional research and innovation actors to industrial stakeholders from different Member States
- Use innovation as a way to reduce energy consumption and greenhouse gas emissions. This could be through promotion of innovative energy efficiency solutions in businesses including in their premises installations and processes. In addition the use of innovative renewable energy technologies could also contribute to this goal
- create policies and schemes to overcome barriers to innovation take-up further develop industrial clusters that include small and medium-sized enterprises within and outside national borders.

The improvement in economic conditions over the last two years has translated itself into close to full employment. This has led to shortages of high-skilled labour and a mismatch between skills available and the needs of Irish firms to upgrade their own skills levels and competitiveness. Irish firms continue to face challenges/lose workforce to established foreign multinational companies in particular regarding more highly skilled employees. Ireland should look to improve the match between the supply of and demand for SME-relevant skills in particular managerial and digital skills. High priority targeted investment needs have therefore been identified for the development of skills for Smart Specialisation industrial transition and entrepreneurship in synergy with small and medium-sized enterprises-relevant lifelong learning actions and upskilling under Policy Objective 4 and in particular to:

- develop and upgrade skills for smart specialisation industrial transition and entrepreneurship
- reap the benefits of digitalisation for companies and citizens via the 2025 EU Gigabit Society compatible broadband speeds being delivered from the ERDF 2014-2020 period.

This means in practice in particular to:

- foster innovation management in Irish SMEs in particular with regard to upgrading managerial skills and the need to address the issue of smart industrial transition integrate high education and vocational excellence with national regional and transnational innovation its diffusion and skills development systems
- create new business models and forms of employment arising from the digital transformation whilst ensuring fair working conditions and social protection help the small and medium-sized enterprises across the country to use superfast and ultrafast broadband being delivered to allow such enterprises to increase their competitiveness to innovate increase productivity and to reach new markets and customers and grow rapidly foster the adoption of digital technologies in Irish small and medium-sized enterprises enable Business-to-business Business-to-customer and Customer-to-customer new business opportunities.

Italy
Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation
Expenditure on research and innovation in Italy is significantly below EU average and the country is considered a moderate innovator. Italy has room to foster productivity growth by enhancing research and innovation capacities and the uptake of advanced technologies in line with national and regional smart specialisation strategies. High priority investment needs are identified to address the technological economic and societal challenges while tackling strong regional divergences in particular to: • increase the number and the scale-up of innovative firms in knowledge-intensive sectors with the highest growth potential • foster knowledge exchanges between research organisations and businesses especially innovative small and medium sized enterprises in particular through collaborative partnerships and training. • support innovative services for research organisations and companies that cooperate with the aim of transforming new ideas into commercially viable innovative enterprises. Given the lack of integration of digital technologies in the economy and the low level of digital skills investment needs have therefore been identified to promote digitisation for citizens companies and governments and in particular to: • increase digital skills in small and medium sized enterprises and their uptake of digital technology solutions including e-commerce e-payments cloud-computing services and also internet of things cybersecurity and artificial intelligence • improve the deployment of digital public services for both citizens and businesses and e-procurement to support the efficiency and transparency of public administrations. Italian small and medium sized enterprises perform below EU average in terms of productivity and growth. Investment needs have therefore been identified to enhance growth and competitiveness of small and medium sized enterprises and in particular to: • foster growth and productivity-enhancing strategies through promotion of entrepreneurship managerial and financial skills skills related to industrial transition (e.g. energy efficiency and circular economy) and value chains integration • support internationalisation of small and medium sized enterprises to move up in the global value chains including by joining cooperation networks and inter-regional clusters • facilitate access to finance and address regional disparities through a balanced use of grants and financial instruments in less-developed regions and a wider use of financial instruments in more-developed ones.

Latvia
Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation
Latvia's innovation performance lags behind most other EU countries with low added value/complexity high resource intensity and lack of cooperation and integration in global value chains. This has direct consequences on the country's productivity and competitiveness. High priority investment needs have therefore been identified to enhance research and innovation capacities and the uptake of advanced

technologies where appropriate in cooperation with other countries in line with the EU Strategy for the Baltic Sea Region and in particular to:

- strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- increase the number of innovative firms in the smart specialisation sectors by fostering research and innovation to facilitate the transition towards new technologies and value added activities
- strengthen research and innovation by increasing the attractiveness and the competitiveness of the research system
- support collaborative research between universities and businesses.

Latvia rates highly in the offer of digital public services by the government with some weaknesses in quality and open data availability. However companies and people (for lack of skills) do not make sufficient use of the digitalisation opportunities. Priority investment needs have therefore been identified to reap the benefits of digitalisation for citizens companies and governments in particular to:

- upscale and accelerate e-government interoperability of systems and open data availability
- increase information and communications technology uptake in small and medium-sized enterprises including supporting infrastructures and services
- increase e-services provision and their uptake with special focus on rural areas elderly people and in a cross-border context.

In Latvia the level of private research and development expenditure is the lowest in the EU inevitably limiting the advancement of companies towards the technological frontier as well as their productivity and competitiveness. High priority investment needs have therefore been identified to enhance growth and competitiveness of small and medium-sized enterprises in particular to:

- promote entrepreneurship in particular start-ups and accelerators also via technology transfer and development programmes and promoting alternative sources of financing
- strengthen the competitiveness and growth prospects of innovative small and medium-sized enterprises for more sophisticated products and services to move up the global value chain
- support small and medium-sized enterprises to internationalise activities and identify new export markets cooperation networks and interregional clusters particularly in the Baltic Sea region.

The transition to new technologies in Latvia is hampered by low digital proficiency within companies. Moreover, insufficient availability of skilled human resources is one of the country's biggest issues. Investment needs have therefore been identified to develop skills for smart specialisation industrial transition and entrepreneurship in particular to:

- reskill and upskill small and medium-sized enterprises in smart specialisation areas with a particular attention to digital skills and entrepreneurship in order to increase productivity
- enhance market relevance innovation and viability of research institutions' projects via ad hoc training activities.

Lithuania

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Lithuania's general innovation performance and the proportion of innovative and high added value businesses which both are the main drivers of productivity and competitiveness are lagging behind the EU28 average. High priority investment needs have therefore been identified to enhance research and innovation capacities and the uptake of advanced technologies where appropriate in cooperation with other countries and in line with the EU Strategy for the Baltic Sea Region as well as building on the lessons learned in

Lithuania during the implementation of the Commission pilot project on industrial transition and in particular to:

- strengthen innovation performance and productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- increase the number of innovative firms in the smart specialisation sectors with the highest potential and taking into account regional specialisations
- strengthen the supply side of research and innovation by increasing the attractiveness and competitiveness of the research system
- support collaborative research between universities and businesses thereby enabling technology transfer and commercialisation of research outcomes.

Uptake of broadband by households and use of advanced data-driven technologies by firms remain limited despite Lithuania's relatively high ranking in terms of broadband coverage. Priority investment needs have therefore been identified to reap the benefits of digitalisation for citizens companies and governments and in particular to:

- increase Information and Communications Technology uptake in small and medium-sized enterprises including supporting infrastructures and services
- promote the range quality and interoperability of e-services provision and their uptake by citizens with special focus on rural areas and the older population and in a cross-border context
- upscale and accelerate open data e-government.

Firms in Lithuania are relatively small and weakly integrated into domestic and international clusters and global value chains. The start-up ecosystem is relatively young and dynamic and needs further development. High priority Investment needs have therefore been identified to increase the growth and competitiveness of small and medium-sized enterprises and in particular to:

- strengthen the competitiveness and growth prospects of the innovative small and medium-sized enterprises
- internationalise their activities and move up the global value chains
- identify new export markets and promote participation in cooperation networks and interregional clusters including in the Baltic Sea region
- promote entrepreneurship as well as the creation and growth of start-ups/scale-ups and accelerators.

The transition to new technologies in Lithuania is hampered by weak innovation and a low degree of digital proficiency within companies. Investment needs have therefore been identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- provide small and medium-sized enterprises and research institutions with targeted training on how to manage innovations
- support small and medium-sized enterprises in re-skilling in smart specialisation areas
- develop universities' and research institutions' capacity to improve the commercial viability and market relevance of their research projects develop digital skills in small and medium enterprises in order to increase their productivity.

Luxembourg

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Luxembourg appears too dependent on the financial sector and lags behind in diversification of its economic structure. Strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential.

Investment needs have been identified to enhance research and innovation capacities and the uptake of advanced technologies and in particular to:

- support technology transfer and diffusion of innovation through networks between businesses and research centres and through networks of digital innovation hubs and incubators
- enhance cooperation in key digital technologies eco-innovation support cluster development through the implementation of interregional projects across EU national borders
- stimulate integrated cooperation in new value chains across programmes and across borders.

Even though companies perform above the EU average in business digitisation electronic information sharing radio frequency identification and the use of social networks small and medium-sized enterprises lag behind in e-commerce. Investment needs have been identified to reap the benefits of digitisation for citizens companies and governments and in particular to:

- facilitate the integration of digital technologies by companies
- develop sustainable and circular district and cities
- invest in common smart mobility systems through cooperation with neighbouring countries.

Most of the Scoreboard's indicators on innovation in small and medium-sized enterprises are on a declining trend including commercialisation of innovation. The percentage of small and medium-sized enterprises introducing product or process innovations also declined as did the percentage of small and medium-sized enterprises innovating in-house. Investment needs have been identified to enhance growth and competitiveness of small and medium-sized enterprises and in particular to:

- encourage industrial cluster development and enhanced cooperation between small and medium-sized enterprises and universities/research centres and the sustained engagement of small and medium-sized enterprises in the Entrepreneurial Discovery Process
- develop small and medium-sized enterprises skills and capacities in the exportation of their products and services and the commercialisation of innovation especially online.

A large share of companies report difficulties in filling Information and Communications Technology vacancies which suggests a skills mismatch. Investment needs have been identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- provide small and medium-sized enterprises with training and reskilling possibilities for smart specialisation areas with a particular attention to digital skills and encourage them to mutualise their training needs by supporting and co-financing clusters and joint national regional transnational and international cooperation in innovation sectors.

Malta

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Malta's research and innovation performance has improved but the proportion of innovative enterprises is still lagging behind. Priority investment needs have therefore been identified to strengthen research and innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential and in particular to:

- promote business investment in research and innovation science-business cooperation and enhance research and development capacity in sectors linked to the smart specialisation
- enhance development and provision of key digital technologies

- support networking clusters cooperation joint cross-regional and interregional projects
- promote the development of innovative firms in the smart specialisation areas
- improve energy and resource efficiency water-management cycle waste management and sustainable mobility such as for instance in the shipping industry
- foster investment in eco-innovation.

Even though Malta scores well on broadband coverage investment needs are identified to reap the benefits of digitisation for citizens companies and governments including:

- Information and Communication Technologies up-take in small and medium sized enterprises including infrastructures and services
- e-government including the take-up of Europe-wide interoperable services.

Small and medium enterprises have experienced significant growth both in terms of added value and employment. However the limited natural resources of the country may limit their potential. Therefore investment needs are identified to enhance growth and competitiveness of medium-sized enterprises by helping them to turn environmental challenges into opportunities in particular in order to:

- foster the creation of new firms growth of start-ups/scale-ups accelerators develop and implement new business models for medium sized enterprises that address country's environmental challenges in the areas
- encourage the entrepreneurial ecosystem including development of industrial clusters and enhanced cooperation between medium sized enterprises and universities/research centres particularly in the areas of green economy circular economy resource efficiency
- facilitate access to finance and advanced services for medium sized enterprises
- increase medium sized enterprises competitiveness and internationalisation by moving up in the global value chain.

High priority investment needs are identified to enhance skills for smart specialisation industrial transition and entrepreneurship especially having regard to sustainability issues in particular to:

- promote innovation and eco-innovation management in medium sized enterprises promote specific training and reskilling for smart specialisation areas and eco-innovation
- strengthen the integration of education and training institutions within innovation technology diffusion and skills development ecosystems
- develop skills for higher education and research institutions to increase the commercial viability and market as well as sustainability relevance of their research projects.

Netherlands

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Even though the Netherlands ranks high in terms of innovation and competitiveness indices expenditure on research and development relative to gross domestic product remains below national targets with private expenditure on research and development below the EU average. High priority investment needs have been identified to enhance research and innovation capacities and the uptake of advanced technologies within the framework of regional smart specialisation strategies that identify priority areas based on regional needs and potential and in particular to:

- develop and utilise the innovation eco-system and stimulate market oriented cooperation between business and research centres in order to increase business investment in research and innovation in particular in small and medium-sized enterprises
- stimulate interregional cooperation in new value chains also with other Member States
- strengthen investment in developing new processes products and services

- support the development of campuses and living labs with participation of small and medium-sized enterprises
- address skills challenges for smart specialisation and the innovation capacity of small and medium-sized enterprises linked in an integrated manner to investments in the above areas.
- Such investments could also help address the important challenges that the Netherlands faces related to the energy and climate transition and the circular economy.

Poland

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Poland's innovation performance remains far below the EU average much of which is due to meagre research and development investments especially private ones and modest cooperation of public and private innovation partners. High priority investment needs have been identified to enhance research and innovation capacities and the uptake of advanced technologies to be implemented in synergies with other EU programmes and initiatives such as Horizon Europe, Life, Coal Regions for Transition Initiative, Catching-up Regions Initiative and others and in particular through:

- supporting risky elements of research and development business investments including pilot lines early product validation certification and advanced manufacturing
- facilitating business – science cooperation schemes and projects to enable larger research commercialisation and providing research-based and innovative solutions for business
- building critical research mass and attracting talent in strategic smart specialisation areas
- enhancing research and development networking and cooperation (intra-regional, regional, clusters, international, including within the Baltic Sea Strategy) especially within smart specialisations to foster truly innovative projects and ensure better integration into regional and global networks.

The productivity of small and medium-sized enterprises is growing slowly. Smaller businesses also strive to remain competitive and trade on domestic and foreign markets. High priority investment needs have been identified to increase the competitiveness and internationalisation of small and medium-sized enterprises in particular through:

- supporting measures increasing productivity such as improvement of technology management practices and workplace skills for better integration in global value chains
- facilitating access to advanced business services
- further stimulating the entrepreneurial environment including industrial cluster development enhanced cooperation between small and medium-sized enterprises and research institutions and sustained engagement of small and medium-sized enterprises in the development of smart specialisation areas.

The use of information technologies by firms and digital interaction of citizens with public authorities remain low. Priority investment needs have been identified to reap the benefits of digitisation for citizens, companies and governments and in particular to:

- upscale and accelerate e-government including e-health
- support the integration of digital technology by small and medium-sized enterprises to increase productivity and efficiency
- promote digital skills, including upskilling and reskilling to address the gap between the demand for and availability of a digitally-skilled workforce.

Labour shortages translate into growing skills mismatches which hamper the growth of innovative and fast-developing sectors. Investment needs have been identified to enhance skills within small and medium-sized

enterprises and research institutions as regards smart specialisation areas industrial transition and entrepreneurship through:

- developing skills in smart specialisation areas, innovative business models, technology transfers and innovation management also as an integral part of other investments under Policy Objective 1
- strengthening of work-based learning in smart specialisation areas.

Portugal

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Portugal remains a "moderate" innovator and overall low research and development intensity hinders the upgrade of the economic productive structure. The implementation of smart specialisation areas based on national and regional potential strengthens innovation performance and fosters productivity growth. High priority investment needs have been identified to enhance research and innovation capacities and the uptake of advanced technologies aiming at complementarity and compatibility with Horizon Europe instruments in particular to promote:

- public and private investment in research and innovation as a tool to move up the value added chain and to increase innovation in firms across sectors and develop technologies for transition to a carbon neutral economy
- collaboration between public and private research and support technology transfers in a few specialisation identified areas
- mobility of qualified human resources between universities research and development institutions tech centres and companies.

Digital skills and uptake of digital technologies by firms and people remain low. Priority investment needs have been identified to increase uptake to reap digitisation benefits for citizens companies and governmental bodies and promote digital inclusion and in particular to:

- promote the acquisition and development of digital skills and market-driven information and communication technology skills
- support the integration of digital technologies into businesses and production processes of micro and small and medium-sized enterprises including by developing infrastructures and services like digital innovation hubs
- increase the range of digital services provided (e-government, e-procurement, e-inclusion, e-health, e-learning, e-skilling, e-commerce) and taken up by citizens with special focus on rural remote and outermost regions and on vulnerable groups of the population.

A predominance of micro and small companies affects innovation capacity and productivity. Internationalisation levels are relatively weak with the share in medium-high and high-tech exports substantially lower than the EU average. High priority investment needs have been identified to enhance small and medium-sized enterprises growth and competitiveness and in particular to:

- enable firms to scale up, create jobs, internationalise and promote a climate neutral industrial transformation
- encourage the entrepreneurial ecosystem, networking, new marketing tools, strengthening of managerial skills and financial literacy, knowledge-sharing across sectors and national borders
- facilitate access to credit and to equity capital and improve awareness of the available funding opportunities and advanced business services for small and medium-sized enterprises.

Skills gaps hinder productivity technological diffusion and affect the development of innovative competences. Priority investment needs have been identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- stimulate training and re-skilling in smart specialisation areas in particular in key enabling technologies and related skills and in the new emerging fields.

Romania

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Romania's expenditure on research and innovation is significantly below the EU average and the country displays a stagnant research and innovation performance and low technological outputs. High priority investment needs are identified to enhance research and innovation capacities and skills and the uptake of advanced technologies in all Romanian regions including in the capital region taking into account the results of the Catching Up Regions Initiative and in particular to:

- support collaboration between public research institutions and innovative industries increase the attractiveness and performance of research and development organisations and encourage applied research through innovation hubs and joint national and transnational investments in early product validation commercialisation patenting start-up formation and technology transfer
- support Entrepreneurial Discovery Processes and Project Development Labs at national and regional level and provide training on skills for beneficiaries on marketing research results and developing project and business plans in order to strengthen the preparation and implementation of smart specialisation projects
- strengthen research and innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- reinforce the current research and innovation infrastructures capacities and skills to ensure participation in Horizon and other EU programmes and initiatives to integrate international cross border networks and transnational clusters and set-up joint research and education programmes and co-financing schemes
- link higher education and vocational centres to the national and regional innovation and smart specialisation reskilling system
- support the capacities and skills development of regional and national stakeholders involved in the design and implementation of smart specialisation strategies and projects in close cooperation with beneficiaries.

Romania performs significantly below the EU average in terms of digital public services and the integration of digital technologies by businesses. Priority investment needs are identified to reap the benefits of digitisation for citizens companies and governments and in particular to:

- strengthen the Information and Communications Technology up-take by small and medium-sized enterprises including investments in infrastructures foster digital skills and services and further support digital innovation hubs living labs etc.
- increase measures for e-government including the introduction and consolidation of Europe wide interoperable services e-inclusion e-health e-learning e-skilling.

Romania's share of innovative companies is behind the EU average and the country is confronted with a persistent low level of business investment in research and innovation. Priority investment needs are identified to enhance growth and competitiveness of small and medium-sized enterprises and in particular to:

- support the creation of new companies (start-ups, scale-ups), increase their survival rates and raise their degree of competitiveness and internationalisation
- increase the innovation capacities of companies, by introducing product, organisational or marketing innovations, by providing training on innovation management and smart specialisation specific skills,

marketing research results skills, by supporting key enabling technologies and acceleration of market access and by supporting industrial cluster development and integration into industry-research driven cooperation networks ,including cooperation with the EU Strategy for the Danube Region countries
- facilitate access to finance for small and medium-sized enterprises including by encouraging seed and early stage finance for high-potential innovative start-ups.

Slovakia

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Slovakia has shown limited progress in improving research and innovation performance with targets for research and development spending below the EU average. High priority investments have been identified to enhance research and innovation capacities and the uptake of advanced technologies and in particular to strengthen innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential to:

- increase attractiveness efficiency and competitiveness of the research and innovation system supporting consolidation and sustainability of the whole research system notably stabilisation of infrastructure and creating incentives for attracting and retaining qualified researchers in the smart specialisation areas
- capacity building to enhance cooperation between the business and academia mobilising knowledge and technology transfer and strengthening research capacities in industries
- support a transnationally and/or macro regionally co-ordinated research and innovation funding
- support small and medium sized enterprises internationalisation to grasp new business opportunities related to the digital carbon-neutrality resource efficiency and circular economy transitions
- foster business investment in research and innovation and enhance networking cooperation and exchange of experience between academic researchers and companies.

In digitalisation, there is still a significant gap between Slovakia and the EU average. Investment needs are identified to reaping the benefits of digitisation for citizens companies and governments and in particular to:

- increase the information and communications technology uptake in small and medium sized enterprises including supporting infrastructures and services
- increase the quality and effectiveness of e-service provision taking into account regional differences and prioritising regions lagging behind
- cooperate with neighbouring countries in developing mutually recognisable e-services.

Small and medium-sized enterprises are not the moving force of the Slovak economy and smart specialisation is still at its beginning. High priority investment needs are identified to enhance growthand competitiveness of small and medium-sized enterprises in particular to:

- support companies to move up in global value chains increase productivity facilitating participation in industry led and research driven international clusters
- enhance the research and innovation capacities of small and medium sized enterprises by supporting development and implementation of new business models adoption of new and emerging technologies and provision of advanced business services to small and medium-sized enterprises.

Labour shortages lead to growing skills mismatch. High priority investment needs are identified to develop skills for smart specialisation industrial transition and entrepreneurship in particular to:

- provide enterprises and research institutions with tools to adapt and develop skills for smart specialisation industrial transition and entrepreneurship

- training and reskilling for smart specialisation areas at all levels within small and medium sized enterprises and building the necessary administrative capacity with a special attention to digital skills
- improve the practise-based approach in vocational education and training higher education system supporting the linkages between schools and enterprises also taking into account the lessons learnt from the Catching-up Regions Initiative in Prešov region.

Slovenia

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

The national targets for spending on research and development remain far from achieved and the proportion of innovative enterprises lags behind the EU average. High priority investment needs have therefore been identified to enhance research and innovation capacities and uptake of advanced technologies and in particular to:

- strengthen research and innovation performance and foster productivity growth by identifying smart specialisation areas on the basis of national and regional needs and potential
- increase the value added of the economy and strengthen the strong innovator position by increasing the number of innovative firms in the smart specialisation areas
- foster cooperation between research and business including across the EU Strategy for the Adriatic-Ionian Region EU Strategy for the Alpine Region and EU strategy for the Danube Region via strategic research and innovation partnerships centres of competence interregional projects and use of Cloud services.

The uptake of Information and Communications Technology services in small and medium-sized enterprises and further development of digital public services remain a challenge. Priority investment needs have therefore been identified to reap the benefits of digitisation for citizens companies and governments and in particular to:

- increase uptake of Information and Communication Technology in small and medium-sized enterprises including supporting infrastructures and services all with a view to improving the number of enterprises reaching a high digital intensity
- increase the uptake of e-Government services (e-inclusion, e-health, e-learning, e-skilling) and general use of internet services by citizens.

Scale-up and growth rates of enterprises remain low which combined with a challenging business environment and low capacities for technology transfer hinders the growth of the economy. High priority investment needs have therefore been identified to enhance growth and competitiveness in small and medium-sized enterprises and in particular to:

- promote entrepreneurship and increase survival rates of firms in particular by facilitating the economic exploitation of new ideas and integration of business education in the business ecosystem
- raise competitiveness and internationalisation of small and medium-sized enterprises through stronger participation in industry led and research driven international and macro-regional clusters This can be the basis for further innovations and co-operation in line with the EU Strategy for the Adriatic-Ionian Region EU Strategy for the Alpine Region and EU strategy for the Danube Region
- reduce barriers for doing business especially in less developed regions at level 3 of the Nomenclature of Territorial Units for Statistics through upgrading the entrepreneurial support ecosystem
- address increasing demographic challenges by supporting silver economy small and medium-sized enterprises.

Skills shortages and mismatches are among the main barriers for the further economic development of Slovenia. Priority investment needs have therefore been identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- reduce the capacity constraints in the economy address technological change and industrial transition challenges by providing training and skilling in smart specialisation areas
- support small and medium-sized enterprises growth and open up internationalisation opportunities by providing skills trainings on (innovation) management, stock market participation, business development, internationalisation.

Spain

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

Spain remains a moderate innovator and the innovation capabilities of its public sector and companies are insufficient to increase their productivity. High priority investment needs are therefore identified to enhance research and innovation capabilities and the uptake of advanced technologies within the framework of regional smart specialisation strategies identifying priority areas based on regional needs in particular to:

- foster investment in research and innovation in particular to increase the number of innovative firms in the Smart Specialisation Strategy sectors including innovative public procurement and development of new products processes and services
- enhance technology transfer and market-oriented cooperation between businesses research centres and universities in particular through the development and use of innovation eco-systems and the increase of the capacity of firms to internalise external knowledge
- stimulate interregional cooperation in new value chains also with other Member States
- increase synergies and complementarities between national and regional operational programmes through joint programming for a more efficient use of public resources.

In order to increase the uptake of new generation Information and Communication Technology by businesses and to improve the access to e-government and other public e-services priority investment needs are identified to reap the benefits of digitisation for citizens companies and governmental bodies and in particular to:

- support the uptake of digital technologies and Information and Communication Technology based business models for SMEs including infrastructures and services like digital innovation hubs as well as promoting e-skilling and market-driven Information and Communication Technology skills in small and medium sized enterprises
- develop and promote interoperable e-government and e-services (health, education and other public services) in particular in remote and outermost regions and including joint provision of services in border areas.

The reduced size of Spanish small and medium sized enterprises affects their innovation capacity and productivity. High priority investment needs are therefore identified to enhance growth and competitiveness of small and medium sized enterprises and in particular to:

- promote entrepreneurship growth of start-ups/scale-ups incubators and accelerators access to advanced business services and new business models for small and medium sized enterprises in particular through investment in intangibles
- boost exports by increasing the number of regular exporters in particular of SMEs with a focus on developing the link between exporting and innovation

- encourage entrepreneurial ecosystems by supporting networking business transfer ecosystems (industry-led) cluster development and deployment of joint interregional innovative projects also cross-border.

Skill gaps and mismatches hinder productivity and technology diffusion and affect the development of innovative competences in Spain. In this sense priority investment needs are identified to develop skills for smart specialisation industrial transition and entrepreneurship and in particular to:

- stimulate innovation management specific training and re-skilling in the areas of smart specialisation industrial transition and entrepreneurship in particular on key enabling technologies and emerging fields
- integrate education institutions within national and regional innovation ecosystems to increase the commercial viability and market relevance of their research projects.

Sweden

Policy Objective 1: A Smarter Europe – Innovative and smart industrial transformation

In order to reach its ambitious national target for research and development expenditure of 4% of GDP and secure its position as European leader in innovation Sweden needs to make a continuous effort to broaden the innovation base and maintain high level of investments in research and development. Regional differences in terms of innovation performance and competitiveness are accentuated. Investment needs(56) have therefore been identified to further enhance research and innovation capacities and the uptake of advanced technologies and in particular to:

- encourage the development and implementation of tailor-made smart specialisation systems at regional (programme) and national level. Promote further international and regional cooperation to exchange knowledge and achieve critical mass for the specialisations thereby particularly focusing on the 3 middle-income regions (Småland and the Islands, Central Norrland and North Middle Sweden) and the Northern Sparsely Populated Areas in order to support them to catch up and scale up their investments. Promote the coordination between the smart specialisation strategies and national Innovation Partnership Programmes and other relevant strategies (notably the EU strategy for the Baltic Sea Region) and other (non-) European countries
- further encourage regional growth processes and promote research and innovation capacities supporting existing cluster and network structures strengthening the business competitiveness and the business uptake of advanced technologies thereby contributing to diminishing the competitiveness and innovation gaps particularly in the middle-income regions and Northern Sparsely Populated Areas
- strengthen links cooperation and knowledge transfer between academia and business and promote a more active involvement of universities in projects. Support marketable and market-oriented research and development and raise business awareness of upcoming scientific developments. Support the establishment of living labs and test-beds and eco-systems that bring together the demand and supply side ensuring a better uptake of innovation in small and medium-sized enterprises
- support pilot lines early product validation technology transfer and the building of capacities in the development and provision of key digital technologies artificial intelligence cybersecurity high performance computing and in particular in the area of digital skills and deep tech.

The potential of Swedish small and medium-sized enterprises and innovative start-ups is not fully exploited there is a low proportion of SMEs with new-to-market/new-to-firm innovations and the proportion of Swedish female entrepreneurs is among the lowest in the OECD area. Investment needs in research and innovation are identified to further enhance growth and competitiveness of small and medium-sized enterprises and in particular to:

- promote continuous Entrepreneurial Discovery Processes through strengthened entrepreneurial ecosystems and the sustained engagement of small and medium-sized enterprises in these processes support Project Development Labs
- encourage female entrepreneurship including in the Northern Sparsely Populated Areas in order to reach the full potential of the economy and support small and medium-sized enterprises that employ third-country nationals and other vulnerable groups for the cause of integration
- promote the creation of new firms growth of start-ups/scale-ups accelerators as well as new business models and increase the proportion of small and medium-sized enterprises with new-to-market and new-to-firm innovations by giving support to product organisational and marketing innovations. Stimulate the uptake on enabling technologies eco innovation and green- and blue-tech sector technology as well as the acceleration of market access and internationalisation especially in Northern Sparsely Populated Areas
- support the development of regional interregional and international networks to disseminate knowledge create partnerships and promote further innovation and global value chains.

Despite the fact that Sweden is characterised by a highly skilled labour force it lacks Informations and Communications Technology specialists. Employment in high-tech sectors is above EU level only in the three large-city-regions the skills gap figures among the top barriers to growth for companies. Therefore, investment needs have been identified to develop skills for smart specialisation industrial transition and entrepreneurship in synergy with lifelong learning actions under Policy Objective 4 and in particular to:

- promote innovation management in small and medium-sized enterprises and support vocational education and training and reskilling in smart specialization areas within firms building the necessary administrative capacity including in smart cities in cooperation with peers in the Baltic Sea Region with a particular attention to digital skills and the need to address industrial transition
- promote skills development for higher education and research institutions to increase the commercial viability and market relevance and uptake of their research projects as well as their capacities to take part in interactive and open innovation processes including across borders
- strengthen the capacity of small and medium-sized enterprises to adapt to digital/technological transformation and increase their Informations and Communications Technology uptake support the automation of work/processes
- encourage the development of novel applications and the diffusion of digital and other key enabling technologies through extra-regional networks of digital innovation hubs and living labs.

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