Online S3 mechanism for knowledge-based policy advice

ONLINE Platform for Smart Specialisation Policy Advice – ONLINE S3
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1. Introduction

Although the initial design of the Research and Innovation Strategies for Smart Specialisation (RIS3) approach included a wide set of methodologies to be applied throughout its implementation (Foray et al., 2012), some of the key concepts of the various RIS3 steps were not fully understood by the regional actors (Griniece et al., 2017a). Lack of empirical guidance, as well as low levels of analytical skills of the policy-makers, both resulted to low levels of effectiveness regarding the RIS3 outcomes (Capello & Kroll, 2016; Iacobucci & Guzzini, 2016; McCann & Ortega-Argilés, 2016; Kroll, 2015; Kroll et al, 2014; Iacobucci, 2014). To this end, enhancing the analytical skills of regional authorities, as well as the participatory character of the RIS3 policy-design process, should be kept in the spotlight of innovative actions towards a more comprehensive evidence-based strategic planning. Integrated solutions for policy-design, such as the Online S3 Platform, should be considered as key elements reinforcing this vision.

The Online S3 Platform (http://s3platform.eu/) aims to expand administrative capabilities of regional institutions, and thus, become an essential tool for improving the effectiveness of decision-making processes (Panori et al., 2018, Kakderi et al., 2017). This report describes the overall platform mechanism, in terms of information flows and application interoperability. Its main rationale is to present the logical connections and the information links between the 28 developed applications, as well as to illustrate different ways in which they could be combined to provide services to the users. These services could be used to support the RIS3 design and implementation phases, as well as generic processes related to the general concept of strategic planning.

More specifically, the identification and development of 4 comprehensive roadmaps aims on more explicitly guide regional authorities towards an effective implementation of the RIS3 process. The *Mini-S3 roadmap* provides a core set of methodologies and applications that are essential for the development of RIS3 strategies, whereas the *EDP roadmap* targets on providing guidance on effectively supporting the three phases of EDP implementation – knowledge production, stakeholder engagement and knowledge sharing, as well as collaborative decision-making. The significance and role of specialisation analysis in the context of developing and implementing a RIS strategy is addressed by the *Specialisation roadmap*, whilst methodological guidance to policymakers and regional officers on specific (thematic) investment priority areas within their RIS3 strategy is provided by the *Industry vertical platforms and Global Value Chains roadmap*.

The structure of this report is the following: Chapter 2 presents a short overview of the methods that have been selected and used as a baseline for the application design, pointing out some of their key features and functionalities. It also provides a description of the overall Online S3 Platform mechanism, analysing the ways in which different tools are interconnected. It investigates existing information flows during a RIS3 design process and provides a thorough description of the proposed Mini-S3 roadmap. Chapter 3 presents in detail the roadmap that has been identified targeting on EDP implementation, whilst

Chapters 4 & 5 target on describing two additional roadmaps that have been developed, focusing on specialisation analysis and global value chains, respectively. Finally, further potentials and some discussion for the Online S3 Platform are presented in Chapter 6.

2. The overall Online S3 Mechanism

2.1 Problem identification

Strategy design and implementation is a complex and demanding effort and takes multiple forms depending on the organisation and the context of the initiative. Large companies, NGOs, utility companies, cities and regions, governments and international institutions, all these organisations use strategic planning methods and design strategies to succeed in their mission. Strategy design is characterised by uncertainty and ambiguity and requires transdisciplinary knowledge and skills, as there is a plurality of values and opinions to bridge within the organisation, many possible futures, and power games between interest groups internally and externally.

Information systems that support strategy design are becoming mainstream, but also more and more complex. A literature review of information systems for strategic planning reveals a series of factors that influence their success and shortcomings. Apart from pure information systems and dataset feeding the strategy with data, many other IT-based strategy design tools have become available, offline and online. They are used either as e-learning assistants or as step-by-step roadmaps to strategy elaboration. Within this framework, the report focuses on RIS3 and online, web-based environments that can support the design, implementation, and assessment of such strategies.

Smart specialisation strategies constitute the main growth approach of the European Union for the period 2014-2020. These strategies should be formulated by a process of discovery and innovation: as a process of 'choosing races and placing bets' rather than 'picking the winners'. Consequently, strategy interventions should be informed and precise as possible, guided by evidence appropriate to the context, and outcomes that should be monitored and evaluated using quantitative and qualitative metrics and data. The elaboration of RIS3 is an *ex ante* conditionality for the ERDF investments of the Thematic Objective 1 (Strengthening research, technological development and innovation), but also it is relevant to the *ex ante* conditionality of the Thematic Objective 2 (Enhancing access to and use and quality of information and communication technologies) and Thematic Objective 3 (Enhancing the competitiveness of small and medium-sized enterprises). *Ex ante* conditionalities are commitments that should be fulfilled to get financial support from the European Structural and Investment Funds.

To date, various contributions and preliminary RIS3 evaluation reports have highlighted the difficulties in designing and implementing a RIS3 strategy (Capello and Kroll, 2016; Komninos et al., 2014; Iacobucci, 2014; Reid et al., 2012). The initial European Commission's RIS3 planning documents provided little guidance to regional policy makers in the rather

complex process of RIS3 design policy (Iacobucci, 2014; Cooke, 2012). Furthermore, even though entrepreneurs are in better place to identify opportunities, still, the bottom-up approach of EDP, which is one of the main pillars of the RIS3 strategic planning, requires conscious moderation and careful guidance (Kroll, 2015; Iacobucci, 2014; Boschma and Gianelle, 2013). Both Iacobucci (2014) and Iacobucci and Guzzini (2016), explain different methodological ways to overcome the theoretical vagueness of the RIS3 guide in selecting priority sectors, while Boschma and Gianelle (2013) discuss how technological relatedness can provide significant input to the EDP process. Finally, we recently see the development of online tools, through the JRC S3 platform (http://s3platform.jrc.ec.europa.eu/), offering the opportunity to policy-makers to more effectively detect any emerging landscape of specialisations and benchmark regions for improved cross-border learning.

Under this framework, digital platforms have been considered as a key element for enhancing capacity-building for policy-making activities, aiming to upgrade institutional capabilities (Panori et al., 2018; Panori et al., 2017; McCann and Ortega-Argiles, 2016). Added value, when developing policy-making platforms, can be found on the strengthening of the stakeholder engagement processes, as well as the analytical skills of the users. Both of these issues are strongly related to a higher degree of RIS3 effectiveness, in terms of better identifying regional assets and features, as well as promoting opportunities for transferring good policy practices between regions.

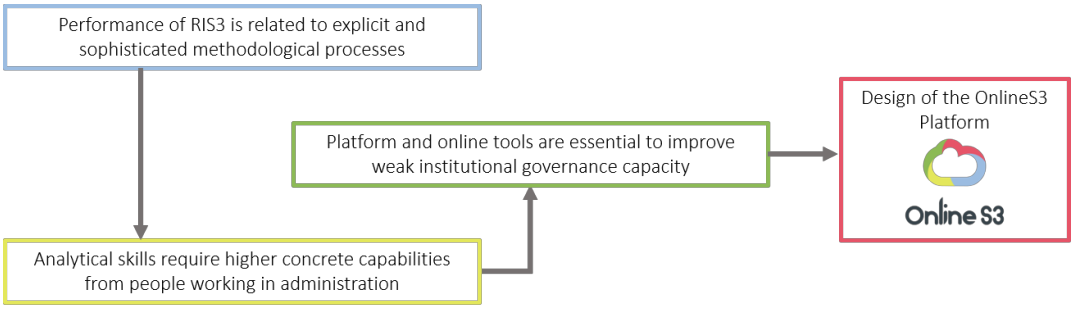
It has been argued that quality of government, alongside with its contextual and structural characteristics, is related to the quality of outcomes of processes constituting key pillars of the RIS3 approach, such as the EDP process (Rodriguez-Pose and Wilkie, 2016; Rodriguez-Pose and Garcilazo, 2015). Moreover, a recent evaluation of a number of implemented RIS3 strategies, highlighted a set of governance-related challenges, including the lack of capability to design and implement regional policies, as well as to actively engage actors in EDP processes (Capello and Kroll, 2016). At the same time, regions illustrating a satisfying level of implementation of the RIS3 policies indicate stronger possibilities to reinforce that kind of policy-making processes, through the development of novel toolsets and policy practices.

Given the fact that the original concept of the RIS3 approach has been based upon an accurate and targeted governmental intervention logic to support several promising activities (Foray, 2014), the definition of potential areas of intervention should be made through an extended set of methods, including descriptive, benchmarking and discovery exercises. As a result, any existing gap between the EU regions, in terms of high analytical skills and thus, administrative capabilities, could lead to increased levels of inequality regarding the RIS3 effectiveness. Under this context, ICT tools and online platforms target to minimize this gap, in order to reinforce the opportunities, even for less developed regions, to design an evidence-based policy, tailored to their regional specificities.

Under this scope, the Online S3 Platform (www.onlines3.eu), being developed in the framework of a Horizon 2020 project (ISSI-4-2015), has been designed to address challenges and shortcomings of RIS3 implementation and assessment. Deploying a connected

intelligence approach, the Online S3 platform uses smart assistants and roadmaps to standardise and automate the tasks of strategy elaboration; give access to databases guiding the strategy formulation by evidence and datasets; and enable participatory design that awakes the potential for collaboration among users and organisations. With all these features, the Online S3 Platform creates a community of actors (people, organisations, machines) of higher creativity, effectiveness and collective intelligence. It is a web environment that enables stakeholders and users to go through the six steps/phases of strategic planning, proposed by Foray et al. (2012) and Gianelle et al. (2016), elaborate an informed RIS3 strategy, and monitor its implementation and impact. **Figure 1** illustrates schematically the rationale behind the development of the Online S3 Platform, which arises as a means for improving weak institutional governance capacity.

Figure 1: Rationale behind the development of the Online S3 Platform.



Source: Authors' elaboration.

2.2 Selection of methods for the Online S3 Platform

Figure 2 illustrates the key phases penetrating an entire RIS3 policy-design process. As it is shown, the six phases included in this process try to capture a comprehensive set of components that are essential to a RIS3 strategic planning procedure. Starting from Phase 1, governance refers both to government and stakeholder engagement, implying a quadruple helix approach, as the key process of the innovation production. This phase is essential to be placed at the start of a RIS3 strategy design, setting the framework of the entire procedure, as user engagement and participation penetrate the whole policy-making process.

At the same time, analysis of the context (Phase 2) is a common process for retrieving background information, necessary for any strategic planning process to identify regional specificities and provide information regarding the existing institutional setting to be considered. This phase includes a broad set of methods, targeting to a descriptive, as well as a comparative analysis of a region. Analysis of the regional context targets on pointing out the strengths and weaknesses of a region, when compared to other regions, similar to it. Phase 3, including shared vision and strategy formulation, denotes the strategic and project-oriented character of RIS3, highlighting the existence of a bottom-up approach in

defining the vision, as well as the priority setting objectives (Phase 4). Policy mix (Phase 5) refers to the definition of the implementation process of the strategy through action plans' design, stressing the need for a structured project-driven approach to RIS3 implementation. Finally, monitoring indicates the need for developing a set of tools for data collection and processing, as key instrument for evaluation of the implemented actions (Angelidou et al., 2017).

It is important to highlight at this point, that the RIS3 policy-design process is not a linear procedure. In many cases, information coming as an output from the implementation of a method, might be used as input to others. Therefore, potential links of information exist between several tools, belonging not only to the same phase, but also to different phases. Thus, it is important to clarify that information flows in many cases overcome the RIS3 phases' sequential logic. Stakeholder engagement, intervention logic, as well as monitoring constitute three characteristic cases of methods, receiving and transmitting information from and to a wide number of other methods.

Figure 2: Phases included in the RIS3 policy-design and implementation process on the Online S3 Platform.

Source: Authors' elaboration based on Foray et al. (2012) and Gianelle et al. (2016).

The selection of the 28 methods, corresponding to the 6 phases of the RIS3 strategic planning process, has been based on a set of methods that have been collected through a mapping exercise, as well as a gap analysis between these methods and a review for good practices (Griniece et al., 2017b). The mapping exercise revealed that regions did not follow in detail the RIS3 steps proposed by Foray et al. (2012), for designing their methodological approaches, as even the key concepts of the various RIS3 steps were not fully understood. The results also point out that there is no real link between the level of innovativeness of a

region and the methodological sophistication of RIS3 design. Hence, it cannot be claimed that moderate and modest innovator regions generally use fewer and less rigorous methods, than leading innovation regions.

At the same time, literature review on good practices has indicated several emerging methodologies, that still have not been used by the regions during their RIS3 design but could possibly enhance the overall effectiveness of the process. These include foresight exercises and diagnostic tools to identify new activities, possible synergies and complementarities that may arise within the regional context (Ortega et al., 2013). Furthermore, the use of unstructured data could reveal potential emerging areas of technological and economic activity in a more accurate way (Bakhshi and Mateos-Garcia, 2016). Focusing on strengthening the evidence-based and participatory character of the RIS3 design, policy-makers could also include crowdsourcing priority setting methods and social media analysis for assessing stakeholders' views, through opinion mining and sentiment analysis techniques. Finally, the lack of policy intelligence tools and methods, reflecting the ways in which the monitoring process could be used with a view of a continuous RIS3 update process, was noticeable throughout the literature review on good practices. The use of open data could work on a positive way towards this direction, as it would allow to track progress in terms of objectives and visions, as well as to see how they match with the overall RIS3 approach.

The results, alongside with a short description of the application that has been developed for each method are presented in Griniece et al. (2017b). The description includes the main functionalities of each application, which have been derived based on the key concepts of the corresponding methodology. Information presented in **Table 1** provides a baseline, upon which we can further understand the main features of the Online S3 Platform mechanism, as well as the arising links between the developed applications. A detailed analysis regarding these issues is given in the following section. It should be noted that in all cases, the name of each method corresponds to the name of the developed application. Moreover, the terms method and tool are being used interchangeably in this report.

Table 1: List of the selected methods/tools for the Online S3 Platform.

Name of the method	Short description
Phase 1: Governance	
1.1 Vision sharing	An application that allows RIS3 managers to create visually attractive infographics that can be used to communicate to a broad audience what RIS3 is about, what are the priority sectors and actions.
1.2 Debate at a glance	Application enabling participatory deliberation, in order for policy makers and stakeholders to visualize and share networks of thought, make their reasoning transparent and open to collaborative and iterative reflection.
1.3 Legal and	An application providing an overview of ERDF regulations and EU

administrative framework	processes of selecting and funding projects in the framework of national/regional Operational Programmes (OPs).
Phase 2: Analysis of the context	
2.1 Regional assets mapping	Application that draws together information on key regional assets. The objective is to support descriptive analysis of regional assets including a number of key categories.
2.2 Research infrastructure mapping	An application for mapping the existing research infrastructures across the EU regions, providing basic background information for regional policy makers in their RIS3 process.
2.3 Clusters, incubators, and innovation ecosystem mapping	An application for mapping the innovation ecosystem of a region, in terms of existing clusters, incubators, co-working spaces, start-up support, and the challenges of openness, funding and sustainability of such 'soft' innovation infrastructure.
2.4 Benchmarking	An application for comparing the performance of a region with regions that are structurally similar, through providing comparative measures for a series of indicators imported by the user.
2.5 Regional scientific production profile	Application producing 'scientific profiles' for regions, based on Scopus data.
2.6 Specialisation indices	The application produces technological and economic specialisation indexes, for understanding the position of regional technological and economic activities in global value chains.
2.7 SWOT analysis	An application for completing the SWOT analysis results, including regional strengths, weaknesses, opportunities and threats.
Phase 3: Shared vision / Strategy formulation	
3.1 Collaborative vision building	This application capitalises on the outputs obtained in 3.2 and 3.3 and provide tailored online guidelines on the necessary additional steps to arrive at a shared vision for regional smart specialisation strategy.
3.2 Scenario building	An application supporting RIS3 scenario building exercises, through the development of baseline scenarios and data projections for scenarios building.
3.3 Delphi - Foresight	An application to provide a supportive function to run Delphi-type methods for RIS3.
Phase 4: Priority setting	
4.1 EDP focus groups	Application providing a roadmap for the implementation of EDP,

	including the definition of industry activities and groups, the selection of stakeholders to be involved, the communication of conclusions about opportunities and emerging innovation ecosystems, and the use of EDP conclusions by the regional and national authorities for drafting calls for actions.
4.2 Extroversion analysis	Application to detect possible industry segments in which regions present increased extroversion, in terms of exports, attraction of FDI, or other forms of regional openness.
4.3 Related variety analysis	Application for calculating the Related/Unrelated variety entropy indexes, estimating whether specialisation or diversification objectives should be given priority.
Phase 5: Policy mix / Action plan implementation	
5.1 Intervention logic	Application where users can build intervention logic roadmaps, essential to achieve the regional vision and priorities. It is a central application that gathers and comprehensively illustrates information from several other tools.
5.2 Action-plan co-design	Application for enhancing collaboration between citizens and policy-makers, throughout the design of an action-plan.
5.3 Budgeting	Application for providing a framework for using different budgeting methods to capture the funding dimension of the RIS3 action plan and the needs for funding across the defined implementation period.
5.4 State-aid law compliance for RIS3 implementation	Application for helping the user/policy-maker to identify, if their policy instruments included in its RIS3 policy mix/action-plan is eligible for State aid.
5.5 Calls consultation	Application enabling RIS3 stakeholders to assess calls for projects under SF operational programmes that are made by regional authorities.
5.6 Innovation maps	Visualisation tool teasing out information about regional technological trends, using grant data that is collected from RIS3 programmes and initiatives.
5.7 Open data tool	Application allowing to track relevant actions from EU research projects available on CORDIS.
Phase 6: Monitoring	
6.1 Monitoring	Application to define the overall process/roadmap for RIS3 monitoring.

6.2 Definition of output and result indicators	Application to provide an online guidance on indicator selection and data processing of the results from the implemented actions.
6.3 Balanced scorecard	Application drawing together all monitoring indicators together with the results and outcomes achieved to date.
6.4 Beneficiaries and end users' satisfaction online survey	Application for collecting information regarding levels of satisfaction of the RIS3 beneficiaries.
6.5 Social media analysis	Application analysing data coming from social media.

Source: Griniece et al. (2017a) and authors' elaborations

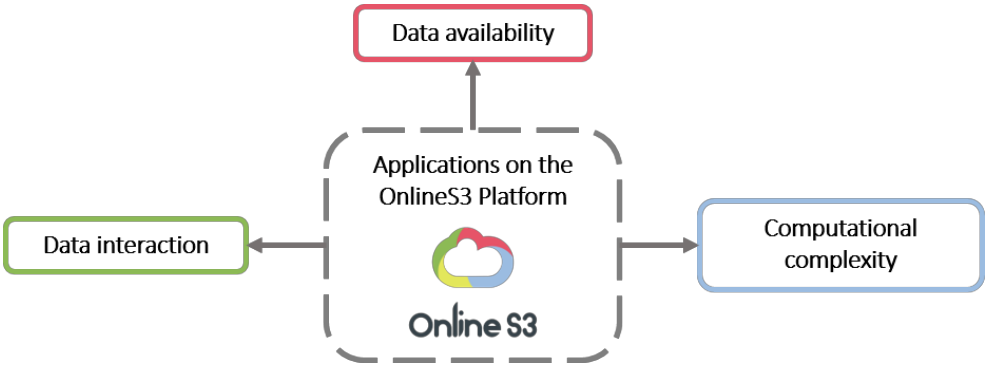
In many cases, policy-makers and regional authorities do not perfectly understand the rationale behind the design process of a RIS3 strategy (Kroll, 2015), not only from a theoretical perspective, but also in terms of data processing and management. This fact results to the development of fragmented approaches, regarding the implementation regional RIS3 strategies, which try to combine outcomes from several methodologies, characterised by missing links between them. This, of course, is an essential parameter that decreases the overall effectiveness of the decision-making process, as it does not take full advantage of the underlying information hidden in the existing data.

The next section tries to further explore the main functional characteristics of the abovementioned set of applications to provide a deeper analysis, which could reveal the rationale behind the selection and use of a concrete set of methods, instead of random selections, based mostly on data availability

2.3 The Online S3 Platform mechanism

In order to effectively categorize the abovementioned applications, a set of parameters has been used, based on the data and computational features of the applications. The main criteria used in this study for the categorisation of the Online S3 Platform applications are illustrated in Figure 3. Lack of data availability refers to the need for the user to provide the essential input to the application, in order to obtain a result. At the same time, existence of computational complexity is related to the feature of a tool to perform any computational process, such as calculation of indices, assessment of co-design processes, visualisation of results, etc.

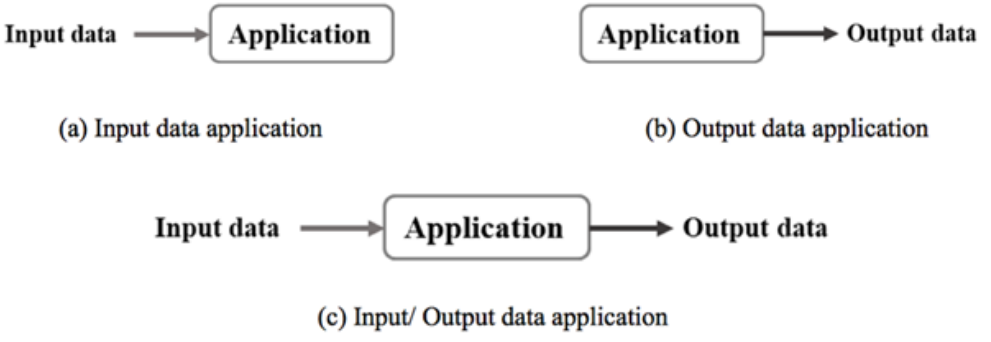
Figure 3: Main categorisation criteria of the applications.



Source: Authors' elaboration.

In terms of data interaction, the abovementioned set of applications can be separated into two discrete categories: i) applications whose outputs are used as inputs for other tools; ii) applications that receive feedback from other tools as input to perform their functionalities; and iii) applications that combine these two characteristics. In the case of input or output we refer to internal data processes, meaning that they come solely from tools that are part of the Online S3 Platform. For example, the *Regional assets mapping* application uses as input a set of data coming from EUROSTAT, whereas its outputs can be used as inputs for the *Benchmarking* and *SWOT analysis* tools. Given the above, this application will be characterized as an output app, as we do not take into consideration the input data, which come from an external source. The three categories of applications are given schematically in **Figure 4**, below.

Figure 4: Categorisation of Online S3 applications based on data interaction.



Results coming from the described classification process are presented in **Table 2**. As it can be seen, in the majority of the cases the user is actively involved in the process for providing all the essential input information for the tools. Moreover, the Online S3 Platform facilitates and enhances the policy-design process, as it offers a significant number of applications that expand users' analytical capabilities, in terms of data processing, including computation of complex indices, visualisation and assessment. This is one of the key advantages of using

the Online S3 Platform tools. It works complementary to the already existing policy-makers' experience, offering them the opportunity to expand the evidence-based basis of their analysis, when designing a RIS3 strategy. This fact strengthens the probability for revealing hidden smart specialisation opportunities within regions and making this imposed ex-ante conditionality even more substantial.

Regarding data interaction, the results for the tools' classification are presented in the third column of Table 2. Given the large number of applications that have been developed for the Online S3 Platform, the definition of all existing information flows between them has been a very complex procedure. A graphical illustration of the most critical information links between the 28 applications is given in Figure 5, below. Not all flows have been included in this diagram, in order to avoid an illegible scheme. Inflows are marked with a solid line, whilst outflows are illustrated with dashed line.

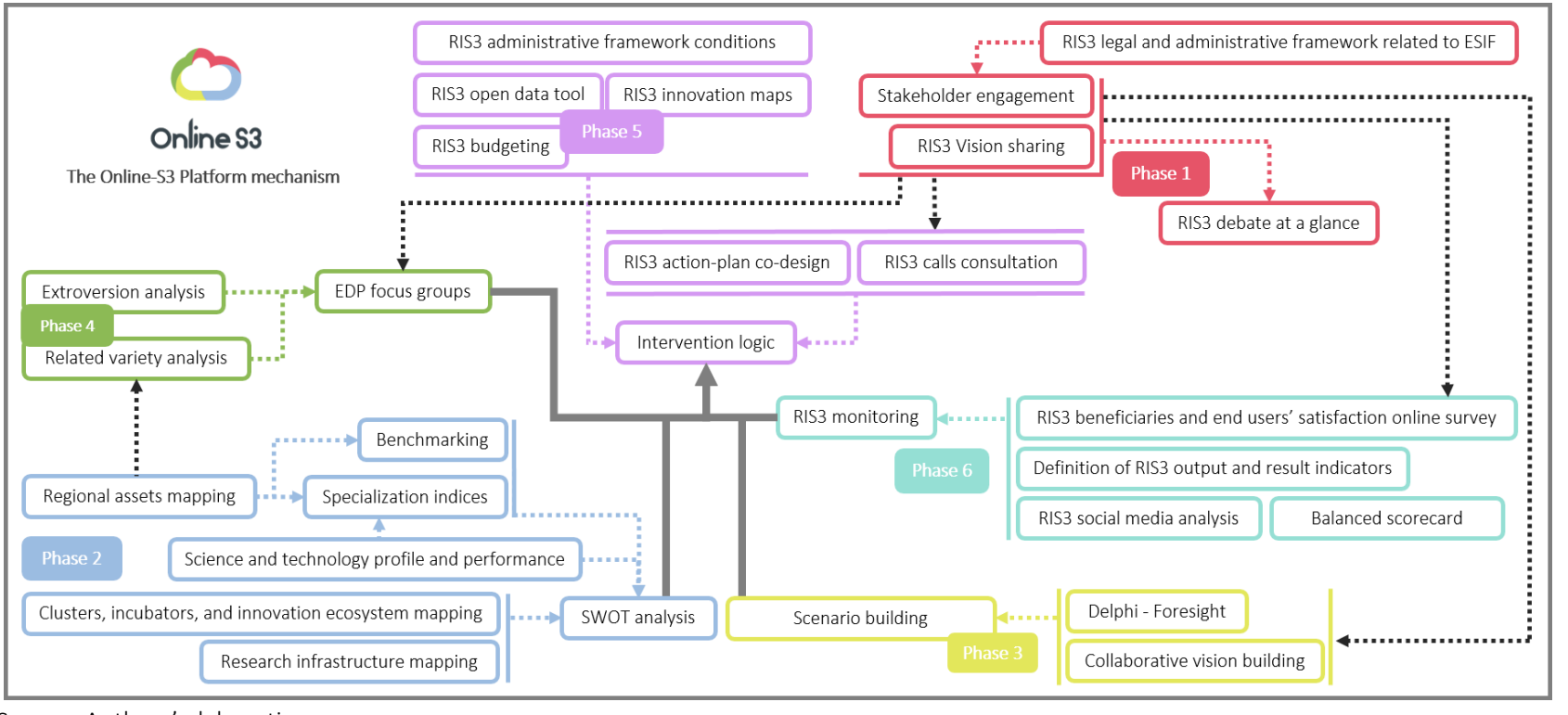
Figure 5 indicates the complexity lying behind the information flows of the Online S3 Platform applications. Analysis of the context and governance are the starting points of the overall RIS3 process, as they provide feedback which is necessary for the next phases to be implemented. Moreover, the underlying links between the *Stakeholder engagement* application and the phases of shared vision, priority setting and policy mix, reflects the central role of public consultation throughout the design process of a RIS3 strategy. Strategy formulation and action plan definition are both strongly affected, and thus, co-created by policy-makers and stakeholders. Monitoring and evaluation, having as one of their main pillars to inform decision-makers about the achievements of the RIS3 strategy and whether implementation is on track (Gianelle and Kleibrink, 2015), provide continuous feedback to the *Intervention logic* application.

Table 2: Results from the application classification process.

Name of the method	Data availability	Data interaction	Computational complexity
Phase 1: Governance			
1.1 Vision sharing	No	Output	No
1.2 Debate at a glance	No	Input/Output	Yes
1.3 Legal and administrative framework	Yes	Output	No
Phase 2: Analysis of the context			
2.1 Regional assets mapping	Yes	Output	Yes
2.2 Research infrastructure mapping	Yes	Output	No
2.3 Clusters, incubators, and innovation ecosystem mapping	Yes	Output	No
2.4 Benchmarking	No	Input/Output	Yes
2.5 Regional scientific production profile	No	Output	Yes
2.6 Specialisation indices	No	Output	Yes
2.7 SWOT analysis	No	Input/Output	No
Phase 3: Shared vision/Strategy formulation			
3.1 Collaborative vision building	No	Input/Output	No
3.2 Scenario building	No	Input/Output	Yes
3.3 Delphi - Foresight	No	Input/Output	
Phase 4: Priority setting			
4.1 EDP focus groups	No	Input/Output	No
4.2 Extroversion analysis	Yes	Output	Yes
4.3 Related variety analysis	No	Output	Yes
Phase 5: Policy mix/Action plan implementation			
5.1 Intervention logic	No	Input	No
5.2 Action-plan co-design	No	Input/Output	Yes
5.3 Budgeting	Yes	Output	No
5.4 State-aid law compliance for RIS3 implementation	Yes	Output	No
5.5 Calls consultation	No	Input/Output	Yes
5.6 Innovation maps	No	Input/Output	Yes
5.7 Open data tool	No	Input/Output	Yes
Phase 6: Monitoring			
6.1 Monitoring	No	Input/Output	Yes
6.2 Definition of output and result indicators	No	Input/Output	Yes
6.3 Balanced scorecard	No	Input/Output	Yes
6.4 End users' satisfaction online survey	No	Output	Yes
6.5 Social media analysis	No	Input/Output	Yes

Source: Authors elaboration

Figure 5: The Online S3 Platform information flow mechanism.



Source: Authors' elaborations

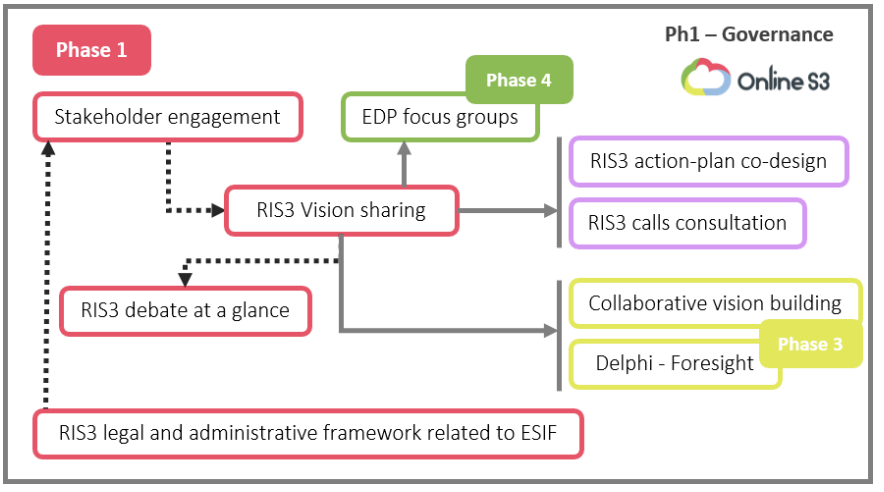
2.4 The Online S3 Platform phases

Within the Online S3 Platform mechanism, Stakeholder engagement, Intervention logic and RIS3 monitoring are, perhaps, three of the most critical applications, penetrating the whole process of policy-design and assessment. In this section, we will further explore their internal structure, in order to highlight their important role throughout the design of a RIS3 strategy.

Phase 1: Governance

The main target of *Phase 1 – Governance* is to facilitate and enhance some essential processes throughout the RIS3 design process. The *Stakeholder engagement* application, together with the *RIS3 vision sharing*, provide the users with all the essential information and utilities, related to the definition of the stakeholders' groups, as well as engagement and dissemination activities. Given that the RIS3 strategic planning process is largely characterized as a bottom-up approach, in terms of stakeholders' participation, these tools constitute vital ingredients for establishing an effective link between policy-makers and stakeholders. Figure 6 presents all information flows starting from these two applications, towards several other tools, belonging to the same or different phases of the overall RIS3 design process. As it can be seen, *Stakeholder engagement* and *RIS3 vision sharing* apps provide feedback to almost all phases of the design process. Looking more carefully at the type of applications linked to them, someone can find traditional methods, such as *Foresight* and *EDP focus groups*, as well as novel approaches, like *Collaborative vision building*, *Calls consultation* and *Action-plan co-design*. At the same time, *RIS3 debate at a glance* focuses on increasing the overall regional policy intelligence, in terms of crowdsourcing priority setting, through opinion mining and sentiment analysis.

Figure 6: Main structure of Phase 1 - Governance.



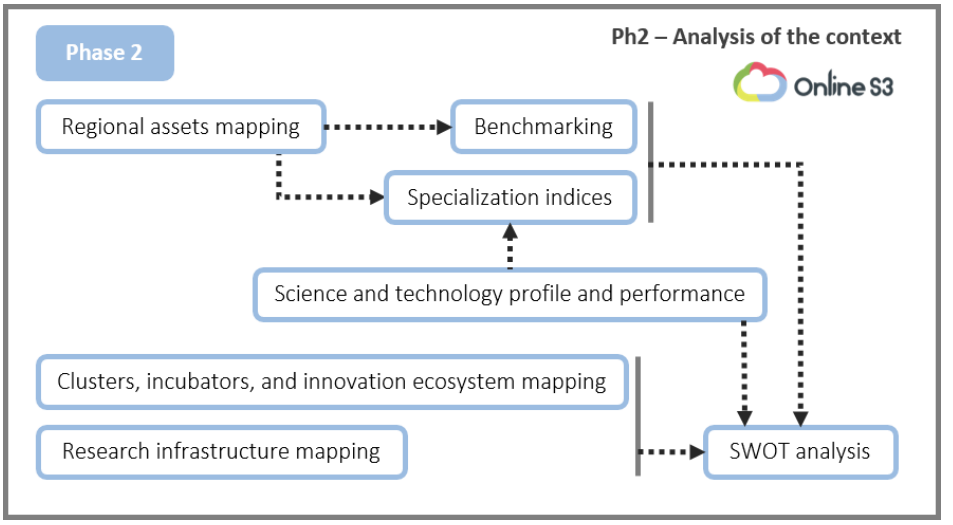
Source: Authors' elaboration.

Phase 2: Analysis of the context

The *Phase 2 - Analysis of the context* phase includes a selection of applications focusing on providing a set of indicators that best describe the overall regional characteristics. The selected variables can be used to a) map the existing infrastructures and reserves, in terms of productive resources, and b) to compare a specific region with a selected group of other regions. These might include regions belonging to the same countries, or regions that tend to be similar to the one under investigation, thus considered to be competitors.

Figure 7 presents the overall internal structure of Phase 2. As it can be seen, the *Regional assets mapping* application constitutes an initial source of data, that can be used as input to perform *Benchmarking* and to calculate the *Specialisation indices*. Moreover, results coming from the *Science and technology profile and performance* tool can also be used as inputs for both these cases. The use of the other two applications, *Clusters, incubators and innovation ecosystem mapping* and *Research infrastructure mapping*, aims to provide essential information regarding the mapping of existing clusters and scientific infrastructures, based on which policy-makers can more effectively design their RIS3 strategy, given the fact that RIS3 strategies should be formulated by a process of discovery and innovation: as a process of '*choosing races and placing bets*' rather than '*picking the winners*'.

Figure 7: Main structure of Phase 2 – Analysis of the context.



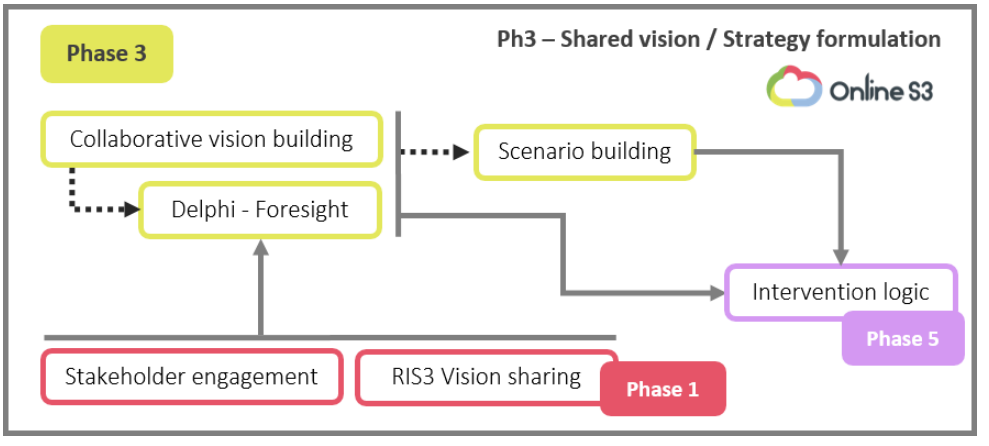
Source: Authors' elaboration.

Phase 3: Shared vision / Strategy formulation

Regarding *Phase 3 – Shared vision and Strategy formulation*, the main concept of this phase is to collaboratively build a common vision and future scenarios for a region, that will be included in the RIS3 strategy. For this reason, *Collaborative vision building,* and *Delphi-Foresight* applications are used, as ways for mining public opinion regarding possible future

scenarios for the region. All these inputs can then be used as a baseline, encompassing place-based characteristics and specificities, upon which the *Scenario building* application can run. As it is shown in **Figure 8**, this phase provides essential feedback to the design of the overall *Intervention logic* of the RIS3 strategy. Moreover, given the fact that both applications, *Collaborative vision building* and *Delphi-Foresight*, are based on stakeholder participation, *Stakeholder engagement* and *RIS3 vision sharing* tools can once more be used to facilitate the process of RIS3 vision dissemination and engagement.

Figure 8: Main structure of Phase 3 – Shared vision/Strategy formulation.



Source: Authors' elaboration

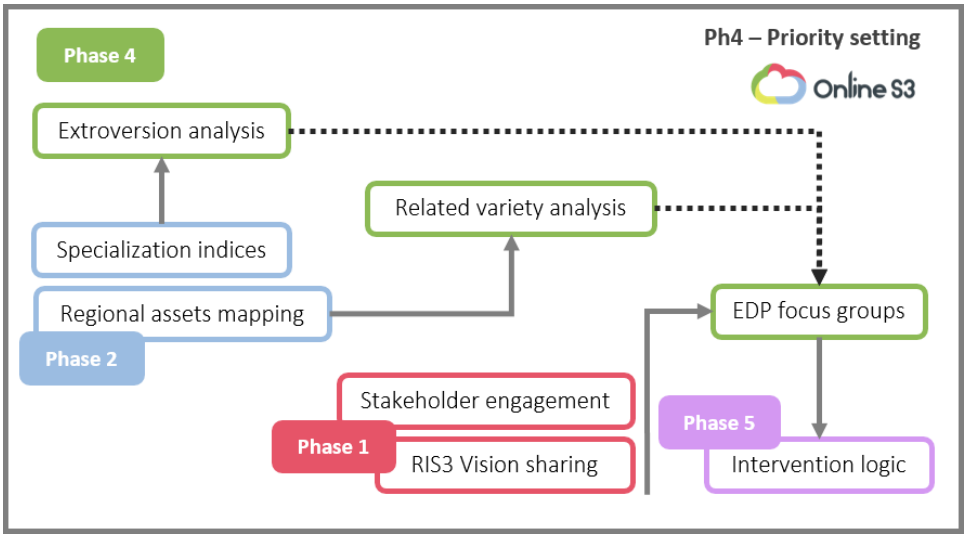
Phase 4: Priority setting

Throughout *Phase 4 – Priority setting*, policy-makers aim to specify a set of priorities that will be used as facilitators of the shared vision that has been formulated during Phase 3. The Entrepreneurial Discovery Process (EDP) is used as the main process for achieving this target. EDP is an exploratory and interactive bottom-up process which *allows mapping promising sectors for investment and domains for future competitiveness* (Periañez-Forte et al., 2016). Furthermore, it *is about prioritising investment based on an inclusive and evidence-based process driven by stakeholders' engagement and attention to market dynamics* (Periañez-Forte et al., 2016) and it can be considered a pillar of the RIS3 design process, as well as one of its main distinguish feature (Santini et al. 2016; Mieszkowski and Kardas, 2015; Martínez-López and Palazuelos-Martínez, 2014).

Under this scope, the *EDP focus groups* application provides a roadmap for the implementation of EDP, including the definition of industry activities and groups, the selection of stakeholders to be involved in the EDP process, the communication of conclusions about emerging opportunities, and the use of EDP conclusions by the regional and national authorities for drafting calls for actions. It is based on the methodology followed by Boden et al. (2015) in the case of the Greek region of Eastern Macedonia and Thrace.

Apart from effectively engage stakeholders and share RIS3 vision, an important part throughout the design of an EDP process includes the definition of the main sectors that will be discussed during the focus group event. As it is illustrated in **Figure 9**, *Extroversion analysis* and *Related variety analysis* are both considered to be the main sources of input for the design of the EDP process. The Online S3 Platform offers the users the opportunity to specify potentially emerging sectors of the regional economy more effectively, by highlighting these links and providing a *Related variety analysis* application, that enhances the ability of policy-makers to choose between related and unrelated variety options for their region. The results emerging from this phase are also used as inputs for defining the overall intervention logic of the RIS3 strategy.

Figure 9: Main structure of Phase 4 – Priority setting.



Source: Authors' elaboration

Phase 5: Policy mix / Action plan implementation

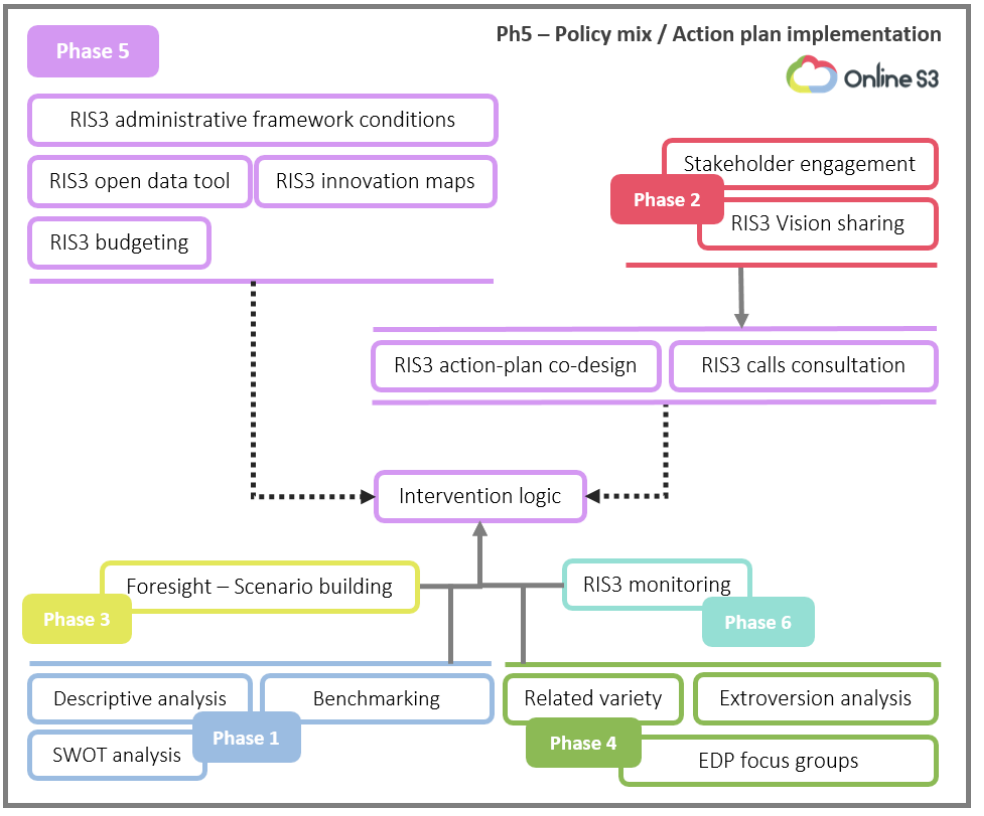
Figure 10 shows the main structure of *Phase 5 - Policy mix / Action plan implementation*, which is in the heart of the RIS3 policy-design process. It is important to notice the high level of connectivity between this phase and all other RIS3 strategy-design stages. Throughout Phase 5, the user develops his main policy mix framework.

The *Intervention logic* application acts as a central point for the policy design process, having a dual character. First, it collects information from several peripheral phases, to depict the overall rationale behind the RIS3 strategy design. Second, it works as a basis upon which policy-makers can detect possible vulnerability issues, regarding the implementation of RIS3 actions, based on the feedback they receive from the *RIS3 Monitoring* application in Phase 6. In the first case, information referring to regional specificities derive from the outcomes of Phase 2, including descriptive analyses, benchmarking and SWOT analysis. The regional context should then be related to the overall vision and priority setting of the RIS3 process,

which are defined through EDP, foresight, extroversion and related variety analyses. A set of result indicators is linked to the selected priorities, expressing the overall vision of the region.

In addition to this, the main outcomes of Phase 5 refer to the selected policy mix and include actions and ways of RIS3 strategy implementation. Applications included in this phase, such as the *RIS3 administrative framework conditions*, the *RIS3 open data tool* and the *RIS3 budgeting*, provide key information regarding the ways of implementing the selected action-plans and priorities (**Figure 10**). More specifically, *RIS3 innovation maps* uses monitoring results as input, to visualize available information about regional technological trends funded by RIS3 initiatives, whereas the *RIS3 open data tool* is a form of a data repository, including information about RIS3 projects linked to specific priorities. Both these applications, are means for communicating the achieved results of the RIS3 strategy, making it comprehensive to the public.

Figure 10: Main structure of Phase 5 – Policy mix/Action plan implementation.



Source: Authors' elaboration

Moreover, the *RIS3 action-plan co-design* and the *RIS3 calls consultation* applications enhance the collaborative character of RIS3 policy-design. The selected policies, calls and action-plans, should at this stage be related to specific output indicators, through the

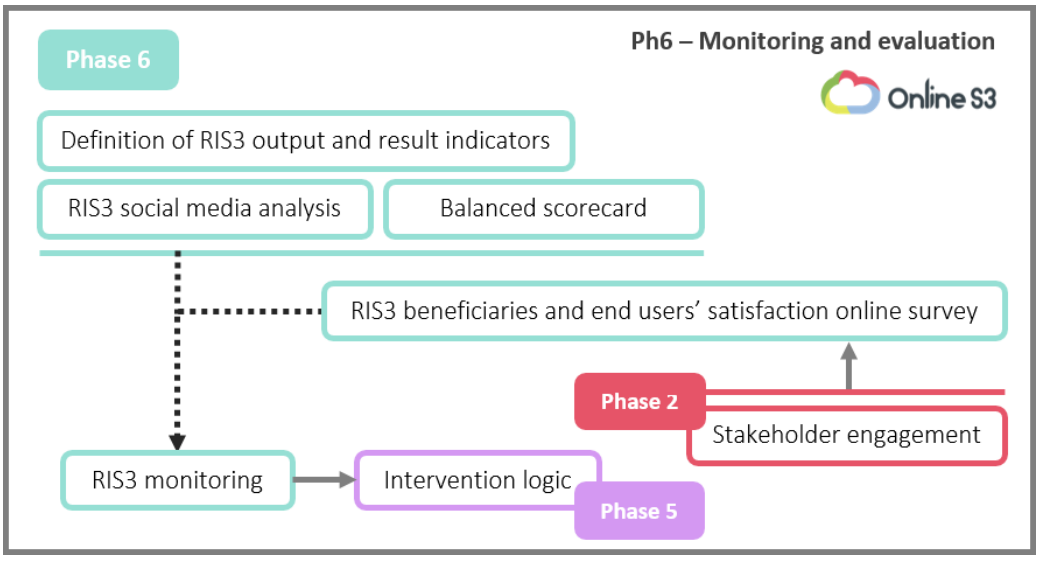
Intervention logic application, to get a clear picture of the rationale between the policy mix and the monitoring process. In general, knowing the rationale behind the vision and the selected policy actions, can be extremely useful to better understand and correct any existing variations between the expected (result indicators) and the actual results (output indicators).

Phase 6: Monitoring and evaluation

Finally, *Phase 6 – Monitoring and evaluation* focuses on collecting crucial information regarding the implementation process of the RIS3 strategy. Figure 11 illustrates the underlying information flows between the existing applications, from which it becomes evident that there is a unidirectional relationship between *Monitoring* and all other applications.

Taking a closer look at the *Monitoring* application, it is characterized as an input/output application, in terms of data interaction. Its main goal is to monitor and evaluate the overall RIS3 implementation process, providing a comprehensive and continuous feedback to decision-makers, regarding the degree to which the actual results are in line with the expected outcomes. This application works as an umbrella for Phase 6, using as its main input the outcomes of the other four tools included in this phase. Thus, the evaluation process, offered by the Online S3 Platform, goes one step further, incorporating a set of different sources and methods for data processing. These consider, not only the output and result indicators, but also the RIS3 beneficiaries' satisfaction and social media analysis outcomes, strengthening in this way the constructive involvement and participation of the stakeholders.

Figure 11: Main structure of Phase 6 – Monitoring and evaluation.



Source: Authors' elaboration

2.5 The Mini-S3 Roadmap

The large number of applications (28) that have been developed for the Online S3 Platform, targeting on enhancing the methodological process of RIS3 strategic planning, is a crucial parameter that should be taken into consideration at this point of analysis.

It is essential to highlight the fact that the use of all the 28 applications during a decision-making process is not the main target of this platform. On the contrary, the Online S3 Platform aims to present a wide selection of methodologies and their corresponding tools to policy-makers, so they can select the ones that they want to use, based on the type of analysis that will be implemented. In order to design and eventually update an RIS3 strategy, it is important to enriched it. This could be reached by gradually moving from an initial basic analysis of the regional context towards a more sophisticated one, that will try to shed light on the most innovative aspects and potentials of the region. However, it is important to keep in mind that an excessive use of methodologies might result to overlapping outcomes, without an essential added value.

To deal with this issue, the Mini-S3 has been designed, including only a short list of the most essential methodologies and tools that should be used during a RIS3 design process. This roadmap includes a set of 14 applications, that have been chosen based on the importance of the corresponding methodology, as well as the feedback we have received from the users regarding their user friendliness. The selection of the tools tries to cover the whole RIS3 strategic planning process. The list of the selected applications is given in **Table 3**, below.

Table 3: List of Online S3 applications included in the Mini-S3 roadmap.

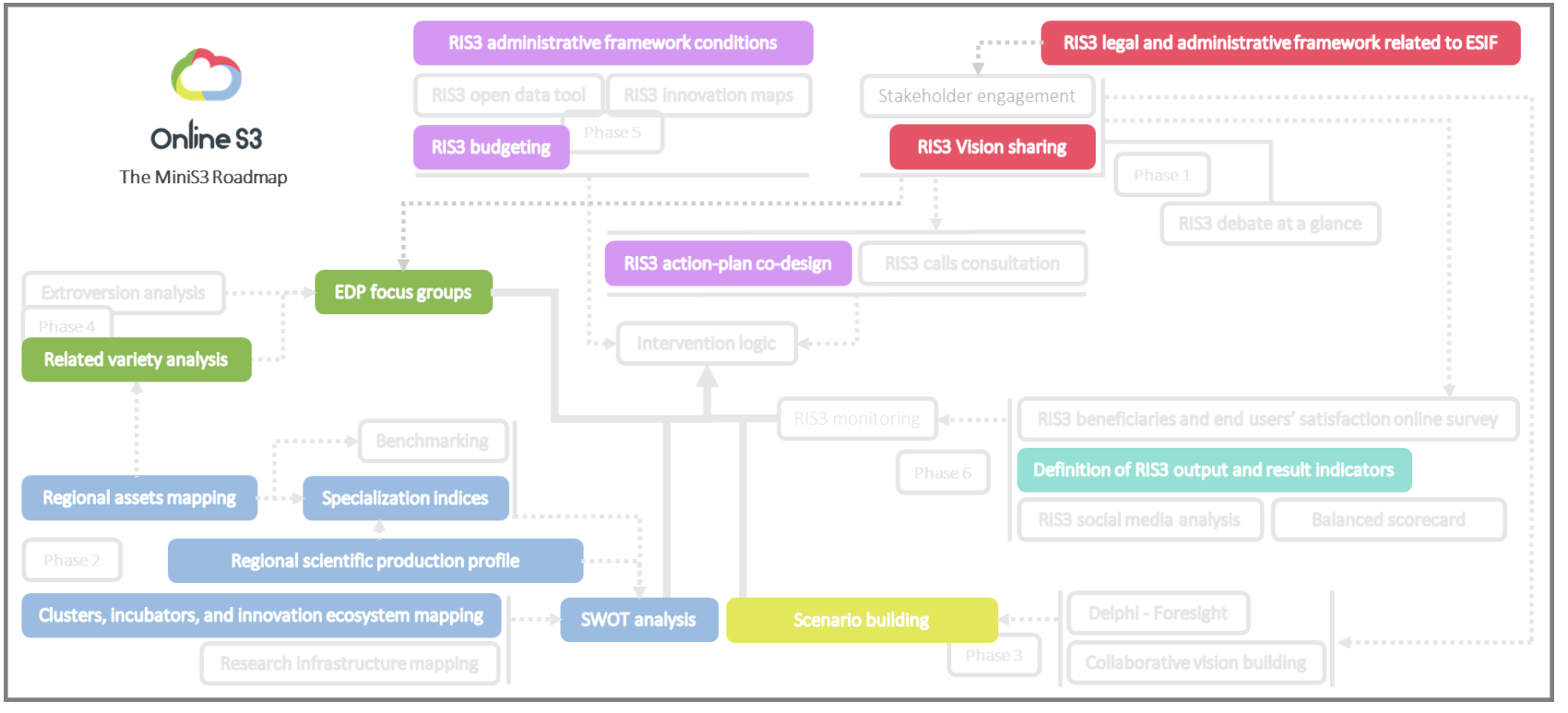
No.	Online S3 Applications	Short description
Stage 1: Analysis		
2.1	Regional assets mapping	A comprehensive and up-to-date mapping of the key regional assets.
2.3	Clusters, incubators & innovation ecosystem mapping	Defining the framework, concepts and categories for mapping the innovation ecosystem of each region.
2.5	Regional scientific production profile	Production of 'scientific profiles' for regions based on Scopus data.
2.6	Specialisation indexes	Technological and economic indexes for understanding the position of regional activities in global value chains.
2.7	SWOT analysis	Analysis of regional strengths, weaknesses, opportunities and threats is a key starting point for applying more elaborate RIS3 methods.
4.3	Related Variety analysis	Analysis of regional specialisation, setting a framework for cognitive/technological

		proximity among the sectors and perform network analysis of related industries and reveal hidden potentials. Use the results to identify new areas for future specialisation
Stage 2: Design		
1.1	RIS3 Vision sharing	Allows RIS3 managers and facilitators to create visually attractive infographic material on RIS3.
3.2	Scenario building	Creates different scenarios to illustrate visions of possible future or aspects of possible future.
4.1	EDP Focus Groups	Supports management activity for focus groups involved in the EDP process, and the communication of conclusions about the opportunities emerged by the local and national authorities.
5.2	RIS3 Action plan co-design	Co-design is a well-established approach in the process of creation, particularly within the public sector.
Stage 3: Implementation		
5.3	RIS3 Budgeting	Provides a framework for using different budgeting methods (incremental, zero budgeting) to capture the funding dimension.
6.2	Output and result indicators	Definition and monitoring of the output and result indicators during the RIS3 implementation processes.
Horizontal activities: Consultation		
1.4	RIS3 legal and administrative framework	Provides an overview of ERDF regulations and EU processes of selecting and funding projects.
5.4	State aid law compliance for RIS3 implementation	Aims at constraining the funding possibilities of public authorities to sustain competition within the internal market.

Source: Authors elaboration

In order to better understand the connections between these applications, **Figure 12** shows the position of each one of them within the overall Online S3 framework. As it is shown, methodologies coming from all the 6 phases have been included in the Mini-S3 roadmap. Emphasis has been given on the mapping of regional framework, as well as the definition of priorities, through sectoral in-depth analysis (specialisation indexes, related variety analysis, EDP, regional ecosystems mapping).

Figure 12: The Mini-S3 roadmap information flow mechanism.



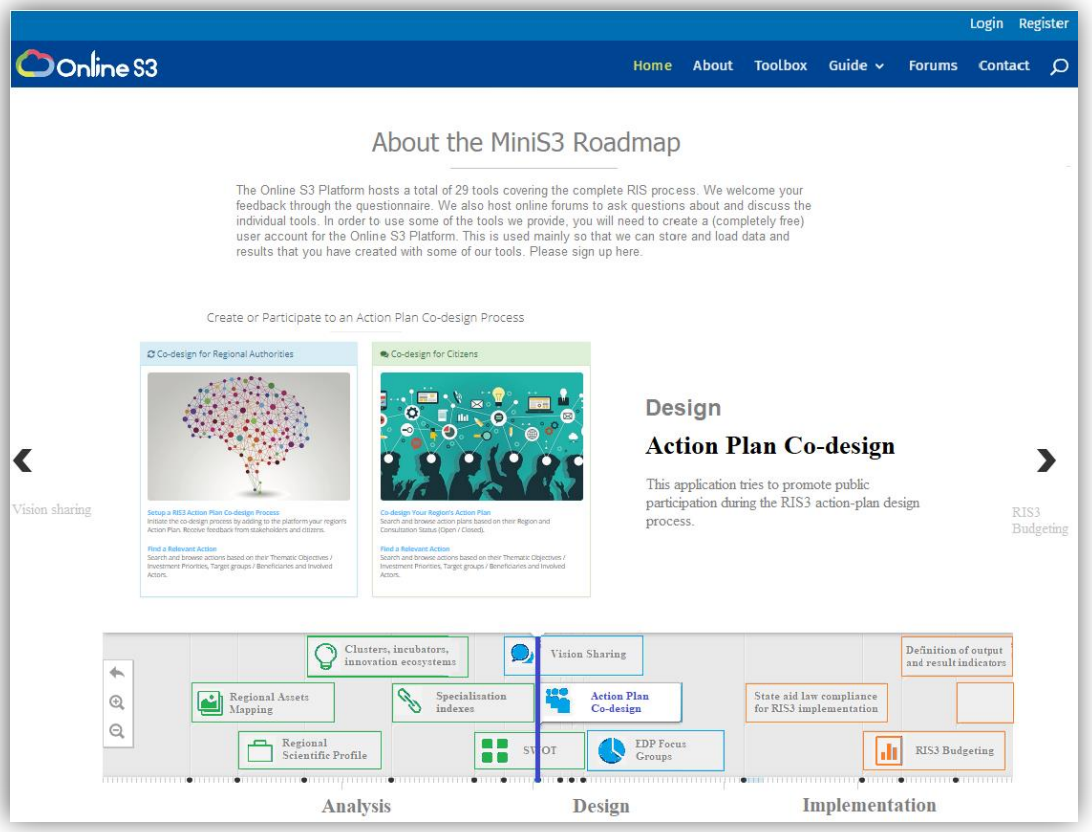
Source: Authors' elaborations

2.6 Interactive online solutions for the Mini-S3 roadmap

In this section, we provide two possible solutions for constructing an online interactive dashboard for the Mini-S3 roadmap hosted on the Online S3 Platform. The main idea of this page is to provide an extremely user-friendly navigation environment, so the potential users can very easily understand the sequential rationale behind the use of the selected applications.

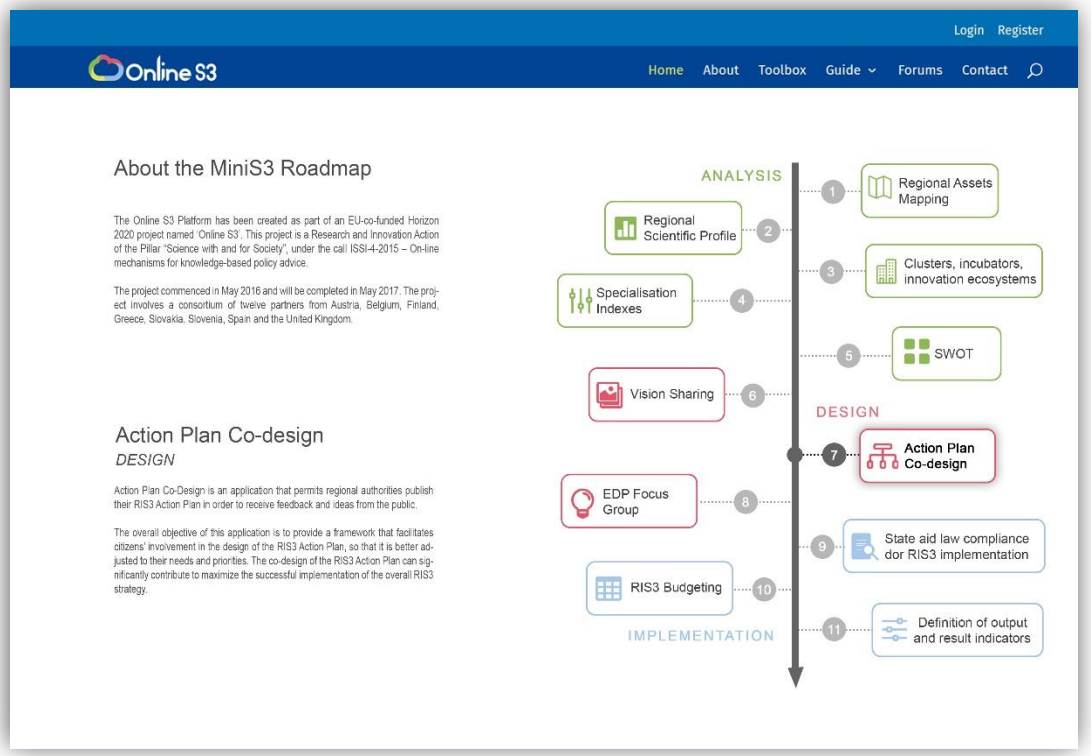
We choose to use a more general categorisation of the stages included in the RIS3 strategic planning process, and thus we derive a 3-stage format: a) analysis; b) design; and c) implementation. There is also a horizontal activity axis that includes consultation tools, that can be used during the whole process of RIS3 design. **Figures 13** and **14** illustrate the suggested mock-ups for the Mini-S3 roadmap.

Figure 13: 1st mock-up for the Mini-S3 roadmap.



Source: Authors' elaborations

Figure 14: 2nd mock-up for the Mini-S3 roadmap.



Source: Authors' elaborations

As it can be shown, both cases encompass some common design principles, regarding the structure of the page. There are three main building blocks:

- general description of the Mini-S3 roadmap and its rationale
- short description of the selected application
- a timeline indicating a type of sequential order that can be followed by the users.

The main difference between these two suggestions is the structure of the timeline. In the first case, a horizontal timeline is being used, making it possible to include overlaps between the different elements of the roadmap. This feature makes it evident that there is no clear sequential order between the applications, indicating that in many cases the user can work with 2 or 3 different tools at the same time. On the other hand, the second proposal illustrates a more minimal character, but does not make it possible to encompass overlaps between the various applications. Both mock-ups seem to be appropriate solutions for the Mini-S3 roadmap.

3. Roadmap focusing on EDP implementation

3.1 The EDP of RIS3: From theory to practice

3.1.1 How to approach the EDP: Case study analysis

The Entrepreneurial Discovery Process (EDP) is an exploratory and interactive bottom-up process which "allows mapping promising sectors for investment and domains for future competitiveness" (Periañez-Forte et al. 2016). EDP "is about prioritising investment based on an inclusive and evidence-based process driven by stakeholders' engagement and attention to market dynamics" (Periañez-Forte et al. 2016) and it can be considered a pillar of the RIS3 methodology, as well as, one of its main distinguish feature (Santini et al. 2016; Mieszkowski and Kardas 2015; Martínez-López and Palazuelos-Martínez 2014). This process, to be activated, "requires governments to provide a dedicated management and to act as platforms to enable, sustain and guide stakeholders' participation across the policy-making process" (Periañez-Forte et al. 2016).

During the EDP, different entrepreneurial actors are brought together in a government-led participatory process to jointly identify fields with smart specialisation potential and define possible activities for preparing their progressive development (Del Castillo Hermosa et al. 2015; Periañez-Forte et al. 2016; Santini et al. 2016). It is important to note that entrepreneurial actors are not only businesses, but any organisation and individual with an entrepreneurial knowledge that can be used to acquire a systematic understanding of "the most promising areas for future regional development" (European Commission 2012). The engagement of stakeholders need to be therefore as wider as possible and, as suggested by the European Commission, it requires an approach based on a Quadruple-Helix innovation model, in which industry, education and research institutions, and government collaborates with the civil society (Carayannis and Grigoroudis 2016; Martínez-López and Palazuelos-Martínez 2014; European Commission 2012).

As reported by Cavallini et al. (2016) "participation of a fourth group of actors is meant to include the demand-side perspective, i.e. the perspective of users, in the strategy development process. The inclusion of this fourth group is believed to strengthen the innovation process in general […] and the entrepreneurial discovery process in particular, as the needs of citizens are better understood and taken into account. The RIS3 guidance document makes a point of emphasising how the consideration of this fourth group of actors may result in securing better conditions to commercialize R&D efforts".

The EDP is an important tool that public authorities need to deploy in order to correctly engage with RIS3 development. The EDP is instrumental in generating a collective debate, integrating the divided and dispersed knowledge belonging to different actors, and setting common priorities for intervention. The two Focus-Group-based EDP implementation approaches tested respectively by World Bank in Poland (Piatkowsk et al. 2015) and the Joint Research Centre's Institute of Prospective Technological Studies (JRC-IPTS) in Greece

(Santini et al., 2016; Marinelli et al., 2016; 2017; Haegeman, 2016; Boden et al., 2015a; 2015b) provide useful information regarding the development of entrepreneurial processes of discovery. Both approaches are discussed in the following sections and used to identify the main tasks to consider in EDP implementation processes and organize such tasks in a step-by-step roadmap.

Case study 1: Greek Region of Eastern Macedonia and Thrace

Between 2012 and 2014, the managing authority of the Greek Region of Eastern Macedonia and Thrace (REMTh) started developing its RIS3 by identifying a group of horizontal and thematic priorities. "The identification of these areas of intervention represents the necessary and preliminary step to allow RIS3 implementation" (Marinelli et al., 2016).

Starting from the results of this activity, the JRC-IPTS and other partners in the region has decided to collaborate and organize a series of four EDP Focus Groups, "each focused on one of the region's RIS3 priorities and aimed at generating innovative ideas through the interaction between business, public and research sectors, but with a set of common aims: to bring together relevant stakeholders in the sector […]; to explore and catalyze the dynamics of the entrepreneurial process of discovery; to increase the understanding of the need [and] select a limited number of priorities; to build trust among stakeholders […]; to examine key criteria to identify and pursue relevant projects for the region; to collect ideas for regional innovation that combine regional strengths with international and emerging trends; to shape initial partnerships around those ideas [and] foster a culture of collaboration […]; to increase awareness of the international context of regional innovation activities" (Marinelli et al., 2016).

The REMTh's RIS3 priorities are Wine, Meat & Dairy, Tourism, and Marble & Non-Metallic Minerals, and the EDP Focus Groups took place between November 2014 and May 2015. The organisation of the four events required an extensive preparation: a desktop-based research phase was conducted to analyze the value chain of each sector and identify the main topics for discussion, together with the relevant regional, national and international stakeholders belonging to industry, academia and national and regional administrations to be invited (Santini et al., 2016; Marinelli et al., 2016; 2017; Boden et al., 2015a).

Each EDP Focus Group lasted approximatively between one and two days and all of them were structured following the same template-agenda, which is illustrated in Table 4. However, "the methodological approach […] has been progressively refined in view of continued replication and adaptation" on the base of the lessons derived from each event (Marinelli et al. 2016). The agenda was composed of two plenary sessions and some interactive parallel sessions (see Table 5). The plenary sessions took place at the beginning and end of the events and included: 1) an introduction to the regional RIS3; 2) one or two presentations from key international speakers; and 3) a final open discussion. The parallel sessions covered "different segments of the value chain of each sector" and also included "a presentation from national and international experts in the field and a phased participatory exercise" (Santini et al., 2016). The presentations from national and

international experts on relevant topics were used as scene-setting tools for stimulating the discussions around the themes identified during the preparation phase. Moreover, as reported by Boden et al. (2015a), the duration of each event was selected by considering the need to have "sufficient time for full parallel discussion [and enhance] the general networking opportunity of the event".

Table 4: Template-agenda of the REMTh's EDP Focus Groups.

SECTIONS AND ACTIVITIES
1. Plenary introduction • Presentation of the region and the regional RIS3 • Presentation of the project • Presentation from international expert on the sector at stake
2. 1st Parallel sessions covering the first part of the sectoral value chain • Presentation by a national expert on the specific value chain building block • Participatory exercise to stimulate interaction among stakeholders
3. 2nd Parallel sessions covering the second part of the sectoral value chain • Participatory exercise to stimulate interaction among stakeholders
4. Plenary conclusion • Reporting back from the participatory exercise • Presentation from international expert on the sector at stake • Round-table and questions from the public

Source: Boden et al. (2015a) and Santini et al. (2016)

The participants to the parallel sessions were grouped considering their expressed preferences but, at the same time, in a way able to guarantee a mix of stakeholders from:

- within and outside the region;
- different counties;
- the public and private research sectors;
- organisations working in different sections of the sector's value chain.

Moreover, the groups were set up by considering the knowledge background and skills of each stakeholder. This made it possible to balance the presence of people with different perspectives, which were linked to four areas: 1) policy perspective; 2) strategic perspective; 3) scientific perspective; and 4) technological perspective (Santini et al., 2016; Boden et al., 2015a).

The parallel sections were split in five main phases, which are described in Table 6, and aimed at: "generating and selecting innovative ideas requiring expertise from different sectors […]; creating partnerships around them and reflecting on their potential development […]; and outlining the first necessary steps for implementation" (Santini et al., 2016). In addition, a moderator was assigned to each discussion group and asked to: manage the debate; report the session's outcomes to the plenary; and carry out some

follow up activities. These activities included: 1) to inform participants about future steps by sending emails; and 2) to update the website of the REMTh's managing authority by uploading information and news related to the EDP Focus Groups' results (Boden et al., 2015a).

Table 5: EDP focus-groups' parallel sessions in Eastern Macedonia and Thrace.

EDP FOCUS GROUP	EDP PARALLEL SESSIONS			
Wine	Research and innovation focusing on technological improvements in wine	Research and innovation focusing on by-products of grapes and wines	Research and innovation related to green energy and the environment in the wine sector	Research and innovation in wine tourism
Meat & Dairy	Research and innovation in animal husbandry	Food processing technologies	Research and innovation in dairy products	Organic meat and dairy products and sustainable production
Tourism	4 seasons tourism	Tourism and cultural heritage	ICT and tourism	Gastro-tourism
Marble & non-metallic minerals	Research and innovation for energy and environmental optimisation of the marble production chain	Management of marble quarries & aggregates - Waste & environmental impacts		

Source: Boden et al. (2015a)

The main outcomes produced by the EDP Focus Groups were a set of entrepreneurial ideas. After the four events, these ideas were systematically collated and then further explored and analyzed during two Project Development Labs and an open online consultation (Haegeman, 2016). As explained by Marinelli et al. (2016): "These [activities] aimed at further refining ideas from the EDP Focus Groups and taking them closer towards implementation, identifying funding opportunities and action plans for policy. The first PDL

sought to translate stakeholder engagement into policy actions and brought together JRC-IPTS and its expert partners, the Managing Authority, representatives of regional and national government with expertise on RIS3, ESIF and state-aid regulations, and representatives of regional higher-education and research organisations. The event focused on the administrative dimensions of the EDP ideas, covering issues related to effectiveness, appropriateness, delivery mechanisms, project selection criteria, fitness to the national RIS3, state aid rules and their implications for launching calls. Building on the first, the second PDL then sought to examine how stakeholder engagement in the first PDL fed back into the policy process and included a presentation and discussion of draft calls. It also explored the possibility of financing EDP ideas (or some of their components) from other funding sources, such as Horizon2020".

Table 6: Structure of each parallel session belonging to the REMTh's EDP Focus Groups.

PARALLEL SESSION'S MAIN PHASES
Task 1. Individual generation of ideas Each participant is asked to reflect and fill-in a simple fiche with the following information: personal profile (i.e. entrepreneur, private sector, researchers, etc.); problem faced and potential innovative idea to solve it; external expertise/partners needed to implement the idea.
Task 2. Presentation of ideas Each participant is asked to present her/his idea to the rest of the group, highlighting the profile of the expertise needed for its further development. To ensure an open and creative environment, ideas are not criticized at this stage.
Task 3. Formation of "idea-partnerships" Each parallel group, building on the outcomes of task 2, creates a consolidated list of ideas in which similar or complementary proposals are clustered. Following that, participants are asked to identify those idea(s) which they are interested in developing further. Based on that, the group - guided by the moderator - proceed to organize itself in different sub-groups or "idea-partnerships". These comprise (ideally) individuals from different sectors (i.e. research and industry) with similar interests.
Task 4. Development of ideas (Phase 1) Each of the 'idea-partnerships' formed in task 3 then discusses the idea further, defining it in more depth, identifying the required contributions from different partners, developing the first considerations on framework conditions (legal problems, needs for human capital, capacities, etc.), on financial planning and on the next steps.
Task 5. Development of ideas (Phase 2) The 'idea-partnerships' then define the concrete title for their ideas, the subsector(s) of interest, a brief project description, a rough estimation of the resources needed, a

timeline, and the stakeholder groups involved. The work is conducted under a set of guiding questions. The criteria for funding are considered.

Source: Boden et al. (2015a)

Case study 2: Poland

The report published by Piatkowski et al. (2015) reports on IDP implementation in Poland, where the discovery process was coordinated by the World Bank. The detailed description offered by this report shows that the World Bank's approach to EDP implementation is very similar to the approach tested by JRC-IPTS in Greece. Both are based on Focus Groups, which are called Smart Labs in the Poland's case. In addition, exactly as happened in Greece, the Poland's EDP started with a preliminary phase based on desktop research, which was conducted along with a high number of semi-structured interviews. These research activities were aimed to identify and analyse potential economic areas for smart specialisation and identify champions and relevant stakeholders with an entrepreneurial knowledge about such areas. The champions represent those regional businesses with high innovation-based growth potential in relation to one of the potential smart specialisation areas and a strong interest in supporting its development.

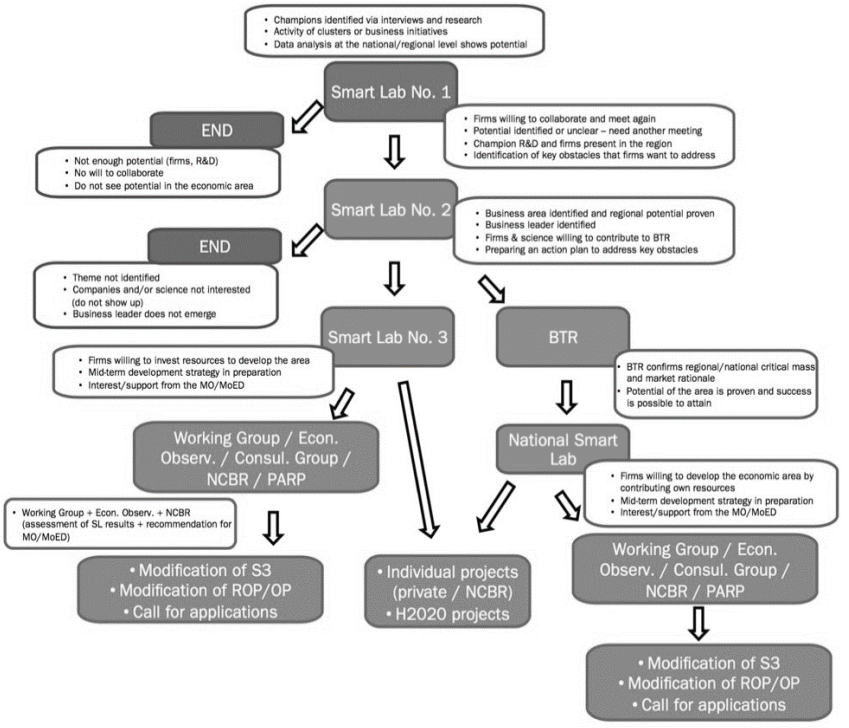
The Smart Labs were then implemented to discuss and validate the potential of each business area and prepare a midterm strategy for its future development. This was achieved by following the procedure shown in Figure 15, in which the Smart Lab process is described. Here each potential smart specialisation's area was progressively explored, thanks to a sequence of focus groups the continuance of which depended on the results achieved with the previous one.

During the first Smart Lab, the participants were requested to: 1) define the business area; 2) prepare a SWOT and/or a value-chain analysis (VCA); and 3) identify the key success factors. The participants were then asked to indicate their R&D needs and perceived market trends. The answers were used to set up the second Smart Lab, which was used to showcase "the scientific potential of regional [research and development institutions and] universities within a given business area in the context of R&D needs and market trends" (Piatkowski et al., 2015) identified during the initial Smart Lab. This second meeting was also used to better define the purpose of the Smart Lab process and "conclude with a joint vision of development of the business area. Depending on the results of the second [Smart Lab], a business-technology roadmap (BTR) [was] subsequently prepared by an external expert(s) in collaboration with a [Smart Lab] business leader" The third Smart Lab was organized "to verify the BTR's proposed development vision for the business area" (Piatkowski et al., 2015).

Each Smart Lab had a maximum duration of four hours, was moderated by a regional consultant, and comprised between of 15 and 20 participants: 8-10 entrepreneurs; 3 research institutions; 3 business support institutions; and members of the regional and national government. The entrepreneurs were selected considering the champion

companies identified during the interview process. The representatives from the research institutions were instead selected among those organisations with sufficient experience in working with business. In addition, it is important to highlight that the Labs were attended only by those who were invited.

Figure 15: The World Bank's Smart Lab Process.



Source: Piatkowski et al. (2015)

The follow-up activities implemented after each Smart Lab included: 1) preparing a report with proposals for next steps; 2) publishing the report online to share knowledge with both the participants and those actors who were not involved in the Lab; and 3) capturing ideas for cooperation.

3.1.2 Roadmap for EDP implementation

Based on the methodologies codified by the JRC-IPST (Santini et al., 2016; Marinelli et al., 2016; 2017; Boden et al., 2015a; 2015b) and World Bank (Piatkowsk et al., 2015), a roadmap for EDP implementation can be structured, which is composed of three main tasks:

Task 1. Knowledge Production

A preliminary research phase is conducted by combining desktop research and interviews to identify and analyse potential areas for smart specialisation.

Task 2. Stakeholder Engagement

Business champions and other relevant regional, national and international stakeholders belonging to industry, academia, national and regional administrations and civil society, are identified. This search activity is implemented for each potential area for smart specialisation. After being identified, the stakeholders are contacted to establish their willingness to participate. Based on the case study analysis, a restricted number of actors are invited to the EDP Focus Groups and the ideal group is composed by 15-20 participants: 8-10 entrepreneurs (business champions), 3 universities/research institutions, 3 business support institutions, and representatives of the regional and national government.

Task 3. Knowledge Sharing and Collaborative Decision-Making

EDP Focus Groups are organized to support knowledge sharing and collaborative decision-making. Two main approaches can be deployed:

- Approach 1 (JRC-IPTS): Thematic EDP Focus Groups are held and the ideas emerging from the parallel discussions are collected, organized and presented to the participants. The parallel sessions are structured in 5 main phases, as described in Table 3. Participants are distributed so that groups are composed by actors from: within and outside the region, and different counties as well; the public and private research sectors; organisations working in different sections of the sector's value chain. Even the knowledge background and skills of each stakeholder are considered, balancing the presence of people with different perspectives (policy perspective; strategic perspective; scientific perspective; and technological perspective). The duration of each event is between one or two days. The ideas acquired during the thematic EDP Focus Groups are systematically collated and further explored and analyzed during two transversal meetings. During these meetings, the attention is focused on the administrative dimensions of the EDP ideas, covering issues related to effectiveness, appropriateness, delivery mechanisms, project selection criteria, fitness to the national RIS3, state aid rules, and funding possibilities. The results of the process are then subjected to an open online consultation to broaden participation and getting new suggestions not only for participants but also form those actors which have not been directly involved in the EDP Focus Groups process.
- Approach 2 (World Bank): A sequence of three of more EDP Focus Groups is organized for each business area, until a joint vision of development of the business area is acquired. The process is stopped if the area does not show enough potential for growth after the first or the second meeting. The first EDP Focus Group is used for exploring the business area and preparing a SWOT and/or a value-chain analysis. Moreover, participants are asked to identify the key success factors and indicate the R&D needs and perceived market trends. The results are used to set up the second Focus Group, which is instrumental in exploring the scientific potential of regional research and development institutions and universities within the business

area. This second meeting need to conclude with a joint vision of development of the business area or the process is terminated. Depending on the results of the second meeting, a business-technology roadmap is subsequently prepared by one or more external experts in collaboration with a business leader of the area, which is identified during the first and second meeting. The third EDP Focus Group is organized to verify the BTR's proposed development vision for the business area. Additional meetings are organized if necessary. Each meeting has a duration of about 4 hours.

Reports reporting on the results of the EDP Focus Groups are produced and shared online. The participants are informed about future steps by sending them emails and updated with information and news related to the EDP Focus Groups using digital tools. To engage additional key stakeholders who were not attending the Focus Groups and to extend the debate, an open consultation is launched which provides anyone with the possibility to join the discussion.

3.2 Online S3 Roadmap for EDP Implementation: Instructions for Use

3.2.1 Selection of Applications for supporting EDP Implementation

We selected 7 applications out of 28 altogether Online S3 applications that support the three phases of EDP implementation – knowledge production, stakeholder engagement and knowledge sharing as well as collaborative decision-making. In this chapter, we briefly introduce these applications.

Application 1.1: Vision sharing

The purpose of application 1.1 is to assist policy-makers with engaging stakeholders in an entrepreneurial discovery process and communicating the resulting vision to them. The development of a vision is an integral part of the RIS3 process. A vision outlines:

1. Where the region would like to be in the future and
2. What its main goals are and why they are important

In effect, the vision acts as a guideline for future decisions and policies in the region. Yet, a vision statement shouldn't be just a bland statement that's light-mindedly and solely formed by the regional authorities and hidden somewhere in formal documents. Instead, the vision should be shared. It should be built by engaging regional stakeholders, such as companies, citizens, educational institutions, NGOs, in the entrepreneurial discovery process, where they discover and produce information about potential new activities and identify opportunities that emerge from this interaction. Meanwhile, the policy-makers should assess the outcomes and ways to facilitate the realisation of this potential. Most importantly, the formed vision should be widely communicated back to the stakeholders.

This application consists of **information material** that can be used for vision sharing and other communication activities related to inviting the stakeholders to EDP process, and **links**

to external services that can be used to create customised information material.

Application 1.2: Debate at a glance

Engaging stakeholders through web-based debating platforms is an effective way to facilitate the entrepreneurial discovery process within a region. These platforms allow policymakers to organise discussions, debates and idea generation online, for example, on the region's vision, policies and opportunities with all stakeholder groups. Thus, they provide an excellent opportunity for not only increasing stakeholder participation but also the transparency and legitimacy of the RIS3 process and its outcomes. For facilitating online discussions, we provide three suggestions for possible platforms:

1. S3Engagement
2. Discuto
3. DebateGraph

These applications have different approaches to facilitating discussion with stakeholders, while they all fulfill the required functionalities. Discuto has the most user-friendly interface, while its disadvantage that it costs. DebateGraph in turn is difficult to install and set up, but offer illustrative tools for collaborative brainstorming. S3Engagement has been developed internally in Online S3, its main disadvantage is the lack of graphics to illustrate collaborative discussion. All the applications can be tested, and the one matching the needs of the user best should be selected.

Application 2.1: Regional assets mapping

This application integrates data on regional assets, e.g. economic performance, employment and infrastructure, into a searchable platform, in order to enable anyone to access, compare and produce visually appealing reports on the assets across the EU. This is useful for anybody wishing to scope potential markets, or benchmark progress in economic development or the growth of particular industries and sectors.

The main output of the application is a Word document setting out a report on the regional assets data which the user has elected to search for using the application, set out in the format which the user has chosen. The report has text boxes under each piece of data where the user can add a description and commentary if they so wish.

The Regional Assets Mapping application uses data provided by Eurostat, the EU's statistical office. The EU regions in the application follow Eurostat's NUTS (Nomenclature of Territorial Units for Statistics) system for dividing up the economic territory of the EU.

Application 2.2: Research infrastructure mapping

Research infrastructures (RI) refer to facilities, resources (including human) and related services needed by the research community to conduct research in any scientific or technological field. Due to the large number of research communities and complex research needs, there are very different types of research infrastructures with specific

characteristics. The use of research infrastructure mapping leads to a better use of the existing and more considerate development of future research infrastructures helping to avoid duplications and redundancies. A comprehensive information base about the European RI landscape enhances and optimizes RIs and their access by scientists and innovation developers, which is a key ingredient for competitiveness as well as a necessary basis for tackling grand societal challenges.

Integration of this information in the design of regional smart specialisation process can help RIS3 stakeholders make strategic choices and support a coherent and strategy-led approach to RDI competence development in European Research Area.

The data that have been used in this application have been extracted from the Meril portal, by the National Documentation Centre EKT/ EIE, under the Creative Commons Attribution No Derivatives NonCommercial 4.0 Licence. Since Meril has not yet launched any mapping tool, the Online S3 Research Infrastructure Mapping tool is the one to be used (more up to date in comparison with the EU existing tools).

Application 2.3: Clusters, incubators & innovation ecosystem mapping

The use of cluster and ecosystems mapping tools can lead to a better definition of those niches in which regions have a competitive advantage, and a better definition of local business needs. This allows more considerate development of future research and innovation policy, promoting targeted initiatives (i.e. research collaboration agreements, training of human capital, creation of competence centres, business start-up schemes in specific fields, PhD scholarships or technical schools), unveiling potential areas of integration with local research institutions and helping to avoid duplications and redundancies.

This application provides instructions on using external information sources provided and run by the EU. The tools described are:

- Tool 1.Regional Ecosystem Scoreboard
- Tool 2.The European Cluster Mapping tool
- Tool 3.The Cluster Collaboration Platform

Application 2.5: Regional scientific production profile

The objective of a scientific production profile is to provide a bibliometric analysis of the scientific performance of regions. The scientific production profiles are generally based on a selected set of bibliometric indicators that aim to compare scientific performance across geographies (regions, but also countries). Scientific profiles and regional benchmarking of these profiles are important for the analysis of the context of a region as it facilitates a comparison of all aspects of a region's performance in relation to science, main fields of

science and specialisation patterns of regional academic systems. When benchmarked to other regions, it can be a valuable tool to identify weaknesses and strengths and link them to overall regional performance.

The elaboration of scientific profiles is based on Publication data. The data source for this application is Scopus. Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings. Although Scopus allows users to download multiple kind of information (bibliometric indicators, document titles, citations, etc.), it does not provide easy access to all this kind of data. However, everyone can download batches of data containing information on the number, subject areas and year of publications for a certain location, which can be used to create a benchmarking analysis for regions, cities or countries concerning the performance of each location in relation to science.

This application provides a tool to produce overviews and comparisons of a scientific production profile of a region, city or country, allowing easy visualisation and comparison of areas' profiles.

Application 2.6: Specialisation indexes

Based on the analysis of existing assets, comparative advantage and regional potential, regions should take into account key strengths and advantages of their technological and economic specialisation. Specialisation by definition has two contrasting aspects: one positive, indicating the areas where a country, a sector and/or a firm exhibits a stronger position than other countries, sectors and/or firms, and one negative, indicating, respectively, the areas of relative weakness. Consequently, technology or scientific specialisation in its positive sense inherently implies a concentration of capabilities on some areas of knowledge. Inversely, in its negative sense, it implies weak capabilities in other areas when compared to a point of reference. The very concept of specialisation, however, means that it is not conceivable that a country achieves specialisation positions across the whole broad spectrum of technologies, sciences and sectors.

In the literature, the measurement of specialisation originates in trade theory. Since then, a variety of specialisation indices have also been developed to capture the scientific and technological specialisation of a country or region, namely, the measurement of publications and data regarding patenting. The method for analysing regional specialisation produces technological and economic specialisation indexes for understanding the position of the regional technological and economic activities into global value chains and uses an interactive dashboard for visualisation.

This application provides tools to produce a report on three aspects of specialisation:

- Technological specialisation
- Regional scientific activity
- Economic specialisation

Application 4.1: EDP focus groups

EDP focus groups tool is the main tool for organising and managing the whole process, through a web-based dashboard. This application also helps RIS3 stakeholders to contact stakeholders participating in this process in a quick and easy manner, as well as to share the outcomes of the process with them. Final reports can also be uploaded on the platform, so that they become available as examples to other policy-makers that try to design their EDP processes.

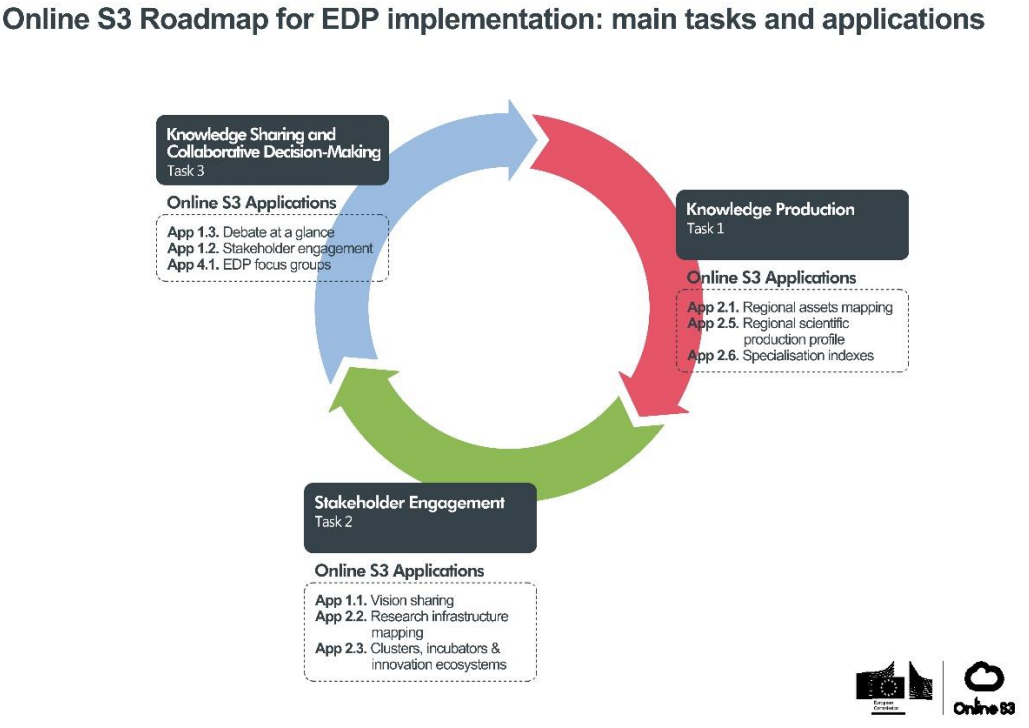
The logical steps of the application, based on its methodological description are:

- *Step 1:* Creation of the regional EDP page.
- *Step 2:* Definition of the main sectors that will be examined throughout the EDP process.
- *Step 3:* Definition of the main stakeholders that will participate at the process.
- *Step 4:* Creation of the event and the EDP Focus Group Agenda.
- *Step 5:* Share information with participants regarding the date and venue of the focus group meetings.
- *Step 6:* Conduct of the event through physical participation of the regional authorities and stakeholders.
- *Step 7:* Development of a report for each EDP Focus Group, as well as a final comprehensive report including a summary of the overall findings. The users will be able to share this report with public, so the stakeholders will be informed for the final outcomes of the process, and other policy-makers can use it as an example for performing their own EDP Focus Groups.

3.2.2 Workflow Description

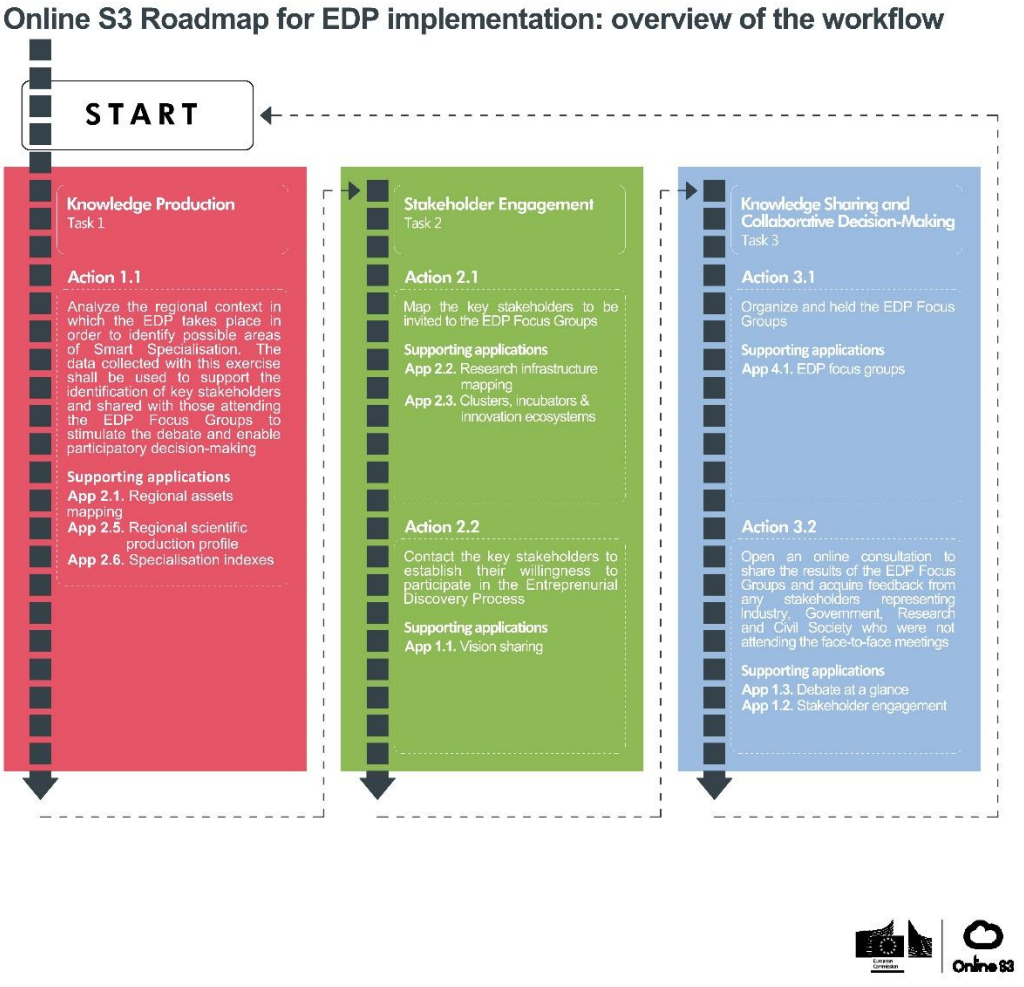
The EDP process workflow is divided into three tasks – Knowledge Production, Stakeholder Engagement, Knowledge Sharing and Collaborative Decision-Making. These tasks are not strictly sequential, but can also happen cyclically one after another, as well as in parallel. The overall proceeding of the EDP process is illustrated in the Figure 16.

Figure 16: Online S3 Roadmap for EDP implementation: Main tasks and applications.



Task 1 involves the analyses of the regional context in which the EDP takes place in order to identify the initial smart specialisation priority areas based on desktop research. This is to identify the key stakeholders for EDP and to share the analyses with those attending the EDP Focus Groups to stimulate the debate and enable participatory decision-making. Task 2 consists of mapping the key stakeholders to be invited to the EDP Focus Groups and inviting them to the EDP process of the region. In Task 3, EDP focus groups are held to support knowledge sharing and collaborative decision-making. The results of the EDP focus group sessions are shared online on a platform that allows receiving additional feedback and continuing the discussion related to the themes raised in the EDP focus group sessions. Figure 17 illustrates the workflow of EDP implementation.

Figure 17: Online S3 Roadmap for EDP implementation: Overview of the workflow.



Task 1: Knowledge production (Apps 2.1, 2.5, 2.6)

Task 1 consists of knowledge production referring to the systematic evidence-based analyses of the regional context to identify its potential focus areas for smart specialisation. The applications that help in this process are *2.1: Regional assets mapping*, *2.5: Regional scientific production profile* and *2.6: Specialisation indexes*.

Application 2.1 provides a platform to search data on regional assets e.g. economic performance, employment and infrastructure, and provides tools to create a report document on the selected forms of data. In the context of smart specialisation, particularly data related to the performance of different sectors of industry should be selected for analysis in order to scope the priority areas for regional focus. This allows to choose the

relevant sectors and potential key stakeholders that should be a part of the EDP. The data used by the application is provided by Eurostat, the EU's statistical office, and it is provided on NUTS2 (*Nomenclature of Territorial Units for Statistics*)-level.

Application 2.5 provides tools and instructions to gather information on the scientific profile of the area. The tool can be used to compare the scientific performance of a region, city or country across various indicators, for example the amount of publications by subject area, year, or affiliation. The most important factors to analyse using this application in relation to knowledge gathering for the EDP are the subject areas where the region is strong compared to some other reference regions, and the main affiliations of publications released in the area. This allows the identification of specialisation patterns of the regional academic systems, as well as identifying the weaknesses and strengths of the scientific research in the region. It also supports the identification of the key regional stakeholders in the scientific research.

Application 2.6 provides the basis of the analysis of the existing assets, comparative advantage and regional potential, in their technological and economic specialisation. The method for analysing regional specialisation produces technological and economic specialisation indexes for understanding the position of the regional technological and economic activities into global value chains and uses an interactive dashboard for visualisation.

Task 2: Stakeholder Engagement (Apps 1.1, 2.2, 2.3)

Task 2 consists of identifying relevant stakeholders that should be part of the EDP of the region and inviting them to take part in the process. Based on the focus found in Task 1, the areas of smart specialisation of the region can be explored more in depth and contact with the stakeholders in those areas made. Application 1.1: Vision sharing contains instructions and useful templates in engaging the stakeholders into the EDP process, while Applications 2.2: Research infrastructure mapping and 2.3: Clusters, incubators & innovation ecosystem are used to map out the stakeholders that should be contacted.

Application 2.2 contains tools to find research infrastructures (RI), i.e. facilities, resources (including human) and related services needed by the research community to conduct research in any scientific or technological field. The tool contains information about research facilities and other resources in the region and enables the discovery of the stakeholders in various areas of scientific and technological research. As there are many different types of research infrastructures, having different characteristics and focuses, the mapping process helps to form a comprehensive understanding of the different RIs, and their interests and agendas. Inviting the stakeholders to the EDP process and focus groups helps to reduce redundancy among their work and allows them to create new forms of cooperation.

Application 2.3 provides instructions on mapping the strengths and weaknesses of the area, according to three external information sources run by the EU. These are:

- Tool 1.Regional Ecosystem Scoreboard
- Tool 2.The European Cluster Mapping tool
- Tool 3.The Cluster Collaboration Platform

The objective of the Regional Ecosystem Scoreboard is to capture the quality of conditions in the regional ecosystem that can foster or hinder innovation and entrepreneurship. The emphasis of the Scoreboard is on the dynamics and on the conditions, that characterise the quality and nature of the regional ecosystem, but it is not about measuring performance. The The European Cluster Mapping tool provides sectoral and cross-sectoral regional data and visualisation of the geographical concentration of cluster development in Europe. The Cluster Collaboration Platform allows the discovery and categorisation of clusters in the region.

The purpose of these tools is to help in discovery of the parties to contact and to invite to be a part of the EDP focus group sessions as well as the EDP process outside of the sessions. They do not provide centralised tools to find out all the individual stakeholders from all of the sectors of the quadruple helix used in the EDP process, but rather provide information of the direction and conditions of the region to provide directions from which to search the stakeholders to involve.

After the stakeholders to contact have been decided, *Application 1.1: Vision sharing* can be used to establish communication with them. The application should be used in the end of the process to communicate the resulting vision as well, but the guides provided are useful in inviting the stakeholders to be a part of the EDP to begin with. The application provides several templates for efficient communication to the stakeholders, from which the region can choose the most fitting ones. Documentation for using various online applications for creating information materials is also provided. These tools are Canva, Piktochart and Infogram, with which engaging visualisation of customised information material can be created.

Task 3: Knowledge sharing and collaborative decision-making (Apps 1.2, 4.1)

In Task 3, the EDP focus group session is organized and held. In the EDP focus group sessions the stakeholders are invited to face to face meetings and workshops to develop common goals for the region and share knowledge. After the focus group session, the resulting documents and themes should be uploaded online for discussion, and to involve the stakeholders who did not attend the face to face sessions to allow broader dialogue to take place in an open and transparent way.

Application 4.1: EDP focus groups helps in organising and managing the process of holding a face to face focus group session. The application guides through definition of the main

sectors examined in the process, definition of the main stakeholders, creating the agenda for the meeting, contacting the stakeholders, conducting the meeting and sharing the outcomes of the focus group. The resulting documents can be uploaded to the application as examples for other policy-makers. The results of the previous tasks will help in defining the scope and discussion topics that should be discussed in the meeting, as well as give background in the preparation of the focus group in regard to the target audience to invite.

After the face to face session, the discussion related to the issues raised in the EDP process should not cease. For this purpose, the discussion should be moved online, allowing a wider audience to participate in the process of knowledge sharing and collaborative decision making. *Application 1.2: Debate at a glance* is provided for facilitating online discussion. Both of the applications serve similar purposes, offering platforms where stakeholders can engage with each other and with the policy-making organisation. Application 1.2 offers guidance for using two external tools for the online discussion. These are *Discuto* and *DebateGraph,* and a more limited but custom platform for discussion related to RIS3 strategies called S3Engagement. Brief overviews of these three options are provided below, based on which the most suitable application can be selected by each EDP discussion facilitator.

- Discuto: The most user friendly of the three, but includes usage fees, which can make the use of the tool costly for large audiences.
- DebateGraph: The application can be difficult to set up and install but offers very flexible options for discussion. It is also free-of-charge.
- S3Engagement: The platform is simple and lacks many of the features the other external applications have but is developed as a part of the Online S3 project, and as such has no dependency on any external businesses.

3.3 Dashboard

Two options for possible dashboards are presented below in Figures 18 and 19.

Figure 18: First mock-up for EDP roadmap dashboard.

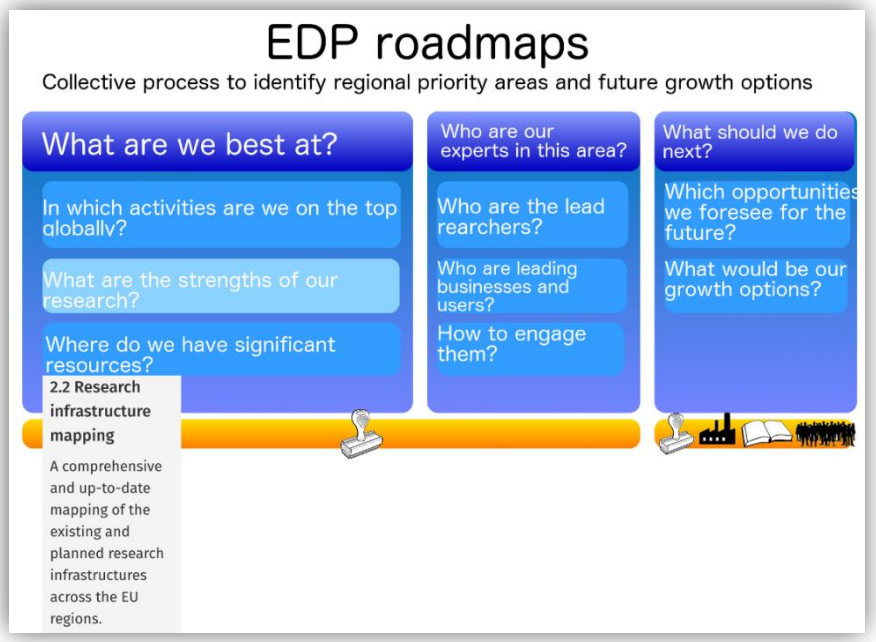
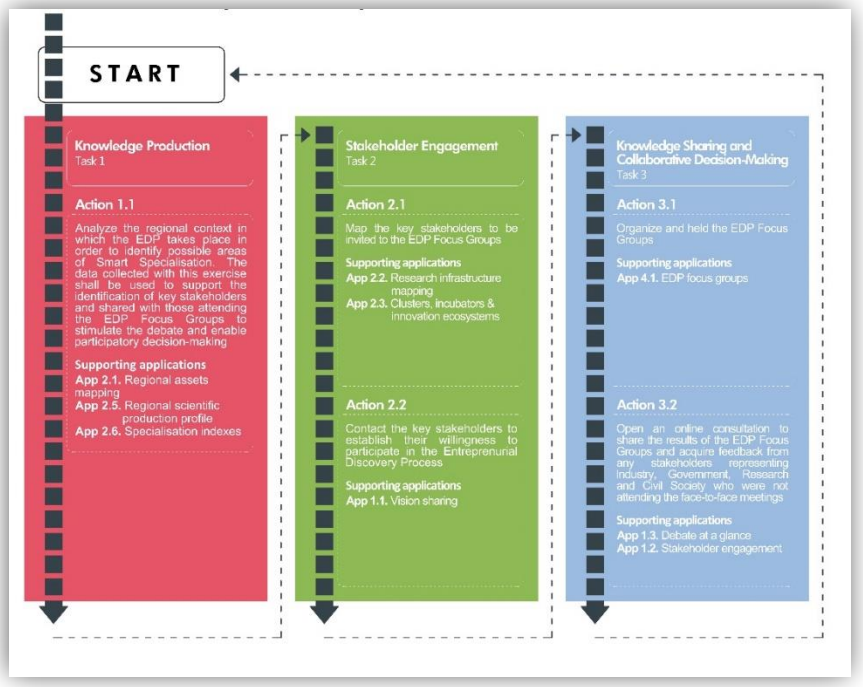


Figure 19: Second mock-up for EDP roadmap dashboard.



4. Roadmap focusing on Specialisation analysis

This roadmap addresses the issue of the significance and role of specialisation analysis in the context of the development and implementation of a smart specialisation strategy for research and innovation (RIS3). It explains its usefulness, provides examples of questions that policy makers may ask when conducting it, and describes three possible approaches to the analysis. In addition, different methods for specialisation analysis are described. A conceptual framework that serves as a basis for a discussion on how specialisation analysis could be performed is discussed. Options for managing the specialisation analysis process via the Online S3 platform and for applying the apps available in and through the Online S3 platform are discussed and presented.

This roadmap is structured as follows: the first chapter explains the role of specialisation analysis in the context of RIS3; the second chapter describes the Online S3 applications that are relevant for the roadmap. The workflow to manage the specialisation analysis is presented in the third chapter, while the final chapter presents the proposed specialisation roadmap dashboard design.

4.1 The role of specialisation analysis in the context of RIS3

Specialisation analysis has a threefold usefulness in the process of designing and implementing RIS3:

1. it helps inform the Entrepreneurial Discovery Process (EDP) on RIS3 prioritisation choices,
2. it facilitates public-private investment decision-making in RIS3 priority areas, and
3. it supports system of monitoring and evaluation (M&E) in that it makes possible to change ('real-time') regional specialisation during the RIS3 implementation.

It thereby assists users, be they policy-makers and their assistants, EDP participants or analysts, when posing questions such as:

- How is our country/region positioned in key technologies necessary to support development of high-value added and/or knowledge-intensive sectors?
- How are investments channelled via the RIS3 influencing or strengthening specialisation?;
- What is the potential to build on existing specialisation to anticipate or prepare for future global market trends or societal challenges?

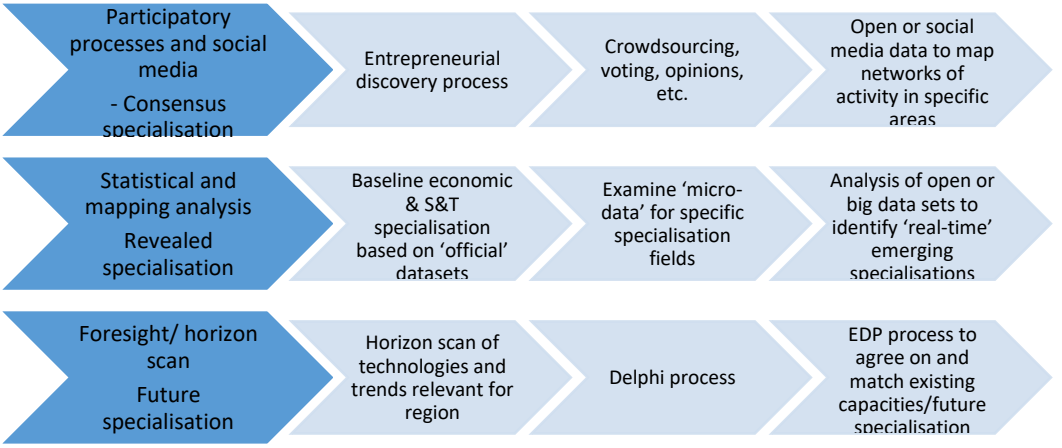
“Specialisation and resource concentration is a way to obtain scale economies in R&D investment“ (Iacobucci, 2014: 119, 123). Specialisation analysis helps establish a baseline situation of an economy at a regional or a national level, and see which sectors already stand out. For instance, the importance of various sectors came out of the RIS3 analysis for Galicia (Xunta de Galicia, 2014). In Wielkopolska in Poland “a comprehensive empirical analysis, consisting of a data-based statistical analysis on economic specialisation, a

questionnaire-based analysis on innovation needs of regional enterprises, and a specialisation analysis for the science sector" (Kroll et al., 2014: 34) was carried out. In the Baltic Sea Region (BSR), "a Smart Specialisation analysis indicates many areas for BSR transnational and inter-regional collaboration: common/complementary priority groups, common challenges, distribution of ESIF funding to the similar areas for intervention" (Ketels and Pedersen, 2016: 40).

Furthermore, the Online S3 project found that there had been a widespread use of methods to analyse regional or national context, and that may serve for specialisation analysis. All 30 countries and/or regions analysed by the project used regional profiling (100% of the cases), and that was the most common method. Other methods were used somewhat less often (noted here in decreasing frequency of usage): SWOT analysis and working groups/focus groups (87% of the cases), benchmarking (63%), bibliometric analysis (57%), stakeholder interviews (47%), collaboration and networking analysis and online survey(s) (37%), cluster analysis and value chain analysis (27%), gap analysis (20%), social network analysis (13% and product space modelling (7%) (Griniece et al., 2017b: 7-8).

There are three possible perspectives on specialisation analysis. Specialisation could be determined by a joint process of deliberation ('Consensus specialisation'); secondly, it could be based on a statistical and mapping analysis of the current situation a country or a region finds itself in ('Revealed specialisation'); thirdly, be focused on foresight or horizon scan revealing a 'Future specialisation'. This is shown in Figure 20.

Figure 20: Three possible perspectives on specialisation analysis



Source: Authors' elaboration

All of them are grounded in EDP and the sequence of analytical steps are not necessarily linear, but rather have a circular, recurring character. 'Consensus specialisation' is based on a process of deliberation. The process will necessarily be accompanied by crowdsourcing, opinions, voting, and other methods that take the discussion further. Among them there

can be stakeholder interviews, working groups and focus groups, information events and information dissemination, etc. Open or social media data can be used to map network of activity in specific areas and yet other methods could be put to use in order to identify the priorities: idea competitions, participatory deliberation and collaborative writing and annotation, etc. 'Revealed specialisation' is grounded in EDP, but with a very strong analytical focus. Baseline economic and science and technology (S&T) specialisation can be explored by a number of methods such as bibliometric analysis, cluster analysis, value chain analysis and others. Details of specialisation field can be seen in 'micro-data', and open or big data sets can serve to identify 'real-time' emerging specialisations. 'Future specialisations' can be determined by doing a horizon scan of technologies and trends relevant for the region, and by pursuing delphi and foresight methods, scenario building, etc. This approach is again based on EDP so as to agree on and match existing capacities and a future specialisation profile.

Although the RIS3 design process often represents a mix of methods that contain elements of all three of the aforementioned specialisation analyses, the focus below is on methods that help determine current specialisations. On the other hand, the analysis of the current specialisation could be in use in any of the aforementioned approaches. The analysis needs to assess the entrepreneurial environment, regional assets, as well as assess the way the region or the country is connected to other regions and the rest of the global economy (Foray et al., 2012: 19). The entrepreneurial environment is crucial for the EDP, which "is a mechanism to integrate and combine dispersed and fragmented knowledge in order to open and explore a new domain of (market and technological) opportunity...[and] to produce information about the value of the considered domain, in terms of potential innovations, spillovers and structural changes" (Foray, 2016: 1434). The focus here will nevertheless be on the analysis of regional assets and outward linkages.

There are different methods for specialisation analysis. Economic specialisation could focus on Revealed Comparative Advantage (RCA) for trade/exports or on Related Variety. Educational or skills specialisation focuses on science, technology, engineering, and mathematics (STEM), and skills for key enabling technologies (KET). Scientific specialisation analysis produces scientific Activity Index (AI). And finally, technological specialisation analysis makes use of Revealed Technological Advantage (RTA) for patents. Moreover, there are other, supplementary methods, helping countries and region determine their specialisation. They will be briefly mentioned in the second chapter, when describing applications.

Economic specialisation can be analysed by means of RCA, and related variety. RCA is an index helpful in calculating comparative advantage of good or services in international trade. "[T]he RCA indicator relates the ratio of exports (X) to imports (M) in a certain country (and region, respectively) r for a respective product group or industry i to the export to import ratio for total manufactured goods in year t. A positive (negative) Revealed Comparative Advantage (RCA)... indicates a positive (negative) trade specialisation and, in turn, a comparative advantage (disadvantage) for the respective product group/industry.

Hence, positive RCA values reveal a highly competitive performance of domestic firms in the industry/sector under consideration" (Cordes et al., 2016: 9). "[T]he concept of related variety holds that some sectors are more related than others, and will generate relatively more Jacobs externalities" (Frenken, Van Oort and Verburg, 2007: 689). Jacobs externalities are regional knowledge spillovers (Frenken, Van Oort and Verburg, 2007: 685). Higher related variety of a region would be positively correlated with learning opportunities there and knowledge industry-to-industry spillovers (Boschma, 2014: 53).

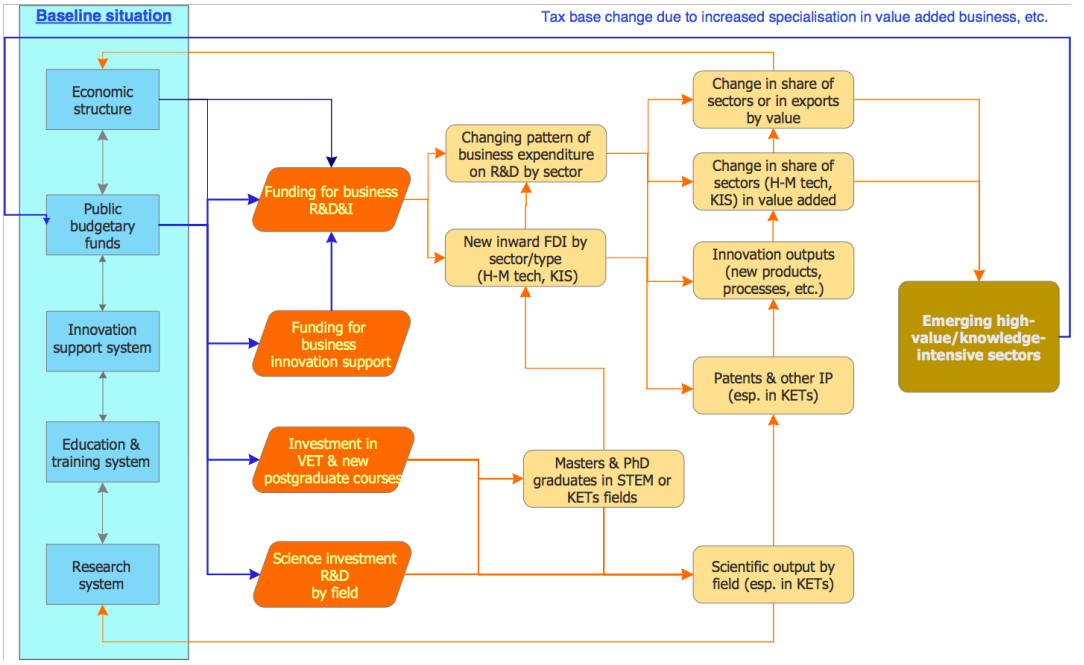
Educational or skills specialisation focuses on key disciplines for development of R&D (STEM) and KETs. "KETs have been defined by the European Commission as knowledge intensive technologies associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment. KETs enable process, goods and service innovation throughout the economy and are of systemic relevance. KETs currently include the following six areas of technology: micro-/nanoelectronics, nanotechnology, photonics, advanced materials, industrial biotechnology and advanced manufacturing technologies" (EC, 2016: 10).

Resources and performance in science can be tracked through various ways. Scientific Activity Index provides quantitative assessment of researchers and academic results, e.g. by analysing number of publications, calculating the the citation index (Griniece et al., 2017b: 85). Scientific Specialisation Index shows percentage of publications per scientific discipline (see Online S3 Platform, 2018). Share of human resources in the fields of science and technology is another example. Further possibilities may be an analysis of the number of publications by scientific field and by region, analysis of academic organisations by publishing activity, as well as longitudinal analysis of scientific production in a region.

RTA index shows patent activity in a technology. If a region does not produce any patents at all in a technology then the index shows a value of zero. A value of the RTA of one would mean that the region is at the EU average, while a value of RTA higher than one shows a relative specialisation in that technology of the region (Online S3 Platform, 2018).

Analysis of specialisation always needs to account for the existing socio-economic structures of a country or a region, i.e. of a certain baseline situation. One such example is given in Figure 21. Left hand side of the diagram (shaded blue) shows a baseline situation showing a certain economic structure, innovation support system, education and training system, a research system, and public budgetary funds. While all of the aforementioned influence each other, public budgetary funds are crucial for investment into research, development and innovation (R&D&I), corresponding innovation support measures as well as in vocational education and training (VET) - marked orange in the diagram. This investment affects several processes in an economy (shown in light ochre in the diagram), eventually resulting in the emerging high-value/knowledge-intensive sectors (shaded light brown) that in turn affect public budgetary funds.

Figure 21: A conceptual framework for specialisation analysis



Note: R&D&I is an abbreviation for research, development and innovation; VET stands for vocational education and training. H-M tech stands for high-technology and medium-high technology industries; KIS is an abbreviation for knowledge-intensive services. STEM abbreviation stands for science, technology, engineering, and mathematics. KET is an abbreviation for key enabling technologies. IP stands for intellectual property.

Source: Authors' elaboration

The next chapter describes Online S3 applications that may be used in the specialisation analysis.

4.2 Online S3 Applications relevant for the Roadmap

There are 10 applications that can be used to discover specialisation of a country or a region in different fields. A brief description of each application is provided below[1], together with an explanation how it can be used.

Application 2.1 Regional assets mapping. This application works as a dashboard, providing information on seven different domains: geography, demography, economy, sectoral structure, business characteristics, and innovation system at NUTS II level and for a number of years. The output generated by the application can be organised either based on the variable or based on the region. It can be presented as a table (downloadable in a .xlsx

[1] The description is largely based on Online S3 Toolbox (2018) and the accompanying documents found at the website, online.

format). They can also be shown in a form of a line graph or a bar chart and subsequently export the graphs in the .png format. As noted by Griniece et al. (2017b: 25), mapping regional assets is crucial and serves as a basis for other methods.Next two applications provide information on innovation infrastructure (Griniece et al., 2017b: 26). These are application 2.2. (Research infrastructure mapping) and 2.3 (Clusters, incubators & innovation ecosystem mapping).

Application 2.2 Research infrastructure mapping. This application provides information on research infrastructures in the EU and Norway, Turkey and Switzerland. Research infrastructures are all those physical and human resources that provide services for research in science or technology fields. The application draws on the European Strategy Forum on Research Infrastructures (RI) data, and from the MERIL database. Additionally, the users can update the information themselves. The users first need to select which RI they would like to search for, and it will be shown on a map. The users can then zoom in for the most pertinent information regarding the RI. The application can also export the results to a report in .docx format.

Application 2.3 Clusters, incubators & innovation ecosystem mapping. This guide provides a link to: 1) The European Cluster Mapping Tool, 2) Regional Ecosystem Scoreboard, and 3) Cluster Collaboration Platform. The instructions how to use them are provided in the guide itself. The first tool visually shows cluster analysis from a sectoral or a cross-sectoral perspective. The second scoreboard provides analysis of conditions affecting entrepreneurship and innovation either in NUTS I or NUTS II regions, depending on the country. The Cluster Collaboration Platform serves for mapping cluster organisations, and it shows them on a map of Europe (and the World).

Application 2.4 Benchmarking. This application provides regional comparisons based on either a .xls file that can be uploaded or on the generation of a new table. Data could also be imported from the application 2.1 Regional assets mapping. A reference region will be compared to selected regions. The data can be exported to a .xslx or a .csv format. The analysis thereby made can also be visualised on a diagram. Benchmarking “method will foster analysis that places regions in international comparative perspective“ (Griniece et al., 2017b: 26). For example, share of human resources in the fields of science and technology can be analysed with this application.

Application 2.5 Regional scientific production profile. The application enables users to carry out bibliometric analysis of scientific performance at the national, regional and the city level. The data are based on Scopus database, and the application's three tools can provide a subject area analysis, an affiliation analysis or an annual analysis. The results are available as charts, and a Word document report is generated at request. “There is a need to increase understanding of knowledge produced and available in regions. This is relevant for linking it later to the demand for knowledge and identifying emerging areas of activity“ (Griniece et al., 2017b: 27). An analysis of the number of publications by scientific field and by region, of academic organisations by publishing activity, and an analysis of scientific production in a region over time can all be done with this application.

Application 2.6 Specialisation indexes. This application generates technological (RTA), scientific (AI), and economic indexes (RCA) that enable users to analyse how regional activities fare in global value chains. The scientific profile data obtained in the Application 2.5 (Regional scientific production profile) need to be uploaded in order to calculate the Scientific Specialisation Index. For the Economic Specialisation Index (i.e. RCA), export data of the region need to be provided. The results can be visualised in a dashboard and a report can be generated as a textual file.

Application 4.2 Extroversion analysis. This tool provides a link to two external apps: The EU trade Tool and the Trade Competitiveness Map. The former helps visualise inter-regional trade flows (exports and imports), and see competitors of the region, the competitiveness scores, and trade network scores. The latter enables analysis of country and product competitiveness on the basis of many different indicators, with the help of graphs.

Application 4.3 Related variety analysis. The application analyses sectors by the number of employees, unveils sectoral specialisation (that shows whether an industry at the regional level is performing relatively better than at the national level), technological specialisation (concerning patents), and correlated sectors (if any). The images thereby produced can be exported to a file. As this method was not used in cases examined by Griniece et al. (2017b), the application serves an important purpose of providing an important and a user-friendly means of analysis.

Application 5.3 Budgeting. The budgeting application helps users visualise and manage budgeting data for the NUTS 0, NUTS I and NUTS II regions through an online dashboard. It produces an overview of the RIS3 financial plan. Users need to provide initial data, as well as define the time period of the financial plan and the RIS3 priorities. The application enables extraction of tables and graphics. As RIS3 background analysis has thus far lacked a standard budgeting analysis that would help the process of RIS3 design.

Application 5.6 Innovation maps. This application uses grant data on innovative programmes in different regions. Data could either be inserted manually or imported (also from the application 5.7 Open data tool), enabling more detailed analysis. Data can subsequently be visualised (through a heat map or a bubble map), as well as extracted.

These ten applications can be used in a workflow to manage the specialisation analysis, as explained below.

4.3 Workflow to manage the specialisation analysis

This subsection is concerned with the way in which applications are organised in this specialisation analysis and with which goals and elements of the specialisation workflow described earlier they can be associated.

4.3.1 Process overview

These ten applications discussed in the previous subsection can now be shown to work in

the following way. In order to explore the baseline specialisation, policy makers could use all ten of them:

- 2.1 Regional assets mapping,
- 2.2 Research infrastructure mapping,
- 2.3 Clusters, incubators & innovation ecosystem mapping,
- 2.4 Benchmarking,
- 2.5 Regional scientific production profile,
- 2.6 Specialisation indexes,
- 4.2 Extroversion analysis,
- 4.3 Related variety analysis,
- 5.3 Budgeting, and
- 5.6 Innovation maps.

In the next step, in order to monitor investments by specialisation area, users will follow developments in the sphere of investments, and analyse changes that occur during the chosen analysis time frame by using the applications

- 5.3 Budgeting, and
- 5.6 Innovation maps.

There are a number of developments in the economy that have occurred as a result of RIS3 as mentioned above. Hence one can analyse outcomes in terms of changing specialisation. Some of the changes in specialisation have been captured in Figure 22:

1. Change in share of sector or in exports by value,
2. Change in share of sectors (H-M tech, KIS), in value added,
3. Innovation outputs (new products, processes, etc.),
4. Patents & other IP (esp. in KETs), and
5. Scientific output by field (esp. in KETs).

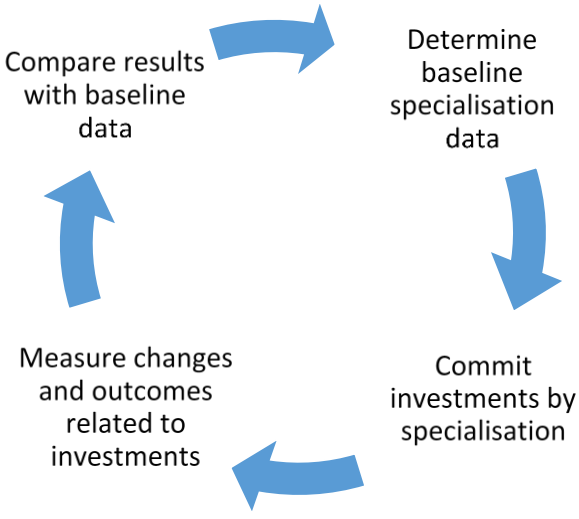
These can be analysed by using the following applications:

- 4.2 Extroversion analysis,
- 2.6 Specialisation indexes,
- 4.3 Related variety analysis, and
- 2.5 Regional scientific production profil e.

Any changes in the results need to be compared with a previously analysed baseline situation. That comparison will enable an analysis of the emerging high-value/knowledge-intensive sectors. For these sectors, application 4.3 (Related variety analysis) will be of use.

In later analysis iterations, data gathered in the previous analysis period can then be used as new baselines against which to measure developments and evaluate changes; the described analysis process should be understood as cyclical. The following figure (Figure 3) outlines this cyclical monitoring and evaluation approach:

Figure 22: Specialisation analysis workflow



4.3.2 Determining baseline specialisation data

The target domains for determining the baseline situation in terms of the policy analysis have already been indicated in previous subsections of this section. Five topics are relevant at this step.

The topic of **Economic structure** is concerned with identifying the current economic structure in a region in order to identify areas where additional funding may strengthen specialisation efforts. Economic structure investigations can be supported by the applications 2.1 Regional assets mapping (that informs an all-around analysis of an economy), 2.4 Benchmarking, 2.6 Specialisation indexes (measuring technological, scientific and economic specialisation indexes), 4.2 Extroversion analysis (leading to tools that analyse trade and competitiveness) and 4.3 Related variety analysis (with a specific focus on identifying areas of specialisation).

The topic of **Innovation Support System** focuses more directly on the available infrastructure to enable innovation (assumed to be encouraged in areas identified for specialisation activities). These efforts can be supported using the application 2.1 Regional assets mapping in order to identify existing key regional assets, 2.2 Research infrastructure mapping in order to identify current and planned research infrastructure and 2.3 Clusters, incubators & innovation ecosystem mapping, a tool for defining niche areas in which regions already have a competitive advantage.

The topic of **Public budgetary funds** can be supported by the application 5.3 Budgeting when the process reaches the stage of planning resource allocation for funding.

The **Education & training system** and the **Research system** present in a region are often factors of key importance for innovation, particularly when it relies of activities that are not

short-term market focused, and when it relies on the availability of appropriately skilled and trained staff. The applications 2.2 Research infrastructure mapping, 2.3 Clusters, incubators & innovation ecosystem mapping and 5.6 Innovation maps highlight areas of research focus and excellence in a region by examining existing infrastructure and funding that has been received in terms of relevant research grants. The application 2.5 Regional scientific production profile generates scientific profiles using data on scientific publications.

4.3.3 Committing investments by specialisation

Four topics are relevant in terms of committing funding for specific areas of innovation.

Funding for business R&D&I and Funding for business innovation support services are two measures that target business innovation. The former includes direct funding of firms' R&D&I and the latter is intended to support advisory services, cluster managers, and other services that include advising for innovation activities. The application 5.6 Innovation maps can be used in order to track funding previously granted so as to identify areas where complementary support may be useful.

Investment in VET (Vocational and Educational Training) & new postgraduate courses and Science Investment R&D by field focus on scientific research and fostering education in topic areas relevant to targeted specialisations. As for commercial innovation activities, research funding that has been granted can be monitored through the application 5.6 Innovation maps.

All topics in this subsection can of course be supported via the application 5.3 Budgeting.

4.3.4 Measuring changes and outcomes related to investments

Eight measurable areas are of concern in this segment of topics in specialisation analysis. As for previous steps, these topics can be grouped and supported by sets of applications. In this step, the purpose of using the Online S3 applications is to gather data and to measure outcomes caused and/or influenced by funding made as part of an RIS3 initiative.

Outcomes in terms of Changing pattern of business expenditure on R&D by sector and New inward FDI by sector/type (H-M tech, KIS) should be analysed separately, based on Eurostat data.

Outcomes in terms of Change in share of sector of exports by value can be analysed using the applications 2.6 Specialisation indexes and 4.2 Extroversion analysis. Outcomes in terms of Change in share of sectors (H-M tech, KIS) in value added should be analysed separately, but the analysis can be aided by the applications 2.6 Specialisation indexes and 4.3 Related variety analysis.

Outcomes in terms of Innovation outputs (new products, processes, etc.) and Patents & other IP (esp. in KETs) can also be analysed using the application 2.6 Specialisation indexes.

Outcomes in terms of Scientific output by field (esp. in KETs) can be evaluated using the application 2.5 Regional scientific production profile (for scientific publications). As to

Masters & PhD graduates in STEM or KETs fields the analysis should be based on simple comparisons of reported graduation statistics.

A key outcome of the overall process of analysis, funding and monitoring is to focus on specialisations for which there is potential in a particular region. Hence, the final step of an RIS3 process should focus on evaluating and quantifying the impact of activities on the creation of areas for specialisation, on Emerging high-value/knowledge-intensive business clusters. The application 4.3 Related variety analysis should help in order to gather information on specialisation outcomes.

4.4 Specialisation roadmap dashboard design

This subsection is concerned with the implementation of the specialisation roadmap as a section of the Online S3 platform.

4.4.1 Goals for the roadmap dashboard implementation

All Online S3 roadmap dashboards have been designed with the purpose of providing a specific view on the RIS3 process and on the Online S3 tools that are available to support it. As such, the goals for the dashboard implementation are to provide users of the Online S3 platform with:

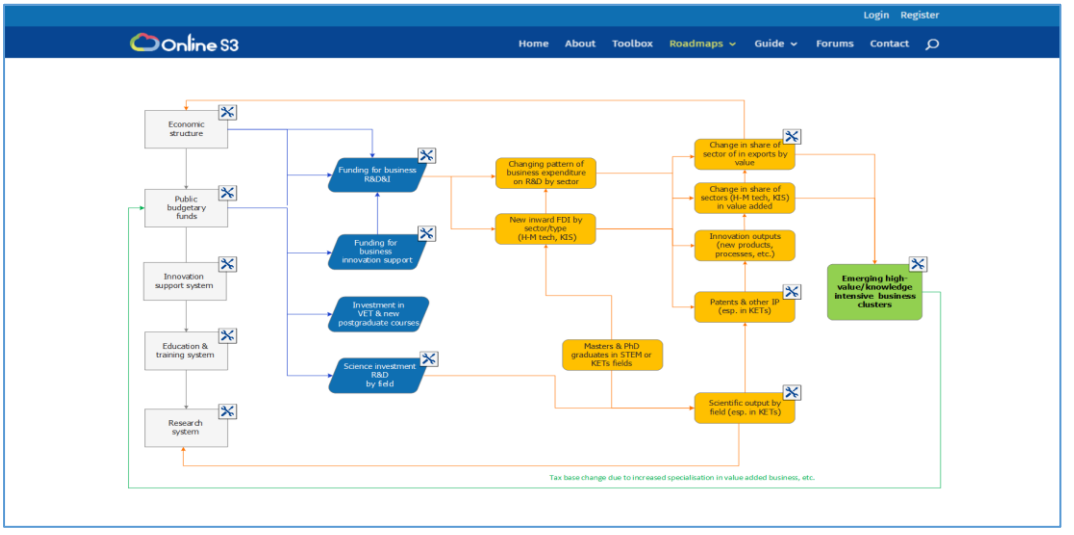
- An easy to understand overview of the roadmap they are using,
- Information on the individual elements of the roadmap if they are not self-explanatory,
- A guide concerning which applications should be used as part of the roadmap, and when/for which specific purpose they should be used.

In terms of presentation, the consortium decided to present each roadmap on a separate, if necessary reactive page on the Online S3 Platform. Partners were asked to create at least two distinct proposals for the design of each roadmap presentation; there was no requirement to present all roadmaps in a uniform way.

4.4.2 Process diagram-based prototype design

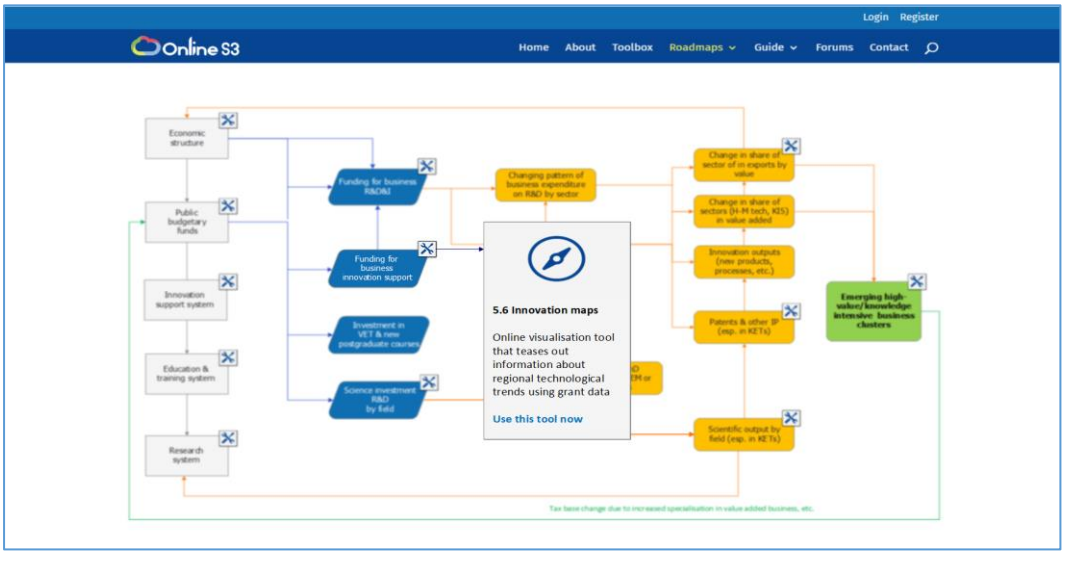
The specialisation roadmap itself has been developed and visualised as a process diagram, so the most straightforward approach for presenting the roadmap is to transfer the process diagram into an interactive format while maintaining the process diagram elements and layout. The following figure (Figure 23) shows a graphical prototype for this type of dashboard design:

Figure 23: Specialisation roadmap process diagram view



The dashboard reproduces the diagram with clearer colour-coding of elements and connections in order to distinguish different phases in the process more clearly. Icons are used in order to indicate process steps where Online S3 tools are available as support. Information on a specific element and on the available tool is available using an overlay pop-up, from which users can also launch individual applications (**Figure 24**).

Figure 24: Specialisation roadmap process diagram view with overlay

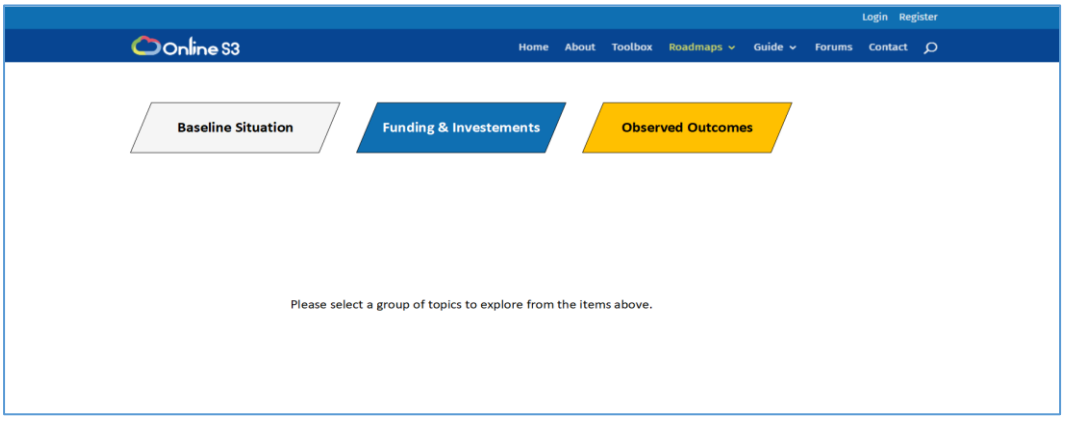


In the prototype for this version of the diagram, inactive elements are blurred out of focus in order to highlight the active element.

4.4.3 Menu-based prototype design

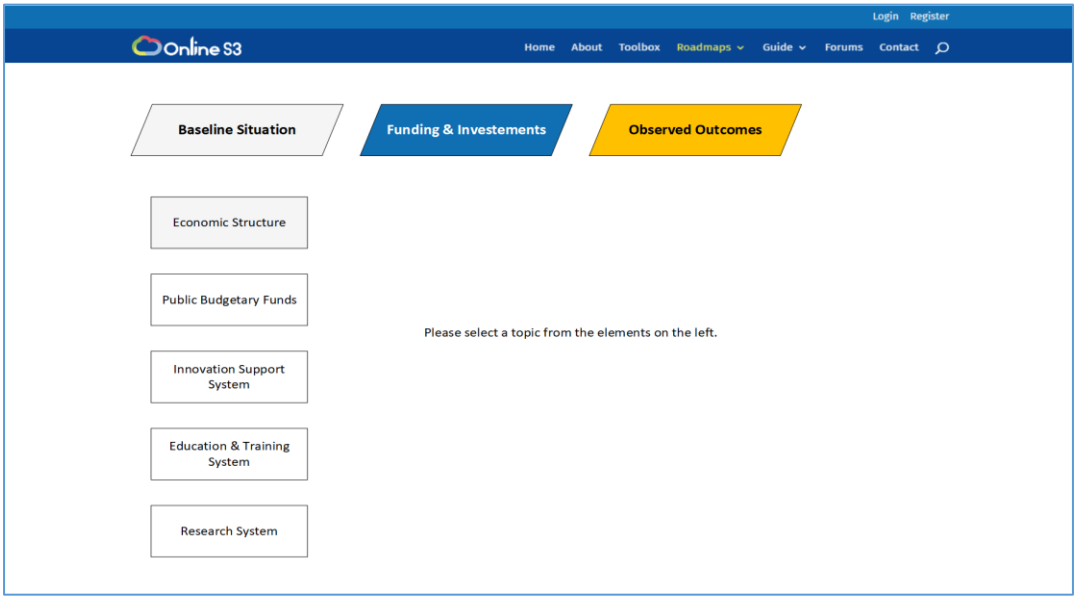
Numerous alternative dashboard representations of the specialisation roadmap are possible. One significantly different alternative option is to make the different process steps of the specialisation roadmap explicit and to use them as a navigation option through the process elements as well as the related applications. Figure 25 illustrates such an approach:

Figure 25: Specialisation roadmap menu view all closed



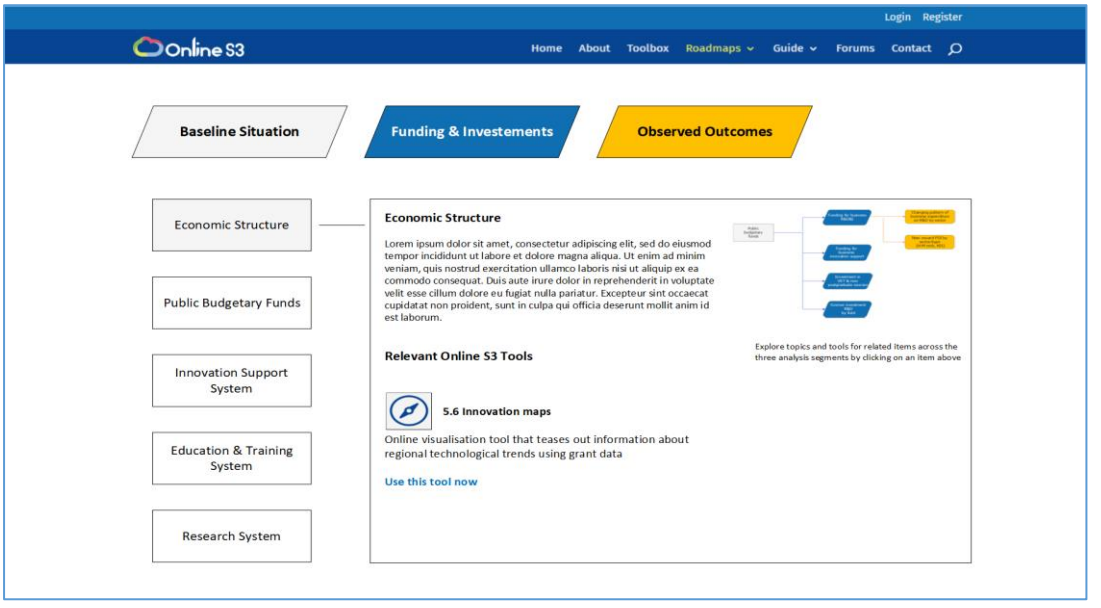
Selecting a topic area displays the elements in the topic area as a drop-down menu list (Figure 26).

Figure 26: Specialisation roadmap menu view menu open



Selecting a menu element then displays information on the selected element as well as information on the related Online S3 applications and the connections of this element with the overall specialisation roadmap (Figure 27).

Figure 27: Specialisation roadmap menu view element view



The diagram view shown in the element view is clickable, so that users can navigate directly between individual elements without a need to switch between menu levels.

4.4.4 Other design options considered

In addition to the presented designs, many other design options can be investigated, for instance:

- explicit representation of the cyclical nature of the specialisation roadmap process (as has also been done in this section), arranging topics and applications around a cyclical diagram;
- swimlane representation of an explicit timeline and of connections between elements that highlights direct relations between individual elements over time;
- wizard-style presentations of activities, where progress through a process is presented by means of individual steps one at a time and successive steps are presented to the user as activities are completed.

Many other visual and structural alternatives can be considered in addition; the three given above have been included in order to highlight completely different approaches to how users would be presented and interact with the design options considered.

4.4.5 Conclusion

The selection between the different alternatives that could be developed into prototypes as well as the selection of the solution to implement were guided by the following criteria:

1. The dashboard should provide an immediately accessible overview of the specialisation roadmap; users will likely use the roadmap view infrequently over a long period of time, so it cannot be assumed that they will remember the complete roadmap or their interactions with it.
2. The dashboard should allow us to provide users with all the information that we need to convey on a single view (i.e. without pagination).
3. The dashboard should retain the full information presented in the specialisation roadmap view as presented in this section.

Among the considered options, reusing the process diagram view of the specialisation roadmap is the option selected by the developers based on these criteria. Changes and improvements to the prototype implementation will be made as part of the development process, so the final version of the dashboard will differ visually from the prototype presented here.

5. Roadmap focusing on industry vertical platforms and Global Value Chains (GVCs) analysis

5.1 Introduction

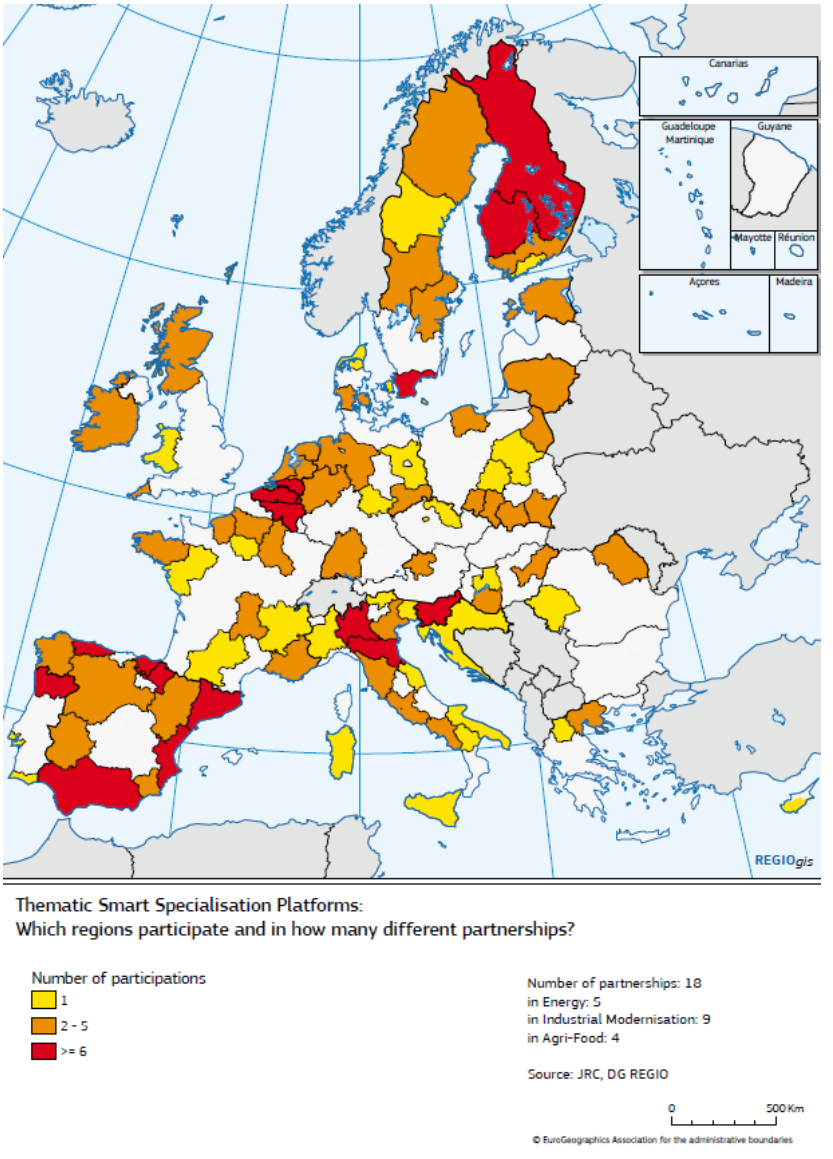
This roadmap aims to provide methodological guidance to policymakers and regional officers on the specific (thematic) investment priority areas selected by the regions/countries within their RIS3 strategy. As many European regions have set related priorities under their smart specialisation agenda, the European Commission focuses on areas of common interest with the purpose to build synergies and complementarities, share infrastructures and access funds from a combination of investment instruments (such as ESIF, COSME, Horizon 2020). Currently, the European Commission has established three Thematic Smart Specialisation Platforms aiming to foster interregional collaboration among regions with matching smart specialisation priorities; these are on Agri-Food, on Industrial Modernisation and on Energy (**Figure 28**). The main rationale for these platforms is to avoid blind duplication of efforts that would ultimately lead to excessive fragmentation and loss of the potential for synergies creation. Such task can be achieved through mapping the national/international context and making systematic comparisons between the region/country and the wider competition with the aim to identify the region's/country's

specific competitive advantage, reveal possible patterns of integration with partner regions and develop potential strategies for differentiation, improvement and growth.

Based on the above, it seems that focusing on a thematic area requires to look beyond the national/regional administrative boundaries. Regions/countries need to map networks and consider the role and input from Global Value Chain (GVC) analysis, meaning the way in which activities of the value chain of a product/subsector are spatially arranged within the constraints of product physical and knowledge characteristics. Currently the effort for smart specialisation policies across Europe is focused on mapping the concentration of capabilities and the way these are leveraged across the European market through networks and value chain linkages for a commercial impact. As this is a complex task to be performed by policy makers, the JRC has published a number of reports (Brennan and Rakhmatullin, 2015; Todeva and Rakhmatullin, 2016a, 2016b) on how GVC mapping can be performed in the context of smart specialisation strategy, providing both methodological information and examples on specific sectors and countries. The theoretical background of this chapter lies on these three reports; however, we adopt a broader and more practical understanding of the concept of GVCs within the RIS3 focusing on the need of regions to design innovative investment projects in thematic areas and niche markets and proposing a series of routes that regions should follow to achieve this. We recommend that these routes, and the use of the proposed tools from the Online S3 project, should be made in combination to the analytical methodologies proposed by JRC for GVCs mapping and analysis.

In this line of reasoning, this roadmap aims to help regions design innovative investment projects per niche market industry and more specifically to i) identify concentration of capabilities in specific sectors or technologies in order to reveal the region's competitive advantage, ii) investigate links of these activities to wider chains of value and the exact position of the region in such chains, and iii) consider scenarios and future actions for improving this position and create greater value to the region. After this short introduction, the next section of this chapter provides a theoretical background on Global Value Chains in the context of RIS3 and what are the main issues for discussion, while the third describes the Online S3 applications that relevant in different areas of GVC analysis and could be used for the definition and implementation of thematic strategies within the RIS3. In the fourth section we describe the different routes that one might choose according to the needs of the analysis, therefore we present alternative workflows and combinations of the relevant applications, which are illustrated through the proposed dashboard sections at the end of this chapter.

Figure 28: EU Regions that participate in Thematic Partnerships.



Source JRC. DG Regio.

5.2 Global value chains within the RIS3 context

Today we notice global fragmentation and internationalisation of production in a way that the new form of global trade can be characterised as chains of value added activities that connect countries and regions. It is estimated that 60% of global trade consists of intermediate goods and services within the GVCs (Brennan and Rakhmatullin, 2015; Todeva

and Rakhmatullin, 2016a). These borderless production systems and interconnected markets fundamentally affect the structure of global trade (OECD, 2013a). During the last decades, for example, manufacturing has migrated to low cost economies, transforming the economies of many European regions. Global manufacturing networks, which differ significantly across industries may change and new ones can emerge capitalising on new technological opportunities and creating value from new business models. The structure and governance of such networks is a rising topic in the scientific and policy discourse.

The value chain is a concept that is used to describe the entire range of activities encompassed between the conception of a product to its end use and beyond, representing the coordination of flows of materials, goods, information, knowledge, finance and people (Gereffi and Fernandez-Stark, 2011; Brennan and Rakhmatullin, 2015). The activities that comprise the value chain include the design, production, marketing and distribution of a product to the consumers. Such activities can be conducted by a single firm but usually they are divided among different firms, increasingly spread over different countries and across industries, which also explains why the value chains are most commonly referred as 'global' (De Backer and Miroudot, 2014).

Global Value Chains are complex globally integrated organisational systems containing fragmented and modularized activities that take place across multiple countries. They incorporate activities from product design, sourcing and production to marketing, distribution, customer support and after use disposal. They also embody a wide variety of assets such as materials, information, financial assets and people flows (Brennan and Rakhmatullin, 2015). The main principles of global value chains are from the one hand specialisation and division of labor and on the other interconnection and high level of coordination and just in time convergence processes (Todeva and Rakhmatullin, 2016a). The value chain represents a modularized version of the Fordist manufacturing process with both linear and interactive processes and functions taking place within and outside the firm which individually add value to the final product. Value chains are determined by the production technologies, the manufacturing processes and the final products; therefore, when studied they are categorized as technology specific, product specific, industry specific, labor intensive, capital intensive and so on (Todeva and Rakhmatullin, 2016a).

At a policy perspective, the global value chain perspective can be used to assess the comparative advantage and level of competitiveness of an industry in a region/country. This is particularly relevant for the Smart Specialisation paradigm which requires regions to build on their own strengths and establish priority areas in the context of national and regional trade networks. This is a major novelty for smart specialisation which requires regions to make decisions taking into account their position in relation to other European countries

and regions and directs them towards growth through co-specialisation (OECD, 2013b). For this type of assessment, it is not sufficient to have only endogenous knowledge of the regional assets and capabilities but also international knowledge of production networks and similar actors (Radosevic and Ciampi Stancova, 2015). Yet, this is not an easy task.

As global value chains (established or emerged) constitute complex value networks, their management and governance require great knowledge of multiple factors and variables which determine the strategic choices of actors that relate to which activities should be performed in house and which will be externalized. Value chain configurations can be influenced by multiple factors, such as cost factors (wage rates, inflation, tax etc.) but also of other, such as the existence of infrastructure, talent availability, IP protection, domestic supply networks and so on. Currently, value chains are mostly coordinated across firm boundaries and not across geographic locations in which firms collaborate. Mapping and analysis of value chains at the regional level is difficult, due to the limitations that exist from the lack of analytical data (e.g. regional input and output data per industry). So far, analysis is mainly done at the country level using data from large multinational companies as well as export trade data.

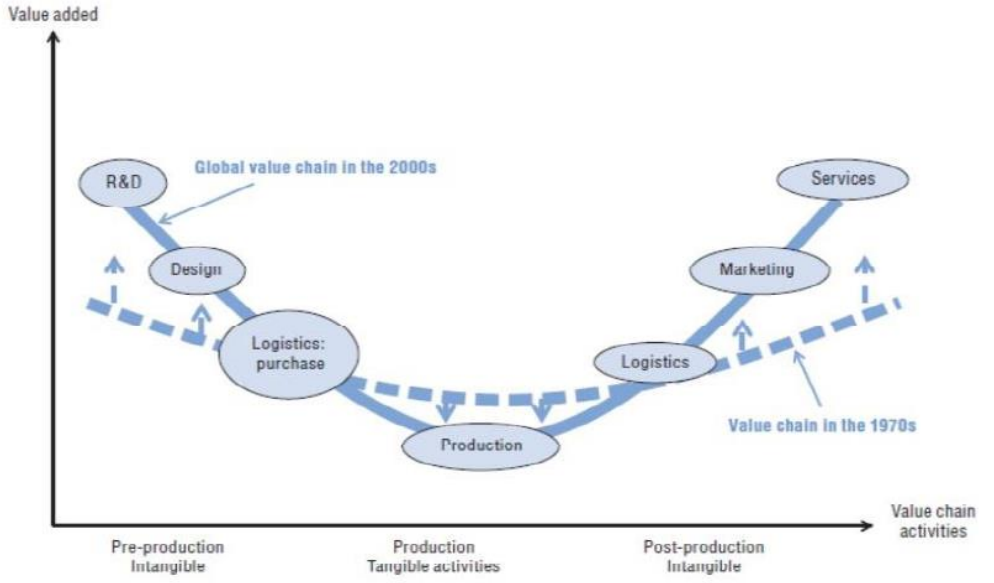
The analysis of GVC also suffers from the shortcomings and limitations of analytical methodologies (Keane, 2014; Todeva and Rakhmatullin, 2016a). Brennan and Rakhmatullin (2015) argue that gaining insight into GVCs should be done in five steps: i) mapping first the various stages across locations and firms, ii) digging into each stage revealing details on the exact activities, resources, assets, and relationships, iii) determining the chain orchestration, iv) decomposing the activities at each stage and v) ascertaining possibilities for participation based on the existing situation but also taking into account future trends. The actual implementation however of these steps is hindered by the lack of data and therefore, their analysis focuses only on the mapping exercise. The JRC publication series on this topic (Todeva and Rakhmatullin, 2016a) discuss several methodologies that arise from strategic management theory, international business and trade theories, as well as industrial organisation approaches, providing empirical observations as an added value to the analysis of GVCs. Finally, in their second paper, Todeva and Rakhmatullin (2016b) propose two broader methodologies, both of which are aligned to the Vanguard methodology for inter-regional collaboration: a top-down global value chain mapping and a bottom-up approach aiming to identify capabilities within the GVC that operate at specific locations.

These efforts highlight the need for the collection of detailed data while they also provide a more technical view into the GVC analysis which might be overwhelming for regional officers and policy makers to adopt within their RIS3 strategy. Detailed focus on a specific

sub-industry that might constitute a segment of a value chain constitutes a relatively complex task that might seem as out of scope from regional authorities. The main problem still exists: **in which projects should a region invest in order to reveal its potential in specific sub-industries that are promoted by the region's RIS3?** This discussion emerges a number of new problems and questions that regions/countries need to answer that come on top of the request for the identification of priority areas for specialisation. These questions are the following:

- **How can I identify the region's/country's areas/sectors/capabilities that are part (or could possibly become) of an integrated value chain and what is the position of my region in this chain?** The implementation of smart specialisation so far focuses mostly on the identification of priority areas through an internal mapping from regional stakeholders and rarely measures the impact of these areas on value added trade or investigate value chain linkages that provide added value to the region. The main challenge though is the identification of the specific activities that seem to create value through their connection to activities conducted in other regions. Yet, understanding the concentration of capabilities in a region or country is not sufficient in order to identify ways of improvement. Value chain mapping is therefore followed by capabilities' mapping which means to map the analytical sequence of activities and assess the value added in each distinct set of activities in order to examine its degree of participation and position in the industry GVC. It also means to identify and map backward and forward (or upstream and downstream) linkages within the value chain.
- **How can I identify opportunities for repositioning in the value chain in order to create further value?** The strategic approach to value chains refers to assessing the value that is added in each activity of the chain and the ability to undergo specific transformations in order to reposition in the chain into an activity with higher value (**Figure 29**). The analysis aims to reveal opportunities for maintaining/extending/deepening or altering the region's/country's positioning on the GVC like for example to invest in General Purpose Technologies (GPT) in order to upgrade moving downstream and upstream in the value chain (OECD, 2013b).

Figure 29: The chain of value added.



Source: Todeva and Rakhmatullin (2016a)

- **With which regions could I explore collaboration and how could I build synergies within the framework of inter-regional and international initiatives?** The concept of Smart specialisation encourages inter-regional collaboration for European value chain integration. Based on the knowledge on the position and strength of a region's/country's industry on the GVC one may identify opportunities to capitalize on complementarities with other location or the development inter-regional/trans-European networks. Collaboration schemes could develop among regions with matching priority sectors or existing complementary capabilities. Moreover, inter-regional partnerships could be explored in order to create new or transform established value chains with the use of innovation technologies in products, processes or services. This means that a similar analysis to other regions/countries should be performed in order to investigate who else holds a significant position on the value chain, how strong is their position and what type of capabilities/clusters they have (e.g. competitive or complementary to the region/country in question).

The present roadmap aims to organize the Online S3 tools and applications in a way that contribute to answering the above questions.

5.3 Online S3 applications with relevance to the roadmap

We argue that a number of Online S3 applications can facilitate regions partly reply the questions described above. The relevant applications, and the way these applications can contribute to the analysis, are described in this section.

- Specialisation indexes (Application 2.6)

The analysis of regional specialisation is key in determining the existence or not of a regional competitive advantage in a specific area. The application produces technological and economic specialisation indexes using an interactive dashboard. It produces indicators such as the Activity Index (AI) for scientific activities, the Revealed Technological Advantage (RTA), and the Revealed Comparative Advantage (RCA) for economic activities. As in the case of other applications it has to be used in collaboration to other applications using qualitative and quantitative information for a subjective analysis of the region.

- Clusters, incubators and innovation ecosystems mapping (Application 2.3)

Cluster analysis is at the heart of GVC analysis as it reveals the extent to which a cluster forms part of a global value chain and provides important insights around GVC participation (Brennan and Rakhmatullin, 2015). Cluster partnerships, the European cluster consortia and many other related initiatives aim to build innovative value chains that foster inter-regional and international activities and collaboration schemes (Todeva and Rakhmaullin, 2016a).

Clusters, incubators and innovation ecosystem mapping is tool facilitates a better understanding of the niches that regions have a competitive advantage in. The tool also allows an improved understanding of local business needs. Hence, the tool helps RIS3 facilitators to gain crucial background information for selecting regional smart specialisation priorities.

The use of cluster and ecosystems mapping tools can lead to a better definition of those niches in which regions have a competitive advantage, and a better definition of local business needs. This allows more considerate development of future research and innovation policy, promoting targeted initiatives, unveiling potential areas of integration with local research institutions and helping to avoid duplications and redundancies. This application will provide the user with information on how to use already existing tools regarding the mapping of clusters.

- Science and technology profile and performance (Application 2.5)

Science and technology profile and performance tool produces scientific profiles for regions based on publications data. This bibliometric analysis allows comparisons between regions

and understanding the scientific performance of the region. The application allows the analysis and comparison of scientific publications among different regions in predefined thematic areas, while it also provides the opportunity to search subareas based on given keywords.

- Extroversion analysis (Application 4.2)

Extroversion analysis helps to determine the areas of present competitive advantage and regional excellence potential. It is an important methodology for priority identification because it contributes to the definition of concrete and achievable objectives. A well designed smart specialisation strategy/extroversion analysis will contribute to the selection of the few priorities that build on the specific strengths and opportunities of the region's economy. This targeted selection will enable the development and advancement of economies of scale and scope, as well as local knowledge spill overs with regards to the selected sectors.

- SWOT analysis (Application 2.7)

SWOT analysis is a useful tool in helping regions determine their regional assets and their relative positioning, and it can be used in order to identify areas of strength of a region to build on and investigate further. It facilitates the collection and evaluation of more qualitative information on specific sectors and key areas (e.g. the existence of strong supplier networks and collaboration, the existence of significant natural resources etc). In combination to other applications such as regional assets mapping (application 2.1), regional scientific profile (application 2.5) and specialisation indexes (application 2.6) this application could be used to identify areas of focus for existing or potential new GVC activities in the region. SWOT analysis is also a useful tool for communicating the regional situation to internal and external stakeholders but most important, it allows users to enter useful information themselves enabling the collection of data from experts on specific matters that are crucial to the assessment of GVCs.

- EDP focus groups (Application 4.1)

Since the data that are required for the analysis of the industry's position on the GVC may be unavailable or very difficult to access, there is a need to engage regional and international stakeholders and experts with deep knowledge of the industry GVC and its characteristics. In the case of the four thematic platforms established by the JRC, engagement and collaboration might be sought with other participating regions.

The harvesting of information through EPD has been implemented during the info-days of the thematic platforms and the official launch of the RIS platform.

- Related variety (Application 4.3)

Related Variety Analysis is an application that is designed to identify highly correlated sectors which can represent underlying regional growth opportunities for diversification. The identification of such sectors is found by means of combining data from two discrete sources: (a) sectoral employment data from EUROSTAT; and (b) patent data from OECD Regional Patent Database.

- Vision sharing (Application 1.1)

The purpose of this application is to assist policy-makers with engaging stakeholders in an entrepreneurial discovery process and communicate the resulting vision to them. The vision statement of a region shouldn't be just a bland statement that is solely formed by the regional authorities and hidden somewhere in formal documents. Instead, the vision should be shared with regional stakeholders (companies, citizens, educational institutions, NGOs), in order to discover and produce information about potential new activities and identify emerging opportunities. Meanwhile, policy-makers should assess the outcomes and find ways to facilitate the implementation of underlying opportunities. Given that the formed vision should be widely communicated back to the stakeholders, this application consists of information material, that can be used for vision sharing and other communication activities related to the RIS3 process, and links to external services that can be used to create customised information material.

- Research infrastructure mapping (Application 2.2)

The use of research infrastructure mapping leads to an effective use of the existing research infrastructures (RIs), at the same time helping to avoid duplications and redundancies. A comprehensive dataset referring to the European RI landscape might enhance and optimize the access to RIs by scientists and innovation policy makers. This is a key factor for strengthening competitiveness, as well as a necessary basis for tackling grand societal challenges. Data that have been used in this application have been extracted from the MERIL portal, by the National Documentation Centre EKT/ EIE, under the Creative Commons Attribution No Derivatives NonCommercial 4.0 Licence.

- Collaborative vision building (Application 3.1)

This method supports reaching a shared vision for a topic by gathering views from stakeholders through a structured collaborative vision building process. This process encompasses the creation of a "vision building session", the elicitation and gathering of input from stakeholders joining vision sessions, the proposal of a vision session, the discussion of the proposed vision session and the generation of a final vision statement.

This tool facilitates this process online and provides a means to document what happened during the process. Facilitators of a vision building process can start a vision building procedure through which stakeholders can provide input and discuss proposed vision statements.

- Debate at a glance (Application 1.2)

The application is based on Discuto, which is a platform for collaborative decision-making. It supports both private and public discussions on documents, collecting feedback, identifying conflicting views and reaching consensus among stakeholders. This tool allows facilitating discussions and debates with stakeholders in a quick and open way. The basic functionalities of the tool are free but upgrading to a paid subscription provides an access to some other useful functionalities, such as the idea generation process and information pages for discussions.

- Action plan co-design (Application 5.2)

Action Plan Co-Design is an application that permits regional authorities publish their RIS3 Action Plan and receive feedback and ideas from the public. The overall objective of this application is to provide a framework that facilitates stakeholders' involvement in the design of the RIS3 actions, so that they are better adjusted to their needs and priorities. The co-design of the RIS3 Action Plan and actions can significantly contribute to maximize the successful implementation of the overall RIS3 strategy.

- Open data tool (Application 5.7)

The RIS3 Open Data tool is a form of data repository that allows for a finely grained tracking of research projects (FP7, H2020) and initiatives implemented in each region with links to respective RIS3 priorities. Data is mined using an automated collection system which mirrors the CORDIS database along with additional information extracted from project and coordinator websites. Through the effective use of this application, the user will receive useful resources to generate a progress report concerning prominent topics of projects implemented throughout regions in Europe. The provided data allows regions to analyse whether their RIS3 objectives and visions are met and allows for networking between regional policymakers with common interests.

- End users' satisfaction survey (Application 6.4)

This application enables collecting reviews and comments from RIS3 beneficiaries (end users) regarding the RIS3 and its implementation. This will help policy-makers understand how well-suited the strategy and the related activities were to the RIS3 beneficiaries (firms, research institutes, universities, public sector and civil society organisations). It's crucial to

gather this kind of end user survey data periodically to support the constant development of the policies. Ideally, the survey should be sent during and after the development of the RIS3. This will support and guide the RIS3 implementation efforts and yield useful information regarding future RIS3 endeavours. Potentially, if the regions use the survey template of this application, the surveys could be used to generate benchmarking data across regions as well. The application includes a ready survey template, which can save policy-makers from the effort of coming up with entirely own questions.

- Balanced scorecard (Application 6.3)

Balanced Scorecard is a strategic planning and management method that aims to align regional authority activities to the vision and strategy of the region. It has been developed to produce a strategic performance measurement system that could use both non-financial measures and financial metrics, providing a balanced view of the performance of policy implementation processes. The tool helps identify what needs to be done and what should be measured, based on the RIS3 strategic plan of the region. A balanced scorecard should result in improved processes, motivated and educated regional authority employees, monitored progress, greater stakeholder satisfaction. Moreover, it should support a holistic perspective on the structure robustness of the policy design model, as well as provide data for better informed decision-making processes. The balanced scorecard is not a one-time process and should act as a feedback method that is applied continuously.

5.4 Workflow description

We propose a five-stage process for designing innovative investment projects per niche industry market, such as: i) mapping sectoral and regional strengths, ii) identification of actors per sector of interest, iii) actors' engagement, iv) collaborative project design, v) monitoring and assessment (Table 7). This is a sequential process with significant though turning points to receive feedback or re-evaluate previous findings from earlier steps. In addition, tools that normally belong to one stage, can be used in another stage with a different perspective depending on the question that is posed each time.

Table 7: Processes in the design of innovative investment projects in thematic areas.

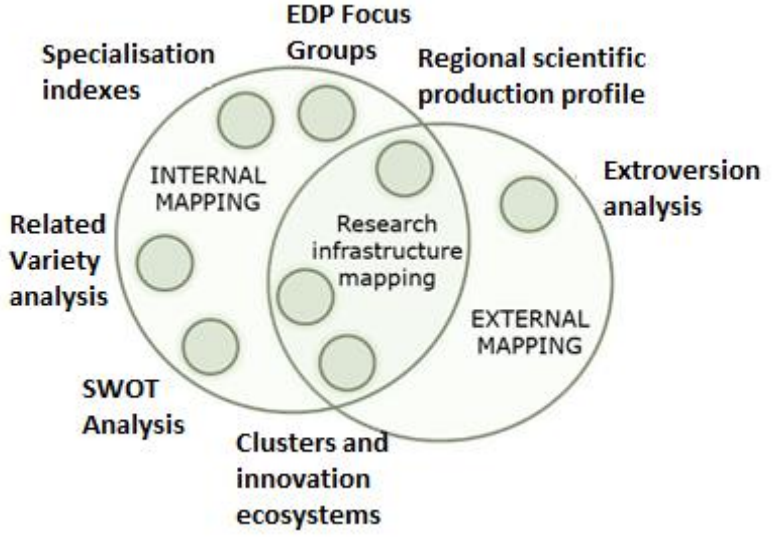
1. Mapping	2. Identification of actors	3. Actors engagement	4. Project co-design	5. Implementation, monitoring and assessment
2.6 Specialisation indexes 2.5 Regional scientific profile 4.3 Related variety	2.3 Clusters and innovation ecosystems 1.1 Vision sharing 2.2 Research infrastructure	1.2 Stakeholder engagement 1.3 Debate at a glance 3.1Collaborative vision building	5.2 Action plan co-design 5.7 Open data repository	6.1 Definition of result and output indicators 6.3 Balanced scorecards 6.4 Stakeholder

4.1 EDP focus groups 2.7 SWOT analysis	mapping 4.2 Extroversion analysis			satisfaction survey

Below, we explain the use of each tool in each of the stage, illustrating the type of interactions and feedback loops that exist in this process.

1. Mapping: The first step is about mapping. The aim of this step is to study a particular area firms' dynamic capability including the tangible and intangible resources, skills, knowledge and learning, experience and competences, R&D capabilities, patents and licenses, brand name and market reputation, organisational processes and routines or other location advantages, in other words to identify how firms produce and create revenues from a particular market. Here, we have a group of diagnostic tools assessing the specific productive, scientific and technological capabilities of a region as well as apparent strengths and weaknesses in a specific thematic area. Mapping includes analysis of the regional specialisation, the exact technologies and scientific sub-fields in the thematic area, the existence of research infrastructures that are useful in this field, the existence of clusters and innovation ecosystems, as well as other industrial sub-sectors with technological proximity (Figure 30).

Figure 30: Schematic representation of a holistic regional mapping processes, using the Online S3 applications.



This exercise however should not be restricted to the internal environment of a region/country. Mapping cross-sectoral and cross-regional activities in the same thematic area as well as other activities in the same value chain will advance the knowledge of regional stakeholders on their own capabilities and will enable them to connect in the most

effective way. This means that it is not only important to know the existence of a cluster in the thematic area of interest within the region, but all other clusters in the same field within the European space. Also, it is important to investigate how regions with the same thematic priority stand in comparison to the region in question or which position they hold in the value chain. Therefore, scientific profiling will identify complementarities and research infrastructure mapping potential collaboration opportunities. In both internal and external mapping, the use of EDP focus groups with regional stakeholders and experts (domestic and international) will validate results and infuse valuable qualitative input to the whole process.

2. Identification of actors: The next step relates to the identification of actors which will be engaged for the collaborative design and implementation of innovative investment projects. For this, existing clusters and institutions should be identified and collaborate with respect to a common vision. At this stage, organisations from industrial sub-sectors with technological proximity to the thematic area in question (as they have been identified by related variety application) should also be spotted and approached.

In the case that the region wants to engage in a collaboration with a peer from the same value chain, then the applications clusters and innovation ecosystems and research infrastructure mapping or applications from previous steps (e.g. extroversion analysis) can identify relevant actors from other regions (Figure 31).

3. Actors' engagement: The third step is the engagement of stakeholders. Here, the applications that are relevant for use include debate at a glance, EDP focus groups and collaborative vision building (Figure 32).

Figure 31: Schematic representation of identification of actors per sector of interest, using the Online S3 applications.

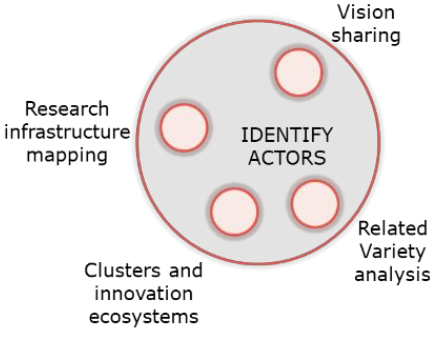
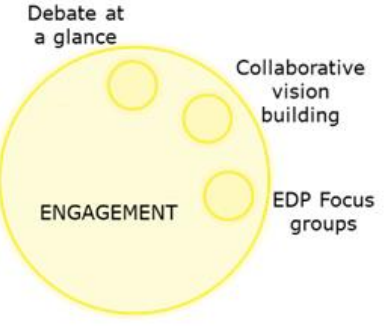


Figure 32: Schematic representation of stakeholders' engagement process, using the Online S3 applications.



4. Project co-design: Steps from now on are very similar to the generic roadmap. Project co-design can be facilitated with the use of tools such as action plan co-design. Other tools such as open data tool might be used to identify open data by different organisations (e.g. clusters, industry organisations, technology vendors etc.) and create a background for

further insight on investment opportunities and emerging markets. In the design or selection of projects, it is important to also assess the availability of funding from different mechanisms, therefore, the open data tool could be broadened to incorporate such information (Figure 33).

Figure 33: Schematic representation of collaborative project design process, using the Online S3 applications.

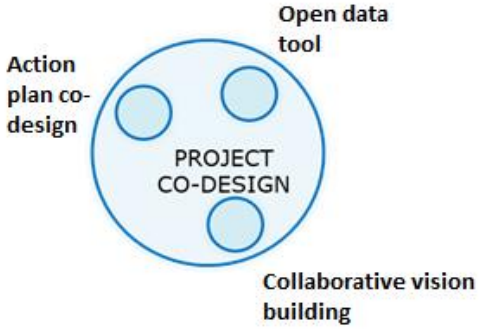
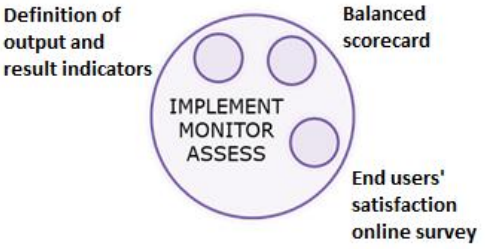


Figure 34: Schematic representation of monitoring and assessment process, using the Online S3 applications.



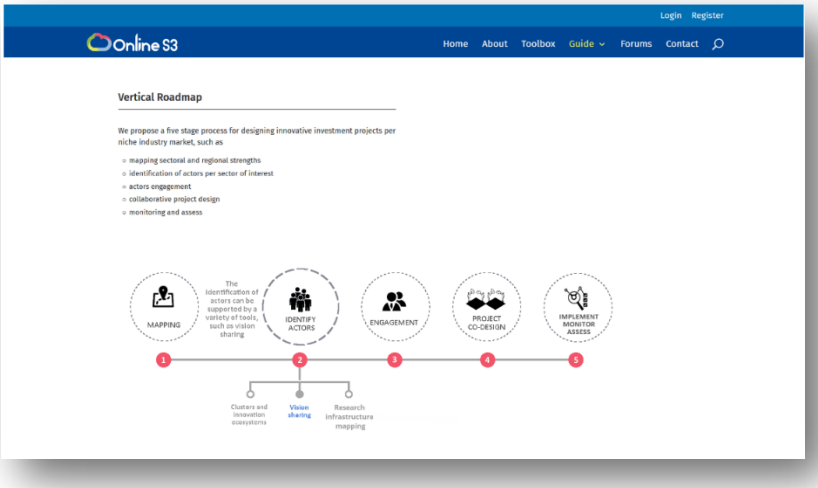
5. Implementation, monitoring and assessment: The final step is about the implementation of the projects, their monitoring and assessment and includes tools such as the definition of result and output indicators, balanced scorecard and stakeholder satisfaction survey (Figure 34).

5.5 Vertical roadmap dashboard design

The illustration of these flows on the Online S3 platform could be done in two possible ways. The main idea is to give the impression of a roadmap with interactive flows illustrating the different combinations of the applications depending on the problem that the region wants to solve. As there is a relatively large number of tools that can be used in this roadmap it is important to provide a user-friendly visualisation scheme that will provide an integrated and comprehensive view of the whole set of relevant tools to the user.

The first version is a linear roadmap of the five steps and the associated applications with recurring though references to applications from different stages. As the user moves the cursor on each step, a descriptive text of the step appears above the line while the associated applications are appearing below (Figure 35).

Figure 35: First mock-up for the vertical roadmap of the Online S3. Source: Author's elaboration.



The second version of the roadmap is shown through five cycles in each of which the applications are presented. Each application has been allocated to the step with the highest relevance and when the user moves the cursor on each one of them, they get highlighted and additional information appears at the right side of the screen. The second version of the roadmap provides one more functionality. The user might get guidance for specific problems with regards to the internationalisation of the thematic priorities and the global value chains. In this case the user has to select one of the available questions that exist at the right side of the page. For each question, the associated tools from different sections are highlighted, while a guiding text appears at the right side of the screen (Figures 36 & 37).

Figure 36: Second mock-up for the vertical roadmap of the Online S3. Source: Author's elaboration

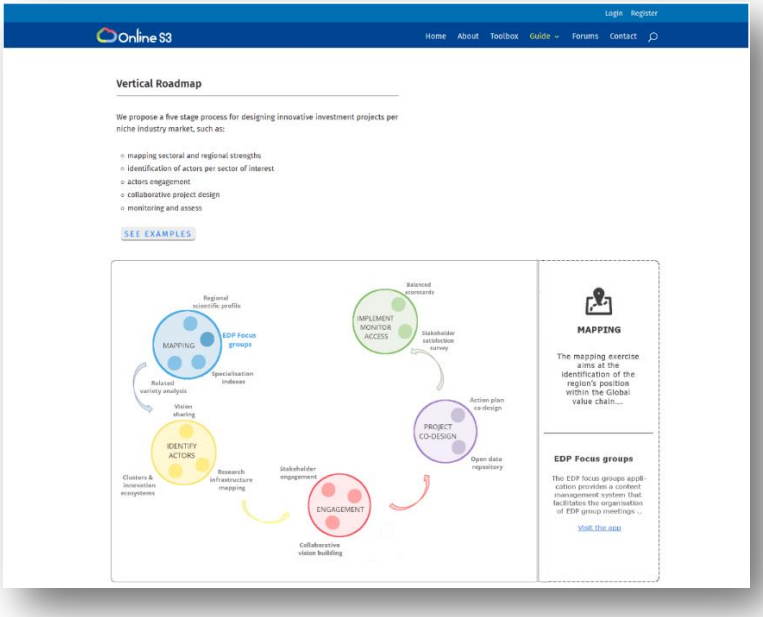
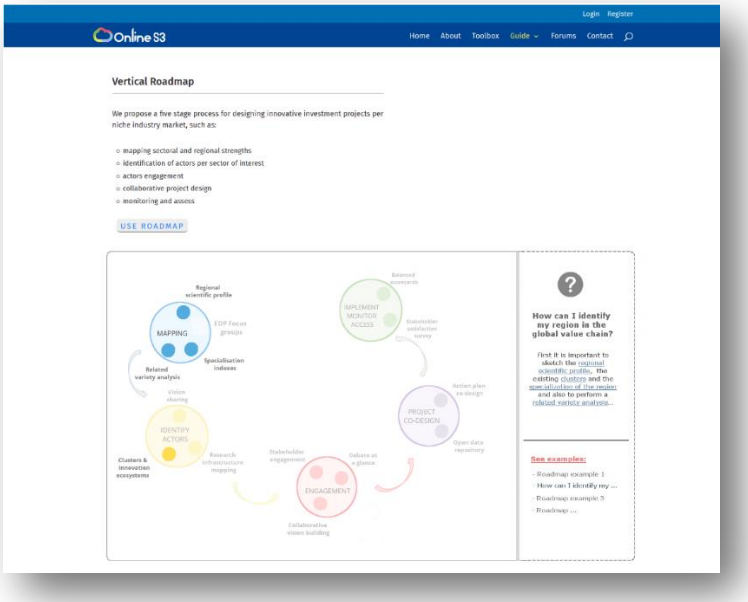


Figure 37: Mock-up showing the changes in combination of tools in relation to the specific question that the user wants to answer.



6. Further potentials of the Online S3 Platform: The Online S3 Services

Despite the applications' standalone character, a further added value could be achieved using the Online S3 Platform, towards more concrete processes related to the concept of smart specialisation. To this end, different combinations of applications may be used to provide solid services that run through a RIS3 strategy design process. Table 7 presents a list of services that could be fostered through the Online S3 Platform. An indicative corresponding set of applications that could be used to strengthen these service is given in the right column. The set of illustrated services is indicative, as a wide variety of different application combinations could be derived, based on the nature of the problem that needs to be solved each time. As it is shown, some of the solutions could be supported by only two applications, but in most cases the optimal number varies between 4 and 5 applications.

Table 7: List of Online S3 Services.

No.	Online S3 Services	Indicative corresponding Online S3 applications
1	Inform and engage stakeholders in strategy development	1.1, 1.2, 1.3, 3.1, 5.2, 6.4
2	Assess regional context and performance	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 4.2, 4.3, 5.6
3	Identify regional business and innovation ecosystems	2.2, 2.3, 4.3, 5.6
4	Compare regions in terms of assets and performance	2.1, 2.4, 2.5, 4.2
5	Select best regional specialisation	2.1, 2.5, 2.6, 4.3
6	Support regional foresight exercise	1.1, 1.3, 3.1, 3.2, 3.3, 4.3
7	Prioritise activities by EDP working groups	1.1, 2.2, 2.3, 2.6, 4.1, 4.3
8	Set a strategy vision in collaboration to stakeholders	1.1, 1.3, 3.1, 3.2
9	Communicate the RIS3 vision	1.1, 1.3, 3.1
10	Elaborate the RIS3 action plan	1.4, 5.1, 5.2, 5.4, 5.5, 5.6, 5.7
11	Co-design innovation support actions	1.1, 1.3, 5.2, 5.6

12	Co-design investments in the targeted sectors or activities	1.1, 2.6, 2.7, 4.3, 5.2
13	Draft and monitor a budget for the action plan	5.1, 5.2, 5.3
14	Assess innovation support actions with respect to state-aid regulations	5.2, 5.3, 5.4, 5.5
15	Monitor RIS3 impact by output and result indicators	5.1, 6.1, 6.2, 6.3
16	Draft RIS3 assessment reports	6.1, 6.2
17	Assess stakeholder satisfaction from the RIS3 actions	6.1, 6.4
18	Capture what social media talk about the regional innovation RIS3 strategy	6.5

Source: Authors elaboration

Based on the above, it becomes evident that the existing Online-S3 applications could be further exploited by decision-makers, helping them to deliver broader services that are placed within the wider context of strategic planning. The users can select themselves the combination of applications that they would like to use, in order to foster specific challenges and processes. The list of services illustrated in Table 3 is indicative and could be further enriched, based on different users' needs and skills.

7. Discussion

Taking into consideration the 28 applications that have been developed throughout the Online S3 project and are related to the 6 phases of the RIS3 design-process, this study has tried to reveal the existing information flows between them. The overall Online S3 Platform mechanism indicates that there is a complex underlying network that links these applications to each other. Having as a starting point the applications belonging to Phases 1 and 2, information flows regarding the analysis of the regional context and the definition of the stakeholders to be involved during the strategy design, start to feed all other data-based processes. The use of sophisticated methods to define regional specificities, which were not applicable previously due to lack of data availability of analytical skills, promotes the evidence-based character of the RIS3 strategy.

At the same time, the design of the stakeholder engagement strategy, through the corresponding applications in Phase 1, provides essential feedback to applications based on public participation. Collaborative vision building and EDP are both further strengthened using the *Vision sharing* tool, as it becomes possible to better communicate the aims and targets of regional RIS3 strategies to the groups of stakeholders being involved. Moreover, the development of applications related to opinion mining and public assessment of the

RIS3 implemented policies, contribute towards a more effective stakeholder-driven monitoring and evaluation mechanism. As a result, the role of public participation is fostered, not only in priority setting, but also during monitoring the RIS3 process, following its bottom-up principles.

In terms of controlling the overall strategic planning and monitoring RIS3 process, the use of the *Intervention logic* application, as a central point for collecting the key outcomes of all phases, is a crucial characteristic of the Online S3 Platform. Having this application as a control panel for the strategy, including its rationale for selecting the vision, priorities, policy mix and measurement indicators, can help policy-makers to have an overall picture regarding the expected outcomes of the process. Thus, any deviation of the actual results could be translated and explained through the *Intervention logic* application. Definition of possible corrective actions may can always refer to this application, to update the overall intervention logic or a part of it.

In order to better understand the overall added value of the Online S3 Platform, it is important to highlight the existing information flows, as we have done in this report. Given the fact that the abovementioned applications have been developed as standalone apps, further potentials of this platform include the development of an interoperability mode. This could provide the final missing links between the 28 applications, facilitating the information flows between them, giving the opportunity to policy-makers to design even more comprehensive RIS3 strategies. Analytical capabilities and public participation should be further enriched and expanded in that case, promoting the effectiveness of the implemented RIS3 strategies.

Finally, the identification of 4 RIS3-related roadmaps, that could be used throughout RIS3 strategic planning processes, adds to the overall added value of the Online S3 Platform. More specifically, the selection of a core number of applications that could be used for specific services provides policy-makers with an enhanced capability for effectively organising their RIS3 strategy. Following the proposed paths, the users can: i) design a RIS3 strategy; ii) engage regional stakeholders; iii) identify highly specialised sectors of the regional market; and iv) design innovative investment projects per niche market industry.

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