State of the art report on methodologies and online tools for smart specialisation strategies

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State of the art report on methodologies and online tools for smart specialisation strategies

ONLINE Platform for Smart Specialisation Policy Advice - ONLINE S3

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1. Introduction

This report provides an overview of the use of analytical methods in the design of regional smart specialisation strategies (RIS3). It then sets out the rationale and justification for the selection of 30 methods currently applied in or applicable to RIS3 development. Using this background information tailored online tools will be designed to enable policy-makers to make full use of these methods in all phases of RIS3 process – designing suitable governance mechanisms, analysing the regional context, building a shared vision, setting priorities, undertaking implementation, and ensuring monitoring and evaluation. Each of the selected methods is described in more detail in Annex 1 (Task 1.4).

The selection of the RIS3 methods, which will further be developed in the remainder of the project into online tools, is based on: 1) analysis of the methodologies applied in RIS3 design in 30 European regions; 2) literature review on the (good) practices for the application of various analytical methods in smart specialisation process; and 3) review of wider sources exploring the state-of-art practices in data-driven applications and online tools for knowledge-based policy making.

2. Methodology

During the mapping exercise the RIS3 design process was investigated in detail in 30 European regions (9 at national level and 21 at regional level). According to the Regional Innovation Scoreboard 2016 (RIS) classification, the selected sample of regions included 6 Innovation Leaders, 9 Strong Innovators, 13 Moderate Innovators and 2 Modest Innovators. This distribution broadly reflects the overall situation across European regions as mapped by RIS 2016. Table 1 summarises the information on the countries and regions included in the mapping exercise.

Table 1 Overview of the mapped regions

Country	Region	RIS ranking	Country	Region	RIS ranking
AT	-	Strong	IT	Puglia	Moderate
BE	Wallonia	Strong	LT	-	Moderate
CY	-	Moderate	LV	-	Moderate
DE	Bayern	Leader	NL	Noord-Holland	Strong
DE	Niedersachsen	Leader	NL	Zuid-Holland	Leader
EE	-	Moderate	PL	Mazowieckie	Moderate
EL	Central Macedonia	Moderate	PL	Warminsko-Mazurskie	Modest
EL	Eastern Macedonia- Trace	Modest	PT	Centro	Moderate
ES	Andalucia	Moderate	SE	East Sweden	Leader
FI	Helsinki-Uusima	Leader	SE	Stockholm	Leader
FR	Aquitaine	Strong	SI	-	Moderate
FR	Midi-Pyrenees	Strong	SK	-	Moderate
HR	-	Moderate	UK	Northern Ireland	Strong
IE	-	Strong	UK	Scotland	Strong
IT	Emilia-Romagna	Moderate	UK	Wales	Strong

The main obstacles encountered during the RIS3 mapping process included a rather limited availability of documentary sources that would give enough in-depth information to understand how RIS3 design process was carried out. Also there were difficulties in reaching out to RIS3 managers in order to gather missing information and validate correspondents' interpretation of the information. Moreover, there were differences in understanding among regional stakeholders about what various methods entail. Often the methods were named in RIS3 process descriptions, but in many cases the mapping exercise could not detect how robust, deep and comprehensive the application of various methods had actually been. Another factor that influenced the identification of applied RIS3 methodologies was the fact that many regions have undertaken analytical exercises independently from RIS3 process

as part of their general research and innovation policy framework. Hence in many cases it was hard to delineate between 'pure' RIS3 methods and the wider R&I policy intelligence gathering routines.

The literature review was conducted using a snowball method. Three key documents were first scanned for good practice examples and other key references in the area of investigation:

- Guide for Research and Innovation Strategies for Smart Specialisations (RIS3), DG Regional Policy, European Commission, May 2012
- Smart Specialisation from design to implementation Handbook, version 30 June 2016
- Innovation-driven Growth in Regions: the role of Smart Specialisation (2013), OECD, Paris.

In addition, the Web of Science was also scanned for journal articles that discuss specific case studies of the RIS3 process. A search for keywords in titles and abstracts was done using 'smart specialisation', 'RIS3', 'S3', and 'entrepreneurial discovery'. The search was limited to country/region specific case studies. Finally, key insights and more state-of-the-art references to ongoing work were obtained through participation to the OECD Blue Sky Forum on Science and Innovation Indicators in September 2016[1]. This resulted in the scanning of 36 journal articles, conference presentations, reports, books and book chapters. A complete list of the literature reviewed is presented in the Annex 2.

The selection process of the methodologies that are proposed for further development into online tools is based on: 1) in-depth understanding how currently regions have tackled analytically the RIS3 design; 2) detection of key patterns in the used RIS3 methodological approaches; 3) highlighting (frequent) methodological gaps in the present approaches to RIS3 design; and, taking into account the outcomes from the review of the state-of-art developments in the field, 4) pointing towards methods where implementation of new online tools could be particularly helpful for regional policy makers, analysts and consultants dealing with RIS3.

The analysis and method selection presented in this report will be further validated and complemented through four targeted workshops with policy makers in Macedonia region in Greece, Slovakia, Slovenia and Scotland as part of the open consultation process under Task 2.3.

3. Smart specialisation as a new policy challenge

Smart specialisation (S3) is a key idea underpinning the EC Cohesion Policy for the period 2014-2020 in the field of innovation and it constitutes an ex-ante conditionality for EU Member States (MS) for receiving Structural Funds support. S3 requirement fosters an in-depth analysis of the characteristics of each European region and MS to promote a transformation of the economy through an 'entrepreneurial discovery process' (EDP). The S3 concept has emerged only recently and in the first years appears to have remained largely ill-understood by regional policy-makers (Kroll, 2015). Yet it puts forward theoretical notions that in many respects challenge more conventional approaches in the design of regional RDI policies. While traditionally the public sector has been regarded as a risk adverse party, smart specialisation foresees channelling of public investments in carefully selected priority areas, where the returns may only be visible in the long-term.

"*The Entrepreneurial Discovery Process (EDP) is considered a, if not the, feature that distinguishes the smart specialisation approach from innovation strategies of the past*" (Rodriguez and Wilkie, 2015). In essence, the EDP concerns the prioritisation of investment based on an inclusive stakeholder engagement and attention to national and international market dynamics. EDP can be used beyond the prioritisation process helping to fine-tune S3 priorities also during the implementation and monitoring phases (Gianelle et.al., 2016). This denotes that policy decisions have to be based on knowledge that is very emergent and exist scattered across stakeholders. This calls for access to more **real-time data gathering** methods, as well as **data visualisation** tools that enable more user-friendly data analysis.

[1] See: https://www.oecd.org/innovation/blue-sky.htm

The EDP logic also requires governments to act as platforms to support stakeholders' participation across the S3 policy process. Smart specialisation is not a matter of 'picking the winners' or imposing a top-down sectoral specialisation; rather, *"it was always seen as being a partnership-based policy process of discovery and learning on the part of both policy-makers and entrepreneurs*" (Foray and Goenaga, 2013). To reach out to traditionally under-represented groups in order to co-create value requires new 'soft' skills and capacities from policy making bodies, such exercise of participatory leadership and effective mediation between uncodified entrepreneurial knowledge and knowledge of policy, legal and administrative framework. According to a survey among ESIF managing authorities, relevant regional innovation policy makers in the EU, around two thirds state that smart specialisation has already triggered the introduction of 'new elements of governance' and more than 90% specify that these novelties will be maintained (Kroll et.al., 2014). In order to support the formation of these processes and provide appropriate avenues for interaction among S3 stakeholders, new methods and tools with various **participatory** and **crowdsourcing elements** are becoming more important than ever before.

Foray (2013) advocated that the portfolio of chosen smart specialisation activities should be constantly reviewed to make way for what is new and promising so that a strategic direction is maintained. A RIS3 has to be inclusive and give a chance to all participants to learn what works or not through continuous monitoring and evaluation of results. Regional specificities are the starting point for EDP, hence it is of key importance that RIS3 design, implementation and monitoring employs **custom-made policy intelligence** that draws upon a wide array of data through web-enabled tools for more ambitious, accurate and timely analysis encouraging more experimentation and discoveries.

4. Existing tools for S3 development

Currently the JRC S3 platform features a number of online tools designed for RIS3 process. These are mostly databases and mapping tools that help to extract information on the selected S3 priorities across European regions, understand the earmarked ESIF funding allocations, provide background information on sectoral trade patterns as a proxy indication for main competitor regions, and a benchmarking tool for finding regions with similar structural characteristics. The available online tools offer mainly the opportunity to scope the emerging landscape of specialisations and find benchmark regions for improved cross-border learning. They offer **limited analytical insight** in support to regional policy-makers and experts in charge of RIS3 processes. There are **no supportive online functionalities designed yet for the implementation and monitoring phases** of the RIS3 design.

Eye@RIS3 is an online database with information on the envisioned S3 priorities of the EU regions. The purpose of the database is to give an overview of regions' priorities in order to enable others to position themselves, to find their unique niches and to seek out potential partners for collaboration. **ESIF – Viewer** is a tool that allows search planned investments in European Structural and Investment Funds (ESIF) data (ERDF, CF, ESF and YEI). The data is fed from the ESIF Operational Programmes at regional level, but also include shares of national and transnational cooperation programmes. The user can search for planned investments per country, region, OP-type and different categories of intervention. **ICT Monitoring Tool** maps specifically the planned ICT Investments under ESIF (ERDF, CF, ESF, YEI and EAFRD).[2] **R&I Regional Viewer** is an outcome of the Stairway to Excellence project[3] and allows a structured and coherent visualisation of three sets of data; namely, main economic indicators from Eurostat, planned R&I-related investments under ESIF and Horizon 2020 funding captured by stakeholders across EU regions.[4]

Regional Benchmarking tool that helps users finding reference regions based on structural similarities in conditions which are relevant for innovation-driven development (social, economic, technological,

[2] http://s3platform.jrc.ec.europa.eu/s3-tools
[3] http://s3platform.jrc.ec.europa.eu/stairway-to-excellence
[4] http://s3platform.jrc.ec.europa.eu/s3-tools

institutional and geographical characteristics). These characteristics cannot be easily changed in the short-term, hence important for learning how innovation and economic evolution take place in a region. **EU Trade** tool is a fully interactive web-based application for the visualisation of inter-regional trade flows and the analysis of regions' competitive position of regions.[5] The competition maps show which regions, and within that which areas, compete internationally with a region under examination. Competition here is defined as the degree of trade networks overlapping with those of their competitors. By investigating this overlap, it is possible to discover which markets are most important for firms and which regions are strong performers (and potential competitors) in these areas (Mariussen et.al.,2016).

The **Land Use-based Integrated Sustainability Assessment (LUISA) modelling platform** of the JRC is used to assess territorial impacts of EU policies and investments ex-ante.[6] It is based on the concept of 'land function' for cross-sector integration and for the representation of complex system dynamics. It uses a new approach towards activity-based modelling based upon the endogenous dynamic allocation of population, services and activities. The ultimate product of LUISA is a set of territorial indicators that can be grouped and combined according to the land function of interest and/or the sector under assessment. The indicators are projected in time until typically 2030 or 2050. The tool has not been used in the context of RIS3, but provides valuable data that could be used at regional level for foresight exercises and future scenarios analyses.

5. Results from S3 mapping exercise

The mapping exercise revealed that **regions did not follow RIS3 steps**[7] **as a rulebook for the design of methodological approaches**. The regional correspondents in charge of mapping struggled to 'fit' the evidence on methods found to the theoretical RIS3 steps. In practice, analytical methods employed under Step 2, Step 3 and Step 4 are highly intertwined making their separation very artificial. Table 2 shows those methods been applied by the RIS3 steps indicating in percentages their frequencies in the sample of mapped RIS3 strategies. It can be concluded that regions do not necessarily apply all steps linearly, but rather use the RIS3 theoretical framework holistically.

Table 2 Frequency of the overlapping methodologies throughout the mapped S3 strategies

Overlapping methods	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Working groups/focus groups	87%	97%	90%	93%	83%	
Stakeholder interviews	47%	40%	37%		20%	
Online surveys	37%	40%	20%			13%
Benchmarking	63%		30%		30%	20%
Peer-review		50%			40%	43%
SWOT analysis	87%		60%			
Regional profiling	100%		53%			
Roadmapping			23%		63%	

The evidence from the mapping exercise also highlighted that the robustness of methodological approaches varied and **in many regions even the key concepts of the various RIS3 steps were not (fully) understood**. This view is supported by findings from the academic literature, which imply that "*between 25% and 40% of the S3 strategies do not even claim to consider some of the most central notions of the RIS3 concept*" (Kroll, 2015).

[5] ibid.
[6] See: https://ec.europa.eu/jrc/en/publication/geographical-database-infrastructures-europe-contribution-knowledge-base-luisa-modelling-platform
[7] As set out in Foray, D. et.al. (2012)

The qualitative review of the mapping results underlined that there is **no real link between the level of innovativeness of regions** (measured by RIS 2016 ranking) **and 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. In fact, it was surprising to see that many leading and strong innovation regions seem to have put little effort into RIS3 process and the strategy design is more 'a lip service' to EC requirements rather than a serious basis for regional economic transformation. At the same time, some regions with much more modest innovation performance and little experience in RDI strategy design have undertaken comprehensive RIS3 exercises introducing novelties into their policy making routines.

The mapping exercise also revealed that there are **only a handful of online tools referenced as sources for RIS3 design**. Mainly these sources are EU level and international policy monitoring platforms and various competitive indexes. On rare occasions, regional correspondents identified specific tools that went beyond these categories. This implies that there is a room for improvement in providing guidance to regions about the existing analytical tools and design of tailored online functionalities in support of regional smart specialisation process

Step 1: Analysis of regional/national context

As is shown in

Table *3*, regional profiling comprising key statistical analysis and qualitative assessment is used by all regions in Step 1 of RIS3 process. Further, SWOT analysis and working groups/focus groups are very widely used for analysing the regional context. Bibliometric analysis and benchmarking is used in slightly more than a half of all the mapped RIS3 processes. Also various stakeholder consultation techniques are rather widespread. Collaboration and networking analysis and value chain analysis is used only in around one third of the mapped RIS3 processes, though these approaches have been used with a varying degree of robustness and complexity. Less frequent is the application of such methods as gap analysis, cluster analysis, SNA and product space modelling.

Regarding the online tools used, the most cited examples include European level policy monitoring platforms and scoreboards, e.g. European Innovation Scoreboard, Regional Innovation Scoreboard, JRC S3 Platform, KETS Observatory, ERAWATCH, OECD-Eurostat Entrepreneurship Indicators programme. In the Lithuanian RIS3 process, the International Trade Centre UNCTAD/WTO - Trade Competitiveness Map[8] was used to benchmark national and sectorial trade performance. SCOPUS SCImago Journal and Country Rank tool[9] for bibliometric analysis was also frequently mentioned. Portugal's Centro region undertook bibliometric analysis using a tool that analyses open access publications.[10] Some regions (mostly in Germany, Austria and Belgium) made use of national online statistical tools providing insights on entrepreneurship, patents and inventions.

Table 3 Most frequent methods employed in Step 1

Step 1: Analysis of regional/national context	Count	%
Regional profiling	30	100%
SWOT analysis	26	87%
Working groups/focus groups	26	87%
Benchmarking	19	63%
Bibliometric analysis	17	57%
Stakeholder interviews	14	47%

[8] http://tradecompetitivenessmap.intracen.org/TP_EP_CI_HS4.aspx
[9] http://www.scimagojr.com
[10] http://www.rcaap.pt

Collaboration and networking analysis	11	37%
Online survey(s)	11	37%
Cluster analysis	8	27%
Value chain analysis	8	27%
Gap analysis	6	20%
Social network analysis	4	13%
Product space modelling	2	7%

Step 2: Governance

Stakeholder engagement and information dissemination methods are the key approaches used in Step 2. Dedicated working groups are used by almost all mapped regions. Online surveys and stakeholder interviews have been employed in 40% of cases. Around one third of the mapped regions have also set up dedicated networking/cluster platforms to drive/support RIS3 governance. Equally, a little less than one third of the mapped regions have used online stakeholder forums and discussion boards in the RIS3 design process. With regards to information dissemination, the majority of mapped regions have made use of information events and various information dissemination channels such as dedicated websites, brochures, etc., yet communication through social media seems an untapped resource. Around a half of the mapped regions have benefitted from expert and/or peer review of the RIS3 design process.

Particularly interesting and probably more advanced examples of online stakeholder engagement platforms are provided by Andalusia (Spain)[11] and the Living Labs Community in Puglia (Italy). In Andalusia, the platform designed a specific collaborative space where invited experts were able to review uploaded content, elaborate observations and indicate the relevance to the RIS3. The Living Labs ICT[12] initiative in Puglia supported RIS3 by stimulating knowledge exchange among regional stakeholders and fostering an emergence of an eco-system that leverages user-driven open innovation in support of local ICT SMEs. Croatia used a designated website[13] that allowed visitors to submit comments to RIS3 draft text after a free registration. The site also enabled "like" and "do not like" functions. Latvia has also implemented an entrepreneurial discovery RIS3 discussion platform in each specialisation area that aimed to pin-point and update possible niches of competitiveness, identify obstacles and problems, as well as to provide feedback on the efficiency of the implementation of the RIS3 investment programme and the necessary changes.

[11] http://ris3andalucia.es/
[12] http://livinglabs.regione.puglia.it/web/blog/welcome;jsessionid=A52C88CAE43D4F45D7CFEE529CB51D29
[13] https://esavjetovanja.gov.hr/Econ/MainScreen?EntityId=2242

Table 4 Most frequent methods employed in Step 2

Step 2: Governance	Count	%
Working groups/focus groups	29	97%
Information events	22	73%
Information dissemination	18	60%
Expert and/or peer review of RIS3 process	15	50%
Online survey(s)	12	40%
Stakeholder interviews	12	40%
Set-up of dedicated networking/cluster platforms	10	33%
Online forums/discussion boards	8	27%
Communication through social media	5	17%

Step 3: Shared vision

The most frequently used methods in Step 3, as indicated by the results of RIS3 mapping, include working groups and focus groups (90%), SWOT analysis (60%) and statistical analysis (53%). Literature reviews featured in around a half of all mapped regions, though the frequency of this method could be underestimated as it is largely taken for granted and seldom spelled out in documentary sources. Scenario building exercises have been highlighted by 40% of the regions. It appears that in practice Step 3 has been largely integrated with other analytical steps. Only less than one third of the mapped regions claim to have undertaken methods such as benchmarking, horizon scanning and foresight.

Among the online tools employed, again various EU level and international platforms are mentioned, including Business Innovation Observatory, European Cluster Excellence Scoreboard, Global Innovation Index, Global Competitiveness Index. Austria and German regions have made use of their national level indicators and cluster platforms. In the Lithuanian foresight process the iKnow tool[14] was used. This tool is an outcome of one of the six Blue Sky foresight research projects funded by FP7. The project is aimed at interconnecting Knowledge on issues and developments potentially shaking or shaping the future of science, technology and innovation (STI) in Europe and the world.

Table 5 Most frequent methods employed in Step 3

Step 3: Shared vision	Count	%
Working groups/focus groups	27	90%
SWOT analysis	18	60%
Statistical analysis	16	53%
Literature review	14	47%
Scenario building	12	40%
Stakeholder interviews	11	37%
Benchmarking	9	30%
Foresight	9	30%
Horizon scanning	8	27%
Roadmapping	7	23%
Online survey(s)	6	20%
PEST analysis	4	13%

[14] http://wiwe.iknowfutures.eu/iknow-description

Step 3: Shared vision	Count	%
VRIO analysis	2	7%
Delphi survey(s)	1	3%
Risk assessment	1	3%

Step 4: Identification of priorities

For the identification of priorities in Step 4, the method used by a majority of regions was working/focus groups (93%). It appears that very few participatory deliberation and collaborative writing and annotation opportunities have been exploited. Equally, stakeholder own reports in traditional formats also have not been widely adopted; the prioritisation outcomes have been crystallised through summarising stakeholder input per a designated working group agenda.

Andalusia (Spain) experimented with used web-based crowdsourcing options, though this can be regarded as first experiment with these functionalities, rather than a fully-fledged approach with robust methodological underpinnings. Helsinki region (Finland) ran an interesting crowdsourcing-based exercise, it was not initiated as part of the smart specialisation process which, however, benefitted from the results. Niedersachsen (Germany) and to a limited extent also Lithuania have employed some idea competition elements in their RIS3 design process.

According to the mapping information, the online tools employed in this step are very limited and limited only to specific web-based consultation questionnaires.

Table 6 Most frequent methods employed in Step 4

Step 4: Identification of priorities	Count	%
Working groups/focus groups	28	93%
Stakeholder reports	6	20%
Participatory deliberation/ collaborative writing and annotation	5	17%
Ideas competition(s)	2	7%
Web-based crowdsourcing	1	3%

Step 5: Policy mix

Working groups/focus groups are mentioned as key methods more than 80% of the mapped RIS3 processes. Also road-mapping emerges as a prevalent technique used in design of the policy mix, though it was hard to assess how sophisticated and thought-through the approaches of regions have been in applying this method. Surprisingly the charting of intervention logic is highlighted only by less than 40% of the regions. It appears that there is some lack of understanding what steps are necessary in the design of an intervention logic and how to approach it in the context of RIS3. Ex-post evaluations of the previous policy mix and benchmarking have been undertaken in around one third of the regions. Around 40% of regions have made use of peer reviews of the policy mix.

The only online tool mentioned in relation to this step is a platform for discussing documents online[15] that was employed during Austrian RIS3 design. The functionalities of this tool enabled to instantly get feedback on a specific policy proposal, identify conflicting views, suggest better solutions and find common ground.

[15] www.discuto.io

Table 7 Most frequent methods employed in Step 5

Step 5: Policy mix	Count	%
Working groups/focus groups	25	83%
Roadmapping	19	63%
Peer review	12	40%
Charting intervention logic of policy mix	11	37%
Ex-post evaluation of policy mix	9	30%
Benchmarking	9	30%
Stakeholder interviews	6	20%
Pilot projects to test effectiveness of policy mix	4	13%
Inventory survey(s)	3	10%

Step 6: Monitoring and evaluation

Definition of output and result indicators is the most prevalent method employed in Step 6. It appears that regions have struggled more with the definition of structural change and context indicators as many of the described approaches seemed simplistic for this comprehensive monitoring requirement. Yet it must be born in mind that currently in many regions the details of monitoring frameworks are only in their design process, hence the mapping results can only show a snapshot of evolving approaches. Around 60% of regions have taken into account various evaluations of regional RDI system for developing RIS3 monitoring and evaluation framework. Peer-review is used by more than 40% and balanced scorecard elements are present only in around one fourth of the mapped regions. This indicates that there is a scope for improvements for ensuring that the designed monitoring systems really serve as proper management tools of RIS3 process.

Table 8 Most frequent methods employed in Step 6

Step 6: Monitoring and evaluation	Count	%
Definition of implementation, output and result indicators	27	90%
Definition of structural change and/or context indicators	21	70%
Various evaluations of RDI system components	18	60%
Peer-review	13	43%
Balanced scorecard	7	23%
Benchmarking	6	20%
Online survey(s)	4	13%
Research assessment exercise	4	13%
Best practice case studies	3	10%

In most cases, the regions employ the online systems and tools used for monitoring Structural Funds investments by gathering information on project-level key performance indicators. The structure of this data is generally not sufficient to enable proper RIS3 analytics. It questionable to what extent regions aim to supplement this basic information for monitoring purposes. For example, Lithuania envisages that the responsible agency for RIS3 (Research and Higher Education Monitoring and Analysis Centre, MOSTA) will perform data mining in the SF database to extract data specifically for

RIS3 monitoring requirements. Austria has a more elaborate approach using the IMPACTSCAN tool[16] and ARISE methodology for designing a balanced scorecard for RIS3 monitoring.

6. Results from literature review on good practices

There are other methodologies that could be used in RIS3 strategy design but do not appear in the selected mapping cases. To provide a broader methodological landscape, this section reviews analytical practices applied in RIS3 design and state of the art data application methods for knowledge-based policy advice, to help identify the gaps between what is currently used in RIS3 design and what methods could be useful to apply more widely in the future.

Step 1: Analysis of regional and national context

Profiling the regional assets and assessing the potential of emerging activities for specialisation require the use of a variety of quantitative and qualitative data. The OECD (2013), based on case studies, found that most countries and regions use different methodologies such as science and technology **indicators analyses**, regional sectoral **employment distribution**, **export indicators**, **road-mapping**, **SWOT analyses** and **foresight** approaches for analysing their regional context and assets.

As expected, focus on the outward dimension of the regional context is predominantly done in those regions that are geographically placed in favourable positions that allow for trans-regional collaboration. For instance, Lower Austria's proximity to the knowledge intensive Vienna region and the neighbouring Czech and Slovak Republics and Hungary led to a focus on strong cooperation with both Vienna, and within the cross-border CENTROPE region. This was done by looking at the opening of new markets for local companies and complementarity between value chains.

For understanding value chains positioning, the OECD's (2013) work on **global value chains** has created new national indicators using a combination of multiple new data sources to measure trade in value-added terms: the **OECD inter-country Input-Output** (ICIO) tables model, and ORBIS firm-level data. This data is only available at national level, but regionalisation of data is technically possible.

Some lead actors and institutions have developed their own methodological tools and databases to analyse existing strengths, although these were not systematically used in the RIS3 process. For instance, since the mid-1990s in Finland, the Technical Research Centre VTT's Group for Innovation Studies has been running and maintaining the **SFINNO database** that started as a research project co-financed by VTT and Tekes. SFINNO is a longitudinal database of about 6690 individual product/service and process innovations of Finnish businesses from across the Finnish economy. The database is compiled using literature based innovation (LBIO) counting, complemented with data on the commercialising firms collected from secondary sources including business registers and the patent office. Data is also collected from the companies themselves based on a questionnaire that defines typologies of different kind of innovations, including previously uncovered areas such as service innovations, and links individual innovations to actors in the Finnish innovation system. Based on the model of SFINNO, the Swedish sister-database **SWINNO** was created in 2008 and has been maintained by the Department of Economic History at Lund University.

In addition to the methods that have been implemented by regions, the OECD (2013) suggests using other indicators of science, technology and economic specialisation for place-based growth. This include longitudinal analyses and comparison of patterns in scientific, technological and economic specialisation; and relative indicators, such as the **Activity Index** (AI) for scientific activities, the **Revealed Technological Advantage** (RTA), and the **Revealed Comparative Advantage** (RCA) for

[16] The IMPACTSCAN project provides a method and tool for regional policy-makers to analyse and evaluate the impact of the regional innovation policy. It has been developed and tested by 7 agencies dealing with innovation policy in seven European regions, and co-funded by the European Commission. Please refer to the user guidelines for more details.

economic activities. All these indicators are important from a benchmarking perspective. More advanced specialisation indicators include **patent analysis**, mapping of **science-technology nexus**, **citation analysis**, and analysis of **co-authorship** and **co-inventorship** patterns.

Affiliation and co-affiliation data from scientific publications can be used to infer mobility patterns (Sugimoto et al., 2016). Data from Thomson Reuters Web of Science (WoS) or Scopus can be used to conduct diachronic network analyses to identify the mobility of people among locations over time. At the regional level, data on the proportion of scholars that are 'sent' or 'received' can be calculated by analysing the directionality of mobility events. The total number of scholars provides a capacity indicator for the region which can be also used to calculate normalised shares both for sending and receiving regions/countries to demonstrate the flow of scholars between EU regions.

There have also been **qualitative** approaches to understanding connectivity and enhancing trans-regional collaboration networks. **Good practice transfers** were, for instance, the main method used in the INTERREG IVC TR3S project, involving 10 partners from nine European regions between 2012-2015. The project organised **working sessions** to exchange experiences among regions and to monitor and follow-up the regional thinking processes for smart specialisation. Good practices were identified, and the lessons learned from each of them shared with other regions who might had to deal with similar comparable challenges. A set of criteria was defined for the selection of good practices:

- Have a clear link to regional smart specialisation approach, provides insight on how it supports regional potential, specific strengths and competitive advantages for companies
- Need to be integrated effectively into the regional or local context and policy, as well as EU policy
- Should trigger the active cooperation of regional stakeholders, lead to private investments and prove itself capable of being integrated, sustainable and transferable
- Can be verified by continuous monitoring and external evaluation.

Pointers to future avenues of data application in the analysis of the regional and national context

Official statistical data has the disadvantage of being static and confined with the standard industrial and occupational codes (i.e. use of NACE codes that do not fit the evolving economic activities of a region). Moreover, these data are mostly geared towards past and present specialisations and may not capture the cross-sector and cross-technology dimension of emerging activities (OECD, 2013). The OECD suggests using **foresight exercises** and **diagnostic tools** to identify emerging activities and new synergies and complementarities.

Unstructured data can be used to **identify emerging areas of technological and economic activity** in a more accurate and timely way (Bakhshi and Mateos-Garcia, 2016). Company websites can be used to identify businesses operating in a new or emerging economic sector, as well as to define new categories of economic activity. This type of data can be analysed with a variety of methods, ranging from the simplest **search of keywords** of interest, to complex unsupervised **machine learning methods and text mining**.

The analysis of unstructured data comes with many challenges as well. First of all, it requires technical expertise and skills, which are most likely not available in regional innovation agencies or other regional bodies in charge of RIS3 planning and implementation. Second, it is an analysis that needs to comply with quality procedures, and thus requires time and planning. One has to keep in mind that automated matching is probabilistic in nature and subject to statistical errors, and arriving to final conclusions require in many cases manual data cleaning which comes with increased costs and time.

Another way of understanding innovation activities, entrepreneurial dynamics and collaboration in real time is the use of **relational data** for mapping networks of innovative activity and collaboration. The relational data available in social network platforms online such as Google, Wikipedia, Facebook

or Twitter allows to construct social and industrial networks that can provide interesting insights on collaboration patterns to the regional policymaker. It can also help understand impact of a given activity. For instance, one could construct the network of relationships among regional stakeholders before and after an intervention or activity linked to the RIS3 process using Twitter data, to see how the process has changed the connectivity patterns of regional stakeholders. This allows a better real-time understanding of connections and communication flows within a region.

Moreover, social network data can be combined with other official statistics, either at the company or organisational level, or the individual level to get a better understanding of innovation dynamics. Probably the most common example of linkable datasets is the **use of alt.metrics**, or the combination of publication data with social media data, to understand the diffusion of academic research outside academia, as a proxy of its wider impact.

The use of big data for innovation analytics has increased over the years around the world. Examples of the **use of open and web data for cluster mapping** in Europe include the Tech Map London (http://www.techmap.london) and the Cambridge Cluster Map (http://www.camclustermap.com). Mapping of innovation clusters using big data. The Tech Map London was originally named Tech City Map and it served as the world's first experiment using big data to understand an innovation cluster. The platform provides a detailed picture of London's S&T sector offering a combination of map visualisations, charts and tabular data. The data is sourced from official Companies House records and it is updated quarterly. Another example of the **use of network science to map industrial networks** is the Danish Net-sights platform (http://www.netsights.dk).

Finally, some online tools such as **Google trends** can also provide interesting insights on what Internet users want to know about, which can provide useful feedback to the policymaker. Google Trends has a "story-centric" homepage, where it aggregates data from Google Search, You Tube and Google News to rank the most searched stories. It also allows searches by keywords and geography. Recent research has used a semantic keyword approach to forecast German Unemployment using Google Trends data with searches for the top job search engines, the German Unemployment Office and keywords such as 'short-time work' (Askitas and Zimmermann, 2011). The main limitation of this tool is that it only provides an aggregate look into behavioural microdata, and is representative only of the fraction of the population that has internet access (Askitas, 2015).

Step 2: Governance: ensuring participation and ownership

Governance arrangements can facilitate or hamper the implementation of smart specialisation strategies. Several of the regions studied have implemented **tripartite (triple helix) models** for the governance of their RIS3, while (fewer) others also use **quadruple helix models.** Generally, governance models involve national and regional level actors, are interactive, and are regionally-driven based on a consensus decision-making mechanism. Multi-level governance remains the exception, rather than the norm (Healy, 2015).

There is a strong focus on creating (new) structures, mostly around three levels:

- A dedicated Steering Group/Steering Committee or Management team
- A Knowledge Leadership Group, or Mirror Group, and
- Thematic or project-specific Working Groups.

In some cases, Innovation Councils have been created or commissioned to drive the process. In some others, new bodies at national level have emerged to facilitate the process of smart specialisation design and implementation within regions of a country (e.g. United Kingdom).

Thematic Working Groups are often used to give direction and set-up specific agendas for the regional specialisation areas. For example, the region of Emilia-Romagna in Italy set up six dedicated **Forums** for each of their prioritised thematic areas. The participation to these forums is flexible and open and involves regional technical experts, but also extra regional partners. The main objective of these

forums is to conduct economic, statistical and qualitative analysis with a **map of innovators** for each of the areas, and to link these to existing initiatives (projects, technologies, infrastructures) within the region, but also at EU level.

In England, a **national oversight forum** or **advisory hub for smart specialisation** has been established which mirrors the role of the RIS3 platform of the Joint Research Centre (JRC) of the European Commission. This resulted from a process where the newly established Local Enterprise Partnerships (LEPs) had been tasked with the delivery of smart specialisation, within the framework of nationally defined priorities. The hub provides support, advice and peer-review processes for the LEPs in designing their strategies. Its aim is to help localities upgrade their capabilities in strategy development by drawing on the best resources available within the country. The advisory capability of the Hub builds on existing networks and initiatives with complementary functions, including the National Centre for Universities and Businesses (NCUB), Innovate UK, the LEP Network, the What Works Centre for Local Economic Growth, the Horizon 2020 National Contact Points and the Enterprise Europe Networks. The hub also seeks to establish institutional arrangements to build coordination and synergies between different European Funds.

Pointers to future avenues of data application in the development of governance structures for RIS3

The development of governance structures is very context specific and is expected to vary largely region by region. The use of **community monitoring** and **community scorecards** for giving feedback and increasing accountability to all regional stakeholders of the RIS3 process, could be largely beneficial for other steps of the RIS3 process, in particular for the RIS3 update. **Opinion mining and sentiment analysis** through the use of social media data and technologies can also support public engagement and provide decision support. Equally, the use of **online participatory planning tools** can enhance the active involvement of all stakeholders in the process.

Step 3: Shared vision

Very little emerges from literature regarding tools that regions are using to achieve a shared vision for the future of the region. **Scenario building** and **foresight** methods are the natural choice for building a shared vision for the future. One of the most comprehensive and broad foresight exercises in the context of RIS3 has been implemented in Lithuania. The country engaged into a national level foresight exercise in order to define national research and innovation priorities through a **mixed qualitative and quantitative method approach**, including expert panels, surveys, statistical and bilbiometrical analysis, roadmaps, and analytical studies on the emerging trends and long term challenges (Paliokaitė et al., 2015). Since at the start of the exercise there was a lack of policy commitment for the whole entrepreneurial discovery process, the foresight approach was organised in three stages. Stage 0 was devoted to scoping, developing and discussing the methodology, awareness-raising, building consensus on the methodological choices, securing funding and constructing a management system. This was followed by Stage 1 that aimed at identifying broader priority areas, and was based on the analyses of long-term national challenges and current research and economic potential. Finally, Stage 2 focused on defining specific priorities within each area following a more detailed analysis of trends and challenges in each of the priority areas. The approach used a combination of **analytical and participatory methods** in order to ensure transparency of the process and provide good 'evidence' that allowed 'objective' decisions.

A few regions (e.g. Flanders, Belgium) mention explicitly the vision of the region by 2020 in their RIS3, but little is said how this vision was conceived and designed. Reaching 'willingness to act' as is suggested in the EC's RIS3 guide 2012 requires numerous discussions and deliberations among regional stakeholders. More broadly, at European level, the European Cluster Observatory recently developed a **foresight** analysis on industrial and cluster opportunities with the aim to explore new societal, technological and economic trends, as well as the ways in which cross-sectoral collaboration

could affect value creation structures and innovation processes[17]. The exercise followed a Delphi-related approach and used a mix of different methods commonly applied in foresight exercises to gather and analyse data and to formulate conclusions and recommendations for policy-makers. Six methods were used: **desk research**, including a literature review, **expert interviews**, an **online survey**, internal and external **workshops**, **horizon scanning** and **scenario planning** (Teichler et al., 2015). The exercise allowed identifying new perspectives related to cross-sectoral and cross-cluster collaboration. Foresight and roadmapping revealed to be an appropriate tool that can help identify new businesses and development prospects and to discuss risks and challenges to forge a common vision among regional stakeholders. This is particularly relevant and useful for the RIS3 process.

A shared vision can also be achieved transnationally. Several regions have engaged in close collaboration on specific thematic issues. One of the most known examples of the development of **transnational approaches to RIS3** is the Vanguard Initiative "New Growth through Smart Specialisation". The initiative is a coalition of regions that places the EU S3 agenda at its core. Its partners seek to 'lead by example' and to drive and support new efforts to generate the scale and capacity for the EU to compete on an international level in several key domains: the bio-economy, efficient and sustainable manufacturing (ESM), high performance production through 3D printing, components for marine renewables and offshore energy applications, and new nano-enabled products. Their main goal is to create new business opportunities and increased growth for the different domains. Another good example of macro-regional collaborations is the Baltic Sea Region (BSR). The BSR Stars is a transnational programme and policy collaboration among 10 countries that aims at strengthening the competitiveness and economic growth in the BSR. The BSR Stars S3 is an INTERREG project that develops integrated innovation support infrastructures, test and demonstration facilities and innovation management tools to leverage complementary competences from their respective S3. It focuses on the bio- and circular economy as cross-sectoral S3 priorities.

Pointers to future avenues of data application in the development of a shared vision

Methods like **participatory foresight** are interesting ways of involving all regional stakeholders in the construction of the RIS3 vision. It allows all relevant stakeholders, including government, business sector, academia, but also citizen organisations, to define and communicate their visions of the future that can be then transformed into relevant long-term RIS3 issues and objectives. Participatory foresight is demand-side driven, and is meant to directly involve beneficiaries and users of the RIS3, providing insight into the demand for societal challenges. This method usually involves **public consultations** feed-in and steered with **expert recommendations**, in many cases facilitated by **web-tools** to carry the information flow.

Within the foresight methods family, the use of **horizon scanning processes** helps decision-makers take a longer-term strategic view and make present choices more resilient to future shocks and uncertainty (Delaney, 2014). It aims to identify changes which may impact on an organisation's ability to achieve its objectives. It can be either passive or active. The former involves understanding issues and priorities in a perceived environment, while the latter involves searching, finding, analysing and assessing how developments, emerging and existing, will influence the 'pertinent' environment. Data is collected from a wide variety of sources including government, commercial and scientific documents, but also from social media, events and conferences, through a variety of techniques including document scanning, expert groups, surveys, social media and text mining techniques.

Recently, some leading applied research institutes have been developing methods for integrated **stakeholder participation and future scenario development through serious games**. An example applied in the field of water and port development, the online game 'Port of the Future Serious Game'[18], aims at raising awareness for policy-making challenges. The game applies a fictional but

[17] http://ec.europa.eu/growth/smes/cluster/observatory_en
[18] https://www.deltares.nl/en/software/port-of-the-future-serious-game/

realistic environment, autonomous scenarios, a set of policy measures and a qualitative set of indicators that provide information on the effects for society and the economy of decision making processes. The procedure of such online games goes overall as follows: the aim is to move away from a given present situation and to reach a vision for the future. To achieve that, a team of up to five players choose appropriate policy measures in four rounds. Different scenarios are played to investigate the wide range of possible impacts and to trigger debate among the players by creating constructive conflicts between them during the negotiation and decision-making process. The main goal is to demonstrate that successful policy-making can only be achieved when all stakeholders work in collaboration.

Step 4: Identification of priorities

Participatory deliberation, in the form of **focus groups**, **web-based public consultations**, **workshops** and **interviews** with key stakeholders, is certainly the most common method used by regions for the identification of RIS3 priorities as reflected in the literature. Clearly, qualitative approaches are preferred over quantitative methods. However, most of regions make use of the evidence (qualitative and quantitative) collected in Step 1 to inform the prioritisation process.

The choice of priority areas happens often based on broad participation of all relevant stakeholders in the regional ecosystem. For instance, the region of Emilia-Romagna launched **a call for expression of interest** to participate in the prioritisation process. A total of 8 **working groups** were set-up to discuss key industrial sectors identified and transversal themes. The German regions of Berlin and Brandenburg work together in their innovation policy since 2007, with their *innoBB strategy*, focusing on five clusters: healthcare; energy technology; transport, mobility and logistics; ICT, media and the creative industry; and optics. Both regions have been using annual **innovation summits** to develop **SWOT analyses** that helped them in the preparation of a RIS3 in the field of innovation policy. The results of the SWOT analysis were used to form spheres of activity for each cluster. Each of the spheres of activity were discussed with the scientific community and the private sector through separate **conferences**. Every actor in each of the clusters had the possibility to give its opinion on the cluster construction and to notify its priorities (Eulenhöfer and Kopp, 2013). In contrast, the Greek region of Eastern Macedonia and Thrace implemented a **participatory and experience-based method** by using Entrepreneurial Discovery Process participatory **focus groups**, and **project development labs** as mechanisms to facilitate dialogue and priority setting (Santini and et al., 2015).

ICTs have strongly facilitated the connectivity and communication with regions and between regions. For instance, in Poland and the Netherlands, the prioritisation process involved all relevant regional stakeholders, including citizens, through **web consultations**. For the development of the regional strategy for the Danube region, and **online process approach** was used to reach a wider audience. Online discussions with over 150 participants, and online moderated focus groups reaching about 50 additional stakeholders were used to formulate concrete recommendations to meet the objective of reinvigorating the region.

Some other regions have a long history of developing prioritisation exercises to continuously improve their regional innovation system. For example, in the mid-1990s the regional government of Lower Austria carried out a **SWOT analysis**, sent **questionnaires** to its companies, organised **workshops** and carried out **interviews** with key stakeholders. It also undertook a survey of activities of other similar regions for benchmarking themselves internationally.

Pointers to future avenues of data application in the identification of priorities

Unstructured data can be used to **identify emerging areas of technological and economic activity** in a more accurate and timely way (Bakhshi and Mateos-Garcia, 2016). Company websites can be used to identify businesses operating in a new or emerging economic sector, as well as to define new categories of economic activity. This type of data can be analysed with a variety of methods, ranging

from the simplest **search of keywords** of interest, to complex unsupervised **machine learning methods and text mining**.

The identification of emerging areas of economic activity could then be prioritised using **crowdsourcing priority setting methods**, offering flexibility to implement factual evidence in the RIS3 process. The overall objective is to assess the stakeholders' views and priorities. In general, this involves running a **cross-sectional online public survey** to understand the challenges faced by stakeholders and their views as to which areas of specialisation are of high priority to the region. Codes are first developed and then applied to all responses to identify prioritisation areas. Innovation crowdsourcing methods have been applied in Poland through online surveys to reach enterprises that usually did not interact with the public sector. Crowdsourcing is generally cost-effective, flexible and a fast way to establish a systematic dialogue between stakeholders and to seek for feedback in relation to priority areas for policy intervention, barriers to innovation, emerging business and technological trends, etc. (World Bank, 2015).

NESTA in the UK, funded by the Welsh government, has been working in innovative ways to generate **predictions about the future specialisations** of UK local economies based on their current profiles. This new approach has been developed by economic geographers and complexity scientists with the goal of generating data that can inform policy decisions. In a first step industries are segmented using business registries in order to generate a list of industry segments and their geographical distributions. The resulting sectoral specialisation patterns are then used to generate measures of complexity. An indicator of complexity is built using the "method of reflections", which is a recursive algorithm that takes the specialisation profile of a local authority and weights it by the extent to which the sectors in which it specialises tend to appear in diversified areas. Finally, these complexity indexes and specialisation patterns are used to carry out experimental analysis of the future path of developments using predictive analytics tools. All of this is included in an **interactive dashboard** with information about local specialisation profiles, past growth and future prospects[19].

Step 5: Definition of coherent policy mix, roadmaps and action plans

As in the case of Step 3, very little emerges from literature as to what regions use as tools for the definition of a coherent policy mix, roadmaps and action plans. Most of what appears in the literature refers to qualitative exercises, based on participatory discussions with key stakeholders, including policy workshops and strategic regional partnerships that work as steering groups or expert groups for the development of action plans.

The region of Flanders in Belgium organised a series of **policy learning exercises** to determine 'policy mixes' for three of their priority areas. The aim of the workshops was to facilitate a learning process to understand what kind of policies were needed and what type of 'government' was required to implement the new emerging prioritised value chains. Similarly, the region of Satakunta in Finland set up **strategic regional platforms** around their selected priorities. These platforms were in charge of developing criteria for actions and project development with RIS3 areas.

Pointers to future avenues of data application in the definition of policy mixes, roadmaps and action plans

The development of **online policy support tools** has been explored recently for specific sectors. An example of this, the Urban Transport Roadmaps project[20] funded by DG MOVE of the European Commission, focuses on the development of sustainable urban mobility plans. The project developed an online tool to help users develop a series of first **scenarios** for their mobility plans; explore and identify appropriate sustainable transport **policy measures**; quantify the transport, environmental

[19] https://arloesiadur-industry-analysis.herokuapp.com/
[20] http://urban-transport-roadmaps.eu

and economic impact of these measures; and consider an implementation pathway or a **roadmap** for the policy scenario. The tool aims to support small and medium sized cities with limited resources or knowledge for modelling, and help city policy makers to explore and scope different policy packages to meet sustainability objectives. Moreover, it facilitates discussion and engagement between key stakeholders with a common tool.

This type of online tools could be designed and applied to support the RIS3 process. In particular, in helping regions identify policy measures that coherent with their overall mission and objectives, and to group these policy measures in consistent **strategies** that help specifying pathways and timelines towards scenarios goals.

Step 6: Monitoring and evaluation

Monitoring and evaluation is one of the RIS3 implementation steps that is relatively well documented in the literature. Several approaches exist for the definition of a monitoring and evaluation system, spanning from the lack of definition and description in the RIS3 documents, to complex systems in place. With regards to the definition of indicators, most of the examples in the literature report regions defining different indicators for the micro and the macro levels.

Latvia has implemented a **three-level monitoring system**, with three types of indicators: RIS3 level **micro** indicators, RIS3 **macro** level indicators and **global** overall RIS3 goals. The macro indicators and the overall goals are defined in major policy documents, including the National Industrial Policy Guidelines 2013-2020; and the Science, Technology development and Innovation Guidelines 2014-2020. Micro-level indicators are those achievable by public funding programmes. Data for the micro indicators is obtained from the management information system of the programmes, project applications and reports.

A similar three level approach has been applied in Lower Austria, using an innovation assessment methodology, that also focuses on three target groups: companies, intermediaries and the region. The assessment methodology is applied at three levels: (1) project level, measuring input, output and direct effects on the regional companies; (2) programme level, focusing on total input, output and impact of a public support programme at intermediaries through a **Balance Scorecard**, and companies through a **company survey** carried out every 5 years; and (3) regional level, measuring the effects of regional policy and its interventions on the region. Secondary data such as the **Community Innovation Survey** and **company specific monitoring** are used for understanding impacts at regional level. The Balanced Scorecard methodology is used to define the objectives and target values of the six components of Lower Austria's economic strategy and to break them down at intermediary level as well as at programme level.

Emilia-Romagna in Italy defines its monitoring indicators per the results and the effects the RIS3 has on the regional economy. They define four types of indicators: output indicators, related to the RIS3 implementation of policies and related actions; **specialisation and transition indicators**, measuring the change of the regional economy in terms of specialisation domains; results indicators, measuring the effectiveness of the strategy; and context indicators, reflecting the evolution of the regional economy. Similar systems focusing on output, result and context indicators are being applied in Galicia, Spain. The region of Wielopolska in Poland, in addition to the inclusion of result, output, context and input indicators, also focuses on monitoring progress at international level by including an **international benchmark** and regional input-output analysis at regional, national and European level.

The region of Aquitaine in France defines very detailed Operational Objectives, linked to Indicators for each of their chosen priority areas in their RIS3 strategy document. The region aims to use its monitoring system to guarantee the renewal of S3 areas. Indicators are selected to be realistic within

the realms of projects appraisals, and to offer the S3 governance bodies a **dashboard** or **RIS3 monitoring chart** enabling an update of the strategy and allocation of funding if necessary.

Several regions integrate standard EU tools in their RIS3 monitoring systems. Latvia makes strategic use of the **Innovation Union Scoreboard** indicators as a framework for its RIS3 monitoring system. One of Latvia's overall goals is to increase its position in the EU IUS. It has also put in place a monitoring model involving four major stakeholders: the Latvian Science and Innovation Strategic Council (LSISC) that proposes strategic goals, determines priorities and directions of activity; the EU funds Monitoring Committee, which oversees the implementation of the EU funds and confirms project evaluation criteria; the line Ministries, which ensure the inclusion of strategic goals in support programmes; and the Ministry of Finance, which ensures the inclusion of strategic goals in the ESF, ERDF and CFs as the leading Structural Funds institution. Moreover, it is planned that **thematic assessments** will be regularly carried out to evaluate specific dimensions of research and innovation.

Pointers to future avenues of data application in Monitoring and evaluation of RIS3

The use of **unstructured data** and **innovation analytics** is a promising area to be further explored and applied to the monitoring and evaluation of RIS3 processes. Interesting work in this respect has been conducted in the region of Wales, with its Arloesiadur –or innovation tool- **data platform** for the Welsh innovation system. The innovation tool gathers data automatically from different sources, **combining official statistics with web-based data** (company websites, software developing or professional meeting platforms, Twitter accounts, etc.). An ongoing project, the Engine, will power an online platform in the form of a **dashboard**, a **data analytics tool** or a **data application** where users can access and interact with the data. It will be able to measure and understand innovation in 'real-time' and inform policy more timely.

In relation to web-based data, the use of **social media data**, for instance, has the potential to track and capture satisfaction of beneficiaries with the overall RIS3 process and also with specific initiatives, projects and programmes that are being implemented in regions.

The collection of databases with micro-data, usually collected through **company surveys**, related to innovation activities is another promising area. Interesting examples of this area are the SFINNO and the SWINNO databases of innovation activities implemented in Finland and Sweden. These databases have been, however, used largely for academic purposes with little application in providing feedback on results and impact for the implementation of regional policies.

7. Gap analysis

Tools and methods used for the **analysis of regional and national assets** are the best documented in the literature. Most of the regions use standard statistical analysis with data from Eurostat, but also from national statistical offices and regional organisations such universities or research centres. A good number of regions also uses existing statistical indexes such as the rankings of the Regional Innovation Scoreboard and context indicators of the Innovation Union Scoreboard. Specialisation indexes are built by many regions, as well as some basic bibliometric analysis. There is no documentation of more sophisticated quantitative tools used for the analysis of the regional context. Even if most of the standard statistical analyses are robust, very few regions have a forward view of emerging areas, using predictive analysis or building on hypotheses of potential regional changes or emerging areas for the future.

Regarding the implementation of **governance** systems that ensure participation and ownership of the RIS3, most of the focus on literature concerns the structures themselves, how they were designed and how these structures will facilitate the RIS3 process. Most of the methods used concern participatory discussions, involving all regional stakeholders in the form of focus groups, discussion groups,

interviews and/or working groups. Little is mentioned, however, about the demand-side of the governance systems, especially in relation to enhancing and increasing transparency of the RIS3 process and providing accountability to all regional stakeholders of the process itself.

As mentioned before, tools and methods used for the **elaboration of a vision for the future of the region** are not widely mentioned in the literature. This gap is likely to exist not because regions do not easy any tools, but rather because most of them involve **participatory deliberation** and **consensus building** that are not likely to be documented as part of the RIS3 process relative to other steps. Moreover, this step has a lot of synergies with Steps 2 and Steps 4.

Regarding the **identification of priorities**, evidence from literature shows that qualitative methods are preferred in the form of participatory deliberations. The use of quantitative methods to inform the prioritisation process and/or a better articulation of the use of data analysed and collected in Step 1 of the RIS process is an identified gap.

The methods and tools used for the **definition of coherent policy mixes, roadmaps and action plans** are not widely documented in the literature. Several of the RIS3 document strategies reviewed did not go in detail in defining their policy mixes. Several regions report a roadmap to achieve their objectives, but the tools used for designing them are not well documented. Many regions make links to other policy documents, or reference their regional action plans, without going in detail either as to how they conceived them. Most of the tools documented refer to qualitative approaches, mostly through policy workshops and discussion groups with the help of a Steering Committee or an advisory body.

There is a **clear gap in the use of RIS3 implementation methods**. For instance, tools for tracking data on projects and initiatives that are publicly funded are not widely used. Good practices in this regard include the open data storehouse of Tekes in Finland, which allows to search for projects and beneficiaries that have been funded through Tekes programmes[21]. The UK has similar approaches to open data: the Gateway to Research database[22] includes data on all publicly funded projects by Innovate UK and the Research Councils. Ongoing studies on open data on the use of EU Structural Funds have shown that most data currently published by the EU national and regional authorities are not compatible yet with some of the fundamental requirements of the open data paradigm (Reggi, 2016). Data is rarely complete, accessible, timely, machine-processable and non-proprietary. Open data on public support would allow to track project themes and topics and see how they match with S3. This kind of data could be highly valuable in tracking progress towards objectives and vision, but also in informing the RIS3 update.

With respect to the **monitoring and evaluation** step, most of the examples cited in the literature concern the definition of an indicator and monitoring system for the RIS3, with different levels of complexity and technicality. The most important gap concerns policy intelligence, or the lack of tools and methods that reflect how the monitoring process will be used in the revision of priorities and policy mix with a view of a **RIS3 update**.

8. Approach to the selection of S3 methods

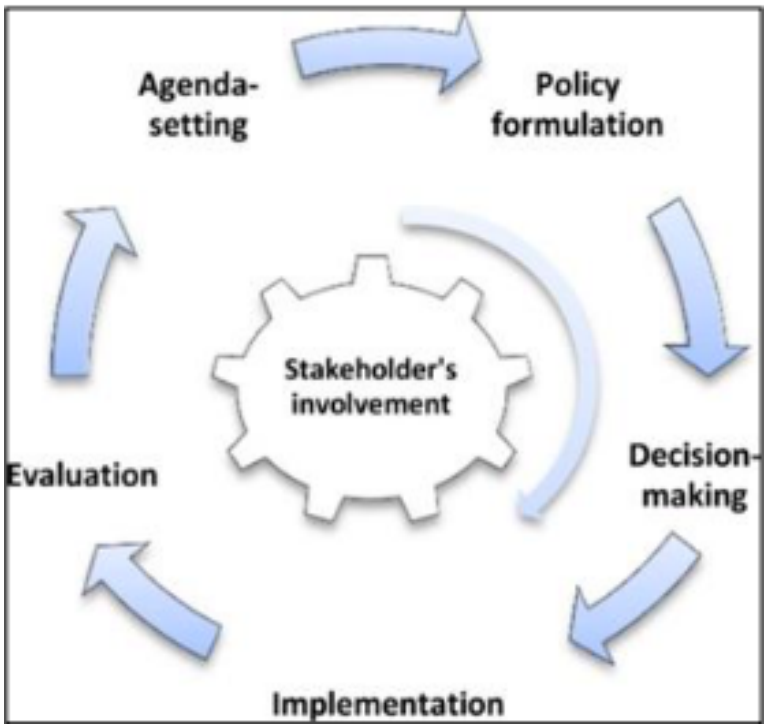
Considering the fact that in RIS3 design practice the defined six analytical steps do not represent distinct and well-understood policy-making phases, **we propose to categorise the selected methods according the cycle of entrepreneurial discovery process** as represented in the updated JRC Handbook Smart Specialisation: from design to implementation 2016 (see Figure 1).

The key reasons for this re-categorisation are: 1) EDP cycle is much more intuitive for policy makers as it follows the key steps of a classical policy cycle; 2) stakeholder involvement is incorporated in all

[21] https://extranet.tekes.fi/ibi_apps/WFServlet?IBIF_ex=o_projekti_htm1&IBIAPP_app=openraho&YKIELI=E
[22] http://gtr.rcuk.ac.uk/

phases; 3) EDP cycle explicitly includes the important phase of implementation that is omitted in RIS3 step approach. Table 9 shows the correspondence between RIS3 steps and phases of the EDP cycle.

Figure 1 The cycle of EDP



Source: Kyriakou and Periañez-Forte (2016), based on Lasswell (1956)

Table 9 Correspondence between S3 step categorisation and EDP cycle phases

Step 1: Analysis of regional/national context	Phase 2: Agenda setting
Step 2: Governance	Phase 1: Stakeholder involvement
Step 3: Shared vision	Phase 3: Policy formulation
Step 4: Identification of priorities	Phase 4: Decision making
Step 5: Policy mix	Phase 5: Implementation
Step 6: Monitoring and evaluation	Phase 6: Monitoring and evaluation

Given the correspondence between RIS3 steps and EDP phases, we propose the following RIS3 process categorisation (we may call them "steps" of "phases"):

Table 10 Proposed categorisation of RIS3-EDP phases

RIS3 phases	**Justification of designation**
1: Governance	The term "governance" refers both to government and stakeholder engagement. Governance implies also a quadruple helix approach as key process of innovation production. This step should be placed at the start of RIS3, setting the framework of the entire process.
2: Analysis of context	"Analysis" is an established and standard term of background information necessary for any strategic planning process. "Context", in particular, refers of regional/national specific conditions and existing institutional setting to be taken into account.

RIS3 phases	Justification of designation
3: Strategy formulation- Shared vision	"Strategy" formulation instead of policy formulation denotes the character or RIS3 as a strategy and project oriented intervention. "Shared vision" makes clear the participatory approach in defining the vision and setting objectives.
4: Priority setting	Definition of activity focus and priorities of smart specialisation.
5: Policy mix – action plan implementation	"Policy mix and action plan implementation" denote the sequence of actions for implementing the strategy. "Action plan" stresses the need for a structured project-driven approach to RIS3 implementation.
6: Monitoring and evaluation	"Monitoring and evaluation" instead of evaluation refers to data collection process, the need of organising aa repository of data monitoring as key process of smartness.

It is important to highlight however that the EDP is not a linear process for any region. In most of the cases the methods and tools used in one step of the RIS3 process are used to feed other steps, and the outcomes can inform back the whole process. It is thus important to clearly note that even if the methods proposed below are classified based on the RIS3-EDP phases they are likely to be used and inform several of the phases.

Table 11 lists the proposed methods for further development. It outlines the overall aim of each of the method, briefly describes the content and notes the current use of this method and justification for the selection. It must be born in mind that analytical methods can be classified according to various aims they help to fulfil such as:

- Collect data
- Link existing data
- Interpret and compare data
- Visualise data
- Make judgements about the future
- Organise communication among stakeholders
- Disseminate information and raise awareness
- Gain understanding of the structure of conflicts
- Contribute to conflict resolution, etc.

More detailed descriptions of each of the proposed methods (T1.4) are listed in Annex 2. The descriptions elaborate on the background and rationale for each of the methods, briefly describes its key principles, assesses usability and potential impact of wider application of the method, provides details on data requirements, lists useful data sources and maps existing applications, as well as sketches the implementation roadmap for design of an online tool. Please note that the annexed method descriptions are to be considered only as the initial drafts of the concepts and ideas for online tools. Further modifications (including substantial revision), updates and fine-tuning of these ideas is undertaken under WP2 tasks.

Table 11 Proposed selection of methods and tools per S3 step

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
1. Governance			
1.1. RIS3 vision sharing	Web-based tool 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, roadmap and action lines. Ready-made infographic templates not only can save RIS3 managers time and effort, but they also ensure consistency of key information on RIS3 across European regions.	Use of information events (73%) Use of information dissemination channels (websites, brochures, etc.) (60%)	There is a need to communicate broadly on RIS3 and engage all stakeholders in the process.
1.2. Stakeholder engagement	The method would provide opportunity to invite RIS3 stakeholders to use online deliberation functionalities specifically tailored for entrepreneurial discovery process. The following elements are key for the anticipated method and application (sorted by importance with respect to RIS3): (1) facilitate discussions; (2) co-creation procedures including provision of feedback (e.g. voting of priorities per impact; plausibility; rank other people ideas thereby allowing the emergence of the most popular ideas); and (3) reputation management system (delegated voting system/'liquid democracy' allowing 'weighted' voting based on expertise in the field.	Use of working groups (97%) Online surveys (40%) Interviews (40%) Online forums/discussion boards (27%) Participatory deliberation/collaborative writing and annotation (17%)	Although online deliberation platforms have been applied in RIS3 process in a few regions, this functionality has not been widely used. The method promises increased stakeholder engagement at a relatively low cost.
1.3. RIS3 debate at a glance	The method would enable participatory deliberation using functionality like argument mapping software DebateGraph, which enables policy makers and stakeholders to visualise and share networks of thought, making their reasoning transparent and open to collaborative and iterative reflection. DebateGraph represents a supportive way of viewing the 'brainstormed' information while debating.	Use of online forums / discussion boards (27%) Participatory deliberation/collaborative	While most of the regions have involved quadruple helix in their RIS3 process, the need to have better transparency and inclusiveness of this

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
		writing and annotation (17%)	process has been underlined. This method is meant for increasing transparency and accountability in the EDP process.
1.4. RIS3 legal and administrative framework related to ESIF	This method will provide an overview of ERDF regulations and EU processes of selecting and funding projects in the framework of national/regional Operational Programmes (OPs). It will enhance the understanding of RIS3 governance within a wider framework of EU policy administration and decision making.	Expert and/or peer review of RIS3 process (50%)	There is a need for understanding the framework of RIS3 within the wider ERDF and Structural Funds operation, involving national and regional OPs.
2. Analysis of context			
2.1. Regional assets mapping	This method will be designed as an online dashboard that draws together information on key regional assets. The objective is to support data transparency that enables gap analysis of regional assets. The mapping will work as a dynamic library including short description of each of the assets (e.g. research services, equipment, etc.) and service portfolio documentation. It will include data on scientific activities, collaboration, human resources and training, data policies, impact, innovation, costs and funding.	Use of regional profiling (100%)	While all regions apply some statistical analysis and qualitative analysis in the first RIS3 phase, the pooling of data sources can enhance this process and enable better comparative perspectives on regional endowments and innovation bottlenecks. Comprehensive mapping of regional assets is key for successfully applying other RIS3 methods.

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
2.2. Research infrastructure mapping	A comprehensive and up-to-date mapping of the existing and planned research infrastructures across the EU regions will provide basic background information for regional policy makers in their RIS3 process. During contextual analysis policy makers can use this information to determine how the current research facilities available in the region benchmark against those of neighbouring regions and how unique the regional RI equipment is on the European scale.	Use of charting the intervention logic of policy mix (37%) Use of online inventory surveys (13%)	These methods enable one-stop-shop access to information on 'soft' and 'hard' innovation infrastructure in European regions for the design of RIS3 action plan that is coherent with the current innovation ecosystem.
2.3. Clusters, incubators, and innovation ecosystem mapping	The method will define the framework, concepts and categories for mapping the innovation ecosystem of the 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. Data and overall analysis can be linked to results of the European Cluster Observatory and its Regional Ecosystems Scoreboard.		
2.4. Benchmarking	The method will allow to compare the performance of a region with regions that are structurally similar. It will enable selecting a series of indicators for comparison and performance assessment. The data can be pulled together from existing sources such as Eurostat, OECD, also national/regional statistical offices and data that are already available at regional level from various European monitoring platforms, such as Regional Innovation Scoreboard, Regional Innovation Monitor Regional Statistics Illustrated, various competitiveness indexes, etc.	Use of benchmarking (63%)	Dashboard-type of tool will gather all relevant sources, making the data search and use more efficient for regions, giving more time to reflect and possibly develop more advanced analysis. The method will foster analysis that places regions in international comparative perspective.

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
2.5. Science and technology profile and performance	This method produces 'scientific profiles' for regions based on Web of Science (WoS) data, Scopus and Google Scholar data. Data is not only pulled from the existing sources, but also new indicators are produced. It gives counts of publications by area, top university or research centre producing the output and other bibliometric indicators (to be defined). The output feed into 2.4 Benchmarking.	Use of bibliometric analysis (57%)	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.
2.6. Specialisation indexes	The method produces technological and economic specialisation indexes for understanding the position of regional technological and economic activities in global value chains. It will integrate the Activity Index (AI) for scientific activities that is developed under method 2.7 and produce such indicators as the Revealed Technological Advantage (RTA), and the Revealed Comparative Advantage (RCA) for economic activities. Interactive dashboard will be used for data visualisation.	Use of cluster analysis (27%) Use of value chain analysis (27%)	There is a need for understanding the position of regional industrial sectors 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. It can be easily disseminated among stakeholders and other interested parties (funding agencies, EC, etc.). There are several useful online tools already available for design of a SWOT. Tailored guidance will be provided to enable the presentation of SWOT analysis specifically in the context of RIS3.	Use of SWOT analysis (87%)	Communication of SWOT summary analysis can be improved to ensure all quadruple helix stakeholders are on the same page.
3. Strategy formulation – Shared vision			

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
3.1. Collaborative vision building	This method will capitalise 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.	Use of working groups / focus groups (90%) Use of stakeholder interviews (37%) Literature review (47%) Benchmarking (30%)	A few regions mention explicitly their vision by 2020, but little is said as to how this vision was conceived and designed.
3.2. Scenario building	A scenario is a 'story' illustrating visions of possible future or aspects of possible future. Scenarios are not predictions about the future but rather similar to simulations of some possible futures. They are used both as an exploratory method or a tool for decision-making, mainly to highlight the discontinuities from the present and to reveal the choices available and their potential consequences. The tool will be designed to support RIS3 scenario building exercises. Data from the JRC's LUISA modelling platform and iKnow tool could potentially be used for the development of baselines scenarios and data projections for scenarios building.	Use of horizon scanning (27%) Use of scenarios (40%) Risk assessment (3%)	Leading regions have been developing methods for integrated stakeholder participation and future scenario development through serious games. Scenario building practice in RIS3 development should be strengthened.
3.1. Delphi - Foresight	Delphi is perhaps the most emblematic Foresight or future studies method. The Delphi method is based on structural surveys and makes use of information from the experience and knowledge of the participants, who are mainly experts. It therefore yields both qualitative and quantitative results and draws on exploratory, predictive even normative elements. A single Delphi methodology exists but the applications are diverse. This tool will propose a supportive online function to run Delphi-type of methods for RIS3.	Use of foresight (30%) Use of Delphi survey(s) (3%)	Methods like participatory foresight are interesting ways of involving all regional stakeholders in the construction of the RIS3 vision, yet their application is not widespread.

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
4. Priority setting			
4.1. EDP focus groups	The method will provide a roadmap for the implementation of EDP, including the definition of industry activities and groups, the selection of stakeholders and business leaders to be involved in the EDP process, 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.	Use of working groups in identification of priorities (93%)	The choice of priority areas happens often based on broad participation of all relevant stakeholders in the regional ecosystem. Working groups are set-up to discuss key industrial sectors identified and transversal themes.
4.2. Extroversion analysis	This method is applied to detect possible industry segments in which regions present increased extroversion, in terms of exports, attraction of FDI, or other forms of regional openness. Extroversion can indicate increased future potential; hence it is a very important aspect to consider during RIS3 process.		There is a need to identify emerging areas of technological and economic activity in a more accurate and timely manner.
4.3. Related variety analysis	This method will allow for calculating the Related/Unrelated variety entropy indexes. It will compare 2-digit and 5-digit sector shares (%) and will estimate the entropy index for regions. The method will enable estimating whether specialisation or diversification objectives should be given priority.	Not used in the RIS3 cases examined, which shows an important gap	The method is key for assessing the potential of industry expanding into new activities and niche markets.

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
5. Policy mix – Action plan implementation			
5.1. RIS3 intervention logic	The method allows identifying if different policy measures are coherent with the vision and objectives of the region. It also suggests strategies to group the selected policy measures, as well as possible pathways and roadmaps towards the achievement of the RIS3 objectives. It is meant to be an information tool, where users can review all possible types of policy measures that can be implemented to achieve specific goals and deal with specific challenges and hence assess the effectiveness of their RIS3 policy intervention logic.	Charting intervention logic of policy mix (37%)	There is a need to identify policy measures that are coherent with the overall RIS3 vision and objectives, and to group these policy measures in consistent strategies that help specifying more concrete pathways and timelines towards the achievement of the overall objectives.
5.2. RIS3 action plan co-design	Co-design is a well-established approach in the process of creation, particularly within the public sector. The method has its roots in the participatory design techniques developed in the 1970s. Co-design is often used as an umbrella term for participatory, co-creation and open design processes. This method goes beyond consultation by building and deepening equal collaboration between citizens affected by, or attempting to, resolve a particular challenge. A key tenet of co-design is that users, as 'experts' of their own experience, become central to the design process.	Use of working groups in the definition of policy mix (83%) Use of stakeholder interviews (20%)	Regions have applied mostly qualitative exercises in action plan design. They have been based on participatory discussions with key stakeholders, including policy workshops and strategic regional partnerships that serve as steering groups or expert groups. There is a room for more elaborate methodological approaches.

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
5.3. RIS3 budgeting	The method will provide a framework for using different budgeting methods (incremental, zero budgeting) to capture the funding dimension of the RIS3 action plan and the needs for funding across the defined implementation period. The potential sources of funding and allocation of actions across the funding lines will be provided.		An essential method for assessing the applicability of the RIS3 policy mix and securing the necessary funds for implementation.
5.4. State aid law compliance for RIS3 implementation	The objective of this method is to provide a better understanding of State aid regulations (and definitions) that affect innovation and that are linked and could benefit RIS3 implementation (e.g. support to SMEs, clusters and research infrastructures). The method helps the user/policy maker to identify, if their policy instruments included in its RIS3 policy mix/action plan is eligible for State aid.		A necessary part of assessing the potential of implementation of the RIS3 action plan with respect to available funding from the OPs and other programmes.
5.5. RIS3 calls consultation	The method will enable RIS3 stakeholders to assess calls for projects under SF operational programmes that are made by regional authorities. The method will enable use of open consultation process so that stakeholders can provide input on the funding priorities, project selection criteria, standard online tool for collecting and assessing RIS3 project proposals, etc.		There is an important need to facilitate the RIS3 implementation process.
5.6. RIS3 innovation maps	Online visualisation tool that teases out information about regional technological trends using grant data that is collected from S3 programmes and initiatives. The tool could also be used to juxtapose the emerging technological trends and defined S3 priorities to see if they have been selected rightly. The method requires the collection of grant data for all regions and/or compliance to the fundamental requirements of open data paradigm, as well as acceptance to use this data from all funders and donors. This is elaborated in 5.7.		Need to make sure that the outcomes of funded projects in terms of knowledge and innovation offer fit with the overall RIS3 implementation strategy.

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
5.7. RIS3 open data tool	Online data tool in the form of a data repository that allows for a finely grained tracking of projects and initiatives implemented in each region with a link to respective S3 priorities. Data could be collected or mined using automated systems following the submission of grant applications.	Tools and methods for tracking data on projects and initiatives that are publicly funded are not widely used.	This kind of data could be highly valuable in tracking progress towards defined objectives and vision and inform the RIS3 update process.
6. Monitoring and evaluation			
6.1. RIS3 monitoring	Monitoring is an integral part of RIS3 and all regions are required to develop tailored monitoring frameworks to receive Structural Funds assistance. The method will define the overall process/roadmap for RIS3 monitoring, which usually encompasses all sorts of activities that relate to the collection and processing of information about the achievement of expected results and the degree of implementation of policy measures.	Use of various types of assessment of RDI system (60%)	Detailed monitoring frameworks are currently under development in many regions and there is an interest in experience exchange on this aspect of smart specialisation design.
6.2. Definition of RIS3 output and result indicators	Output and result indicators constitute an essential part of RIS3 monitoring and evaluation. The indicators are the main instruments of monitoring and evaluation processes to capture the effectiveness of the implemented programs' performance. Output indicators relate to operations supported. Result indicators capture the expected effects on participants or entities brought about by an operation. The method will provide online guidance on indicator selection and catalogue of indicator examples per type.	Definition of O-R indicators (90%) Definition of structural change and context indicators (70%)	EU regions are using different types of indicators to capture the impact of RIS3. The use of a common system of indicators will provide meaning to data and enable benchmarking of performance and efficiency of policy measures

Methods per S3 phase	Description of method	Justification of selection	
		Use in current RIS3	Need identified in good practices / literature review
6.3. Balanced scorecard	Balanced scorecard is a strategic planning and management system that is used extensively in business and industry, government, and non-profit organisations worldwide to align business activities to the vision and strategy of the organisation, improve internal and external communications, and monitor organisation performance against strategic goals. A RIS3 quality scorecard functionality can be considered that would draw together all indicators proposed in regions for the monitoring of their RIS3 together with the results and outcomes achieved to date.	Use of balanced scorecard (23%)	The method enables to trace down the impact of specific actions. It is extremely valuable in the scale-up of projects from the pilot to full scale. There is also an increased need for evidence on RIS3 effectiveness.
6.4. RIS3 beneficiaries and end users' satisfaction online survey	The method will enable collecting micro data directly from the beneficiaries and 'end-users' of public policies implemented through S3. It is intended to understand how well-suited measures were to the needs of firms, research institutes, universities, but also civil society organisations such as NGOs. The method allows also for cross-regional analysis of satisfaction and can inform the RIS3 update process. It could also be used for defining baseline values of satisfaction as well as target values. The questionnaire must be general enough to capture all types of EU regions and policy measures, and specific enough that it is able to quantify overall satisfaction of beneficiaries.		The use of unstructured data and innovation analytics are a promising area to be further explored and applied to the monitoring and evaluation of RIS3 process.
6.5. RIS3 social media analysis	This online tool offers simple indicators on the overall RIS3 process by using data coming from social media, such as Twitter or Google trends. It can also allow for specific searches with keywords of key policies or programmes implemented in the region. The use of social media data has the potential to track and capture satisfaction of beneficiaries with the RIS3 overall process, but also in relation to certain initiatives, projects and programmes being implemented in regions. Using natural language ontologies, it would provide insights into social 'interest' in S3 and could allow for cross-regional comparisons.		Social media analysis is a completely untapped resource in the context of RIS3.

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Annex 2 Descriptions of the selected methods

Title of the method: **1.1 RIS3 vision sharing**
Applicable to the RIS3 phase: **1. Governance**

Background and rationale

The development of a vision is an integral part of the RIS3. A vision outlines where the region would like to be in the future, what the main goals are, and why they are important. As highlighted in the RIS3 Guide (Foray et al., 2012), this vision should be clear and widely communicated to the stakeholders in order to keep them engaged in the RIS3 process. Despite this, some regions do not actively seek to communicate their RIS3 vision or process.

The mapping process of RIS3 strategies indicated that around 73% of the mapped regions held dedicated information events and around 60% spread information through other means such as websites and brochures. There is a clear need to encourage regional policymakers to communicate with stakeholders more actively. One method to do this could be to provide policymakers with ready-made visually attractive material on RIS3.

Description of the method

The simplest option is to provide policymakers with ready information material templates that could be easily used to share information and to request feedback on the RIS3 process. Template designs could take a range of forms, including brochures, websites, social media, etc. These templates would be designed to look attractive and they would describe the RIS3 process concisely. The content could also be translated into all official EU languages to make the RIS3 process more accessible to everyone. The templates would be available for download from the Online S3 platform.

Another option would be to create a tool that retrieves relevant digital content from other services and combines them into a template for policymakers to use. This would ensure up-to-date information on the templates and possible personalisation of content. However, this approach can be technically difficult to develop, whereas using standardised templates does not require the development of bespoke applications.

In any case, the method should support vision sharing in all the phases of the RIS3 process. Therefore, different types of informational material are needed for each phase:

1. At the initial stage of the process → templates for:

- Informing stakeholders on RIS3
- Inviting them to collaborate

2. During the formulation of the strategy → templates for:

- Informing on the progress, planned policies, and vision
- Inviting to collaborate and to give feedback

3. When the strategy is in place → templates for:

- Informing stakeholders on the final strategy, implemented policies, and results
- Requesting feedback

To encourage regions to use these templates and to communicate their vision to stakeholders, the rationale behind the method should be clearly explained on the platform. In addition, guidance should be given on how to effectively communicate the vision to stakeholders. This should include guidance for the use of information material but also for other means of communication, such as information events that are commonly used in the RIS3 process. The guidance should also encourage regions to carry out a stakeholder analysis, where different stakeholder group are identified and their role in the RIS3 process is assessed. The analysis makes it easier to choose the best way of including each group in the process and communicating the vision.

Usability and impact

Overall, the method has a high probability of improving communication about the RIS3 process across regions. Even highlighting the importance of communication on the Online S3 platform is likely to encourage regions to communicate with stakeholders about the RIS3 process. However, by saving policymakers' time and effort in providing ready templates both for every phase and for multiple channels, there is an even greater chance of improving communication. Additionally, this measure will save time for many policymakers across the EU. Finally, the ready-made templates guarantee the consistency of information on RIS3 in the EU.

Required data

The information used in the templates has a different emphasis in each stage:

1. Start of the process:
    - General information on smart specialisation and the R&D&I funding from the EU
    - Invitation to collaborate
2. During the formulation:
    - Information on the progress, planned policies, vision of the region, etc.
    - Invitation to give collaborate and to give feedback
3. Strategy in place
    - Information on the strategy, implemented policies, and the results
    - Invitation to give feedback

Additionally, a guide is needed on the website. Firstly, it should contain information about the role of communication in the RIS3 process and help in identifying the role of each stakeholder group. Secondly, it should assist users in filling in the templates with correct information and to distribute them effectively through multiple channels.

Relevant data sources

Ideas for the templates can be drawn from similar material created by regions:

- e.g. helsinkismart.fi

The data on RIS3 can be retrieved from multiple sources:

- S3 platform
- RIS3 guide
- Other official material from the EU

Multiple tools exist for creating the templates:

- Microsoft Word, PowerPoint, Sway, etc.
- Lots of infographic providers on the internet
- infogr.am, piktochart.com, venngage.com, etc.

Implementation roadmap

1. Download the templates that are suitable for the step of the progress
2. Fill them in with required information
3. Distribute the ready material to stakeholders through multiple channels
4. Gather feedback and adjust the RIS3 process (for example to implemented policies or ways of communication).

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Title of the method: **1.2 Stakeholder engagement**
Applicable to the RIS3 phase: **1. Governance**

Background and rationale

Several applications (e.g. ideascale.com, allourideas.org or www.mywejit.com) have been designed and used to facilitate knowledge transfer, crowdsourcing and collaboration to enable consultative and deliberative processes (e.g., Lathrop and Ruma, 2010; De Cindio and Stortone, 2013; Castells, 2015). The method for facilitating **stakeholder engagement in RIS 3** needs to provide opportunities to invite a diverse set of RIS3 stakeholders to use online deliberation functionalities specifically tailored to promote the **entrepreneurial discovery process**. Thus, the **following elements are key for the anticipated method and application (sorted by importance with respect to RIS)**: (1) facilitate discussions; (2) co-creation procedures including provision of feedback (e.g. voting of priorities according to impact; plausibility; rank other people ideas thereby allowing the emergence of the most popular ideas); and (3) reputation management system (**delegated voting system / "liquid democracy"**) allowing voting that is "weighted" based on expertise in the field. Based on these features the **open-source software LiquidFeedback** appears to offer a promising method for application. LiquidFeedback offers a deliberative process over which proposed suggestions can be *debated, voted, supported, and written in a collaborative way, or questioned*. The application is built on the Schultze method, an improved version of the Condorcet's one (Schulze, 2011).

The method applied by LiquidFeedback was considered and developed to support policymaking processes of a German Party (Domanski, 2012) but it has been also implemented by non-profit associations such as the "Interaktive Demokratie" or other activities toward civic engagement (De Cindio and Schuler, 2012). Furthermore, civil society organizations such as "Slow Food Germany" and local communities such as the "County of Friesland" have been taken advantage of LiquidFeedback for facilitating a broad participation and public deliberation. LiquidFeedback represents a platform to reform democracy. In particular, the web-based application provides a mix of direct and representative democracy, in other words a liquid democracy to boost knowledge exchange in a large civic context (De Cindio and Stortone, 2013).

To conclude, the **following functionalities provide important highlights for the RIS context**

- The method delivers robust outcomes based on the stakeholders provided **proposals, information, suggestion, and needs**. Via LiquidFeedback, decisions can be made within an **interactive democracy** or it can be used as an **innovative communication channel between different stakeholders and engagement level**.

- In RIS3, procedures should be adaptable to any topic. Thus, the **entrepreneurial discovery process within RIS3 can be facilitated** by providing information linked to this adaptability. Via nonbinding suggestions to binding decisions within the method's functions **creative processes among stakeholders are supported**.

- The method represents a direct channel for a broad participation. It can be used to poll the opinion of the public with both **yes/no–questions** but also allow citizens to **rephrase questions and provide answers**. In other words, it empowers citizens to co-create.

- LiquidFeedback is an open-source software established by the "Public Software Group e. V." to **empower democratic decision-making processes online**. This allows every individual an equal opportunity to contribute in the democratic process via a **web browser**. Stakeholders are not required to install the software.

- Although the mapping exercise found no region that has used similar methods to LiquidFeedback in RIS3 process, based on the literature review (De Cindio and Stortone, 2013) this method appears to be a

promising application to enhance the **entrepreneurial discovery process via stakeholder engagement in RIS3**.

Description of the method

LiquidFeedback is a free open-source software for (political) opinion formation and decision making, merging the direct and representative democracy approach. Features of the platform for proposal development and decision making such as the **delegated voting system ("liquid democracy")** enables an innovative procedure of political representation and stakeholder engagement taking the knowledge inequality of its participants into consideration. The **proxy voting feature** generates power structures comparable to **representative democracy**.

The methods applied by LiquidFeedback support decision making based on a comprehensive depiction of the opinions from stakeholders **without hierarchies**. Everyone is encouraged to contribute their own ideas and initiatives. The methods are designed to work with a large set of stakeholders and groups. Conflicts are mitigated by the application of **strict rules** in a predefined process **without moderator interference**. Different settings for timings, quorums and supermajority requirements are possible. So-called "policies" for different types of decisions can be chosen. The outcomes provide rich information, suggestions, directive, or binding decisions (Behrens et al., 2014).

The required method represents an implementation of Liquid Democracy but also offers features for a **unique proposition development system,** where a diverse set of stakeholders may **discuss and decide in a self-organized way** (Bertone et al., 2015). This provides an appropriate **framework for processes for entrepreneurial discovery in line with the recommendation of The World Bank (2016)**. The method encourages a culture of a public–private dialogue, expands public administration's online presence, including in social media, and facilitates collaboration among stakeholders.

The description of the method can be summarized as follows:

- a stakeholder driven and self-organized process with collective moderation
- every stakeholder is allowed to propose ideas, initiate proposals or add suggestions
- feedback is quantified and constructive
- every stakeholder is allowed to initiate alternative proposals or suggestions
- alternative initiatives are voted upon together using Cloneproof Schwartz Sequential Dropping (Schulze Method; Schulze, 2011)

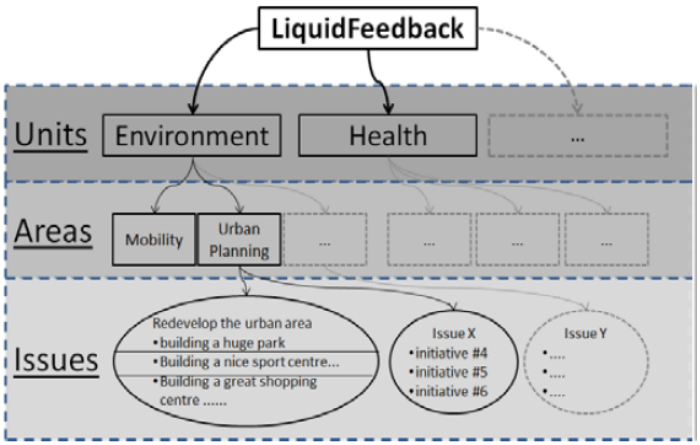
The methods are characterised by the following elements (www.liquidfeedback.org):

- **Liquid democracy:** Liquid Democracy can be referred to as "delegated" or "proxy voting", an idea of transitive, revocable delegations by topic. Individuals' votes possess a "liquid" authority meaning that the voter can delegate his/her vote to other stakeholders (e.g. another expert, colleague etc.) (Edick, 2015). The fundamental idea is a democratic arrangement in which issues are (strongly) suggested or decided by direct ballot. Votes can be flexible, delegated by theme. Allocations are transitive and can be withdrawn.
- **Collective moderation:** All individuals receive equal rights in a scalable structured discussion process in which minorities are considered adequately. Every individual can propose discussions, ideas, suggestions etc.
- **Transparent decision process:** Predefined rules, recorded votes and timings on decision processes are transparent. All relevant data is made available to all stakeholders in adequate formats. Thus, participants can validate the applied procedures. This also provides a protection against non-transparent lobbying.
- **Preferential voting:** The applied method inspires stakeholders to suggest alternatives. A voting system enables stakeholders to express their (dis)agreements. The underlining mathematical environment eliminates vote–splitting. Furthermore, similar proposals don't harm each other. In this way equal treatment of competing alternatives is ensured.

The basics of the methods – the functionalities

The method applied by LiquidFeedback is a deliberative application, with a rich and articulated structure as well as text-based user interface (De Cindio and Stortone, 2013). As illustrated in Figure 1, the tool categorises stakeholders' contribution, so called "issues" into "units" and "areas". This is built by an administrator. The alphabetically listed units and areas, sorted by number of contributors (participants weight), can be added or deactivated (partly hidden). Unit visibility can be restricted to registered stakeholders or open to the wider public (Bertone et al., 2015). Labels should "be chosen wisely, keeping in mind it should be as clear as possible to determine which subject area a new topic should be assigned to." (Behrens et al., 2014; p. 124).

Figure 1 LiquidFeedback structure



Source: Bertone et al., 2015

Main objects and actions

Stakeholders participate by clicking the button of an area. Here, they can open an "issue", which gets a numerical identifier (e.g., #3333). This issue represents a (preliminary) proposal to solve a problem by proposing a so called "suggestion" to solve it. The name can be chosen freely. Any proposal can be disputed by another stakeholder who proposes an alternative solution to the same issue. The initiatives may gain support or receive further suggestions. This will encourage the authors to modify their initial proposals. Stakeholders rank both their own and other individual's suggestions for implementation (Behrens et al., 2014), making them (potential) supporters of the initiatives and suggestions. Authors can invite other stakeholders to co-create an initiative. (Counter)Proposals, which can be also reformulated and improved by the authors, can be supported and can gather suggestions. Figure 2 depicts an example for the items *issue, initiatives, and suggestions*.

Figure 2 Issues, initiatives and suggestions

Source: Bertone et al., 2015

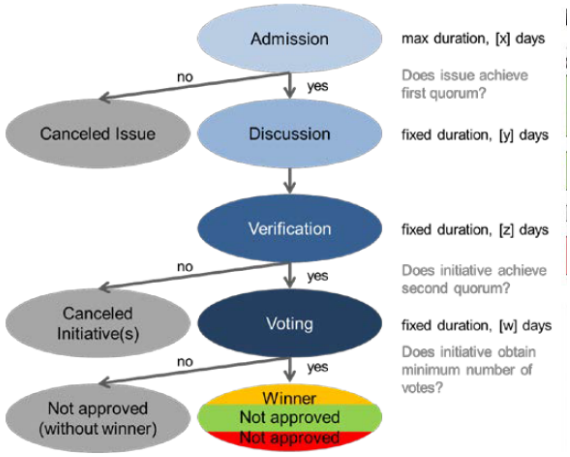
The issue with its "support" actions such as *initiatives, suggestions, and endorsements* establishes a deliberative environment within a given area. Stakeholders announce interest in the issue directly, by ticking the relevant button, or indirectly, by being active in the issue's environment. The participating stakeholder community in the

different areas creates the "reference population" (Behrens et al., 2014; p. 71-72) whose size influences the issue's deliberation path (Bertone et al., 2015).

Deliberation path

As illustrated in Figure 3, the proposed issue is based on a deliberation path of sequential stages entitled *admission, discussion, verification, and voting*. This path represents the "issue lifetime." Shifts from one phase to another will be subject to the set policies setting regarding timing parameters and/or quorums on behalf of the administrator. Two quorums need to be reached during the deliberation path (during the admission and during the verification phase), which are measured as number of supporters based on the reference population. Thus, the state transition happens based on set conditions such as time (e.g., after seven days of discussion) and/or a "quorum" (e.g., if at least there are 40% supporters of the reference population) (Bertone et al., 2015).

Figure 3 The deliberation path



Source: Bertone et al., 2015

The administrator chooses the settings for the policies, which will depend on the type of decision. When opening a new issue, the author chooses a policy to his/her area. Proposals which receive the necessary support are primarily *frozen* to allow other stakeholders to read the last version. Then they can vote. All the proposals referring to the same issue are voted on in one pool: voters can choose *positive, neutral or negative opinions*. Furthermore, priorities can be chosen. The "winning" (or approved) proposals represents the results (Bertone et al., 2015), which are measured based on the Schultze algorithm (Schulze, 2011).

Figure 4 Voting interface, generic example

Approval	1st preference	*A*
	2nd preference	*B C*
	3rd preference	*D*
Abstention		*E F*
Disapproval	preferred to those below	*G H I*
	ranked worst	*J K*

Source: Bertone et al., 2015

If an initiative on an issue passes the first quorum during the admission phase, the whole issue with all its initiatives progress to the next step, the discussion phase. If not, it ends. Individuals can still contribute to the issue during the discussion stage for a given period of time. For instance, stakeholders can give/revoke support, suggest/ co-create alternatives, edit/revoke extant initiatives). A notification system empowers stakeholders to shadow the activities. After the discussion, the issue enters the verification phase. This means proposals are frozen as a final version and can no longer be changed. Now, the stakeholders have time to read this final version (Bertone et al., 2015).

The verification phase, which also lasts for a period of time, is for initiatives that achieve a set second quorum progress to the voting phase. In LiquidFeedback votes are sorted on a given issue. As illustrated in Figure 4, stakeholders can choose in *favor (green) or neutral (gray) or against (red) for voting*. The Schulze (2011) method regulates outcomes, e.g., using the example from Figure 2, "if 35% of voters support the park, 20% the sports center and 45% the shopping center, the latter would not win as in usual single-choice voting, since a clear majority favours some form of public leisure." (Bertone et al., 2015, p. 5). This voting scheme allows stakeholder to express their different levels of agreements to several alternatives.

Delegating to allow for getting advice from experts

Via delegating, LiquidFeedback follows liquid democracy principles, "i.e. transitive proxy voting, a distinctive, innovative feature. Participants can delegate (and then revoke) other members to act (not only vote) on their behalf. These proxies may, in turn, choose other participants as proxies" (Bertone et al., 2015, p. 5). Overall, the method applied by LiquidFeedback enables three levels of delegation (Behrens et al., 2014; p. 26):

(1) Delegation for all issues in all subject areas, within a single unit;
(2) Delegation for all issues in a given subject area;
(3) Delegation for a single issue.

"Any finer delegation (e. g., for a particular issue) overrides a more general delegation (e. g., for the corresponding area). Any form of direct participation will suspend existing delegations" (Bertone et al., 2015, p. 5).

Usability and impact

Usability aspects of the method of LiquidFeedback on the quality of RIS3 process

- Through a participatory contract stakeholders are asked to suggest proposals. The method's / LiquidFeedback's authentication policy requires stakeholders to register, which in turn is dependent on an invitation from the platform's administrator. This process appears to be sufficient for ONLINE S3; however, authentication policies should be examined and, if necessary, improved to ensure adequate settings for future RIS contexts.

- The configuration setting of the method comprises several parameters for shaping the deliberative path. This forms the transition from one stage to the subsequent stage. These parameters are: (1) a quorum for the proposal to start the "discussion" phase; (2) a quorum for progress to the vote phase; (3) the longest duration of each stage and (4) the minimum number of positive votes to be defined as an approved proposal. These parameters effect the number of approved proposals. These flexible settings are essential to adopting the RIS3 development phase to national and regional contexts in Europe. In the framework of a rather fast and competitive electoral campaign, the aim is to fulfil stakeholders' anticipation of seeing their ideas and suggestions considered, while also fostering collaboration, co-creation and aggregation among stakeholders (De Cindio and Stortone, 2013).

- Users are not required to install LiquidFeedback. Stakeholders can access it via a web browser. LiquidFeedback is platform independent.

- Poor usability and an outdated graphical user interface is often the primary reason for not using LiquidFeedback (Bertone et al., 2015). This provides room for improvement within ONLINE S3.

- LiquidFeedback is an open-source software and project and thus provides a suitable format to be embedded in the RIS3 process within ONLINE S3.

- The method should (and LiquidFeedback can) be embedded into a richer platform. It has a very "Spartan" interface, and runs on the open-source software platform openDCN (openDCN.org). Thus, social media sharing facilities are possible (De Cindio and Stortone, 2013). Broad participation is key in RIS3. Thus, this compatible environment facilitates RIS3's objectives.

Impact #1: A book entitled **"The Principles of LiquidFeedback"** provides a comprehensive insight and background information related to the philosophical, political and technological aspects of decision making via LiquidFeedback. Within RIS this software design could empower stakeholder groups to make democratic decisions, giving every individual an equal chance to participate in a democratic process. The principles and rules of procedures developed for LiquidFeedback are explained in detail in this book, discussing the essential features for democratic self-organisation. These principles can be used for the RIS community as a point of reference too. (http://principles.liquidfeedback.org)

Impact #2: The **Liquid Democracy Journal** is devoted toward the democratic principle of Liquid Democracy that follows transitive delegations to represent direct and representative democracy. Apart from liquid democracy this journal is dedicated toward further topics such as electronic *participation, collective moderation, and voting systems*. This dissemination channel could also provide an opportunity for ONLINE S3 to disseminate its contributions. (http://www.liquid-democracy-journal.org)

Required data

LiquidFeedback (www.liquidfeedback.org and www.liquidfeedback.com) is an open-source software and an independent open source project. The software is published under MIT license by the Public Software Group of Berlin, Germany (http://www.public-software-group.org/licenses). The LiquidFeedback software and source code may be obtained free of charge, and there are no royalties. The source code can be downloaded from the website of the Public Software Group e.V. (dev.liquidfeedback.org/trac/lf and www.public-software-group.org/mercurial). "The Public Software Group's liberal licensing model avoids license incompatibilities when

merging the software with other software components. LiquidFeedback and its dependencies are based on MIT– and BSD–licensed components" (liquidfeedback.org).

> **"The LiquidFeedback Maintainers are granting access to the source code repository to developers. Contributors are kindly requested to make their contributions by email together with a feature proposal. Such patches will be reviewed by the maintainers and – if suitable for LiquidFeedback – incorporated" (dev.liquidfeedback.org).**

The core comprises a database scheme for the PostgreSQL database, including the algorithms for delegations, feedback and the voting procedure implemented as SQL views and database procedures written in PL/pgSQL. As it is licensed under the liberal MIT/X11-License it can be included it in any software project, as long as there is PostgreSQL support for the programming language available (www.public-software-group.org). "The user frontend is provided by the LiquidFeedback Frontend. Currently the frontend accesses the SQL database directly and is thus also responsible for access control and locking" (dev.liquidfeedback.org).

The work title „LiquidFeedback" is protected by law. If the software „LiquidFeedback" is changed and distributed, the **name „LiquidFeedback" must not be used.** LiquidFeeback is a registered trademark in the European Union and the United States of America and must not be used for commercial purposes without prior permission. „LiquidFeedback" is properly quoted in CamelCase (e. g. in press, media, blogs, scientific work).

Relevant data sources

- An **installation guideline** is part of the LiquidFeedback Frontend.
- The main information page: http://liquidfeedback.org/
- The Principles of LiquidFeedback: http://principles.liquidfeedback.org/
- Website of the Public Software Group, publishing LiquidFeedback: http://public-software-group.org
- Website of the Interaktive Demokratie, promoting the use of electronic media for democracy: http://interaktive-demokratie.org/
- The Liquid Democracy Journal on electronic participation, collective moderation and participation: http://www.liquid-democracy-journal.org/

Software dependencies:

- WebMCP http://www.public-software-group.org/webmcp
- RocketWiki (LiquidFeedback edition) http://www.public-software-group.org/pub/projects/rocketwiki/liquid_feedback_edition/
- PostgreSQL https://www.postgresql.org

Frequently Asked Questions

- http://www.liquid-democracy-journal.org/issue/2/The_Liquid_Democracy_Journal-
- Issue002-08-Readers_Asked_-_LiquidFeedback_Developers_Answer_001.html

Implementation roadmap

The web application Liquid Feedback is a free open source product with no charges or licence fees. This tool is entirely web-based and emphasizes formal and structured feedback and voting processes, while leaving the means of informal and unstructured discussion to a web forum.

The applied method by which LiquidFeedback provides a mechanism for identification based on stated principles "*it is not intended for pseudonymous use where participants within the system are hidden behind nicknames and only a special group of administrators know (or can guess) who really signed up*" (Behrens et al., 2014; p. 121). After the responsible certifier has an adequate meeting with a stakeholder, the LiquidFeedback administrator creates the account for the user with the basic identification details. Then, an invitation code is sent to the stakeholder's

email address so that the new participant is able to complete further relevant information in the account settings. While the change of the identification name is not possible, individuals can select login name, password, and screen name/nickname on their own. This authentication removes the need for moderators, and LiquidFeedback can build on a "collective moderation" (Behrens et al., 2014; p. 63). Consequently, administrators have no user-management functions. Theoretically, nothing in the software stops administrators from generating accounts with unfilled identification details for potential stakeholders. **Thus, any promise of a strong relationship between the created account and a real person would be lost.** This offers room for improvement.

"After login, registered users operate in thematic areas through first-level activities (participating, declaring interest, delegating, creating new issues). Second-level activities are enabled for a given issue, depending on its phase. Logged-in users can view the identity of proponents, subscribers, supporters, and voters, who remain anonymous to non-registered users" (Bertone et al., 2015; p. 5).

The method applied by Liquid Feedback provides quantitative feedback for the proposers and an overview of supporters and opposers. It also delivers information under which conditions individuals are willing to change their mind. The individual participants can click to indicate agreement or disagreement. Furthermore, the system tracks the different draft versions of a proposal and allows the user to highlight the differences between them with a simple click. This method of structured feedback arranges communication among stakeholder - the creators of a proposal and the voters. The proposers get an idea how successful a proposition will turn out to be, and what to change in order to gain more support. Likewise, voters can influence the propositions via feedback and co-creation, or instigate a new initiative with a counter proposition. Overall, the system makes use of the innovative and established Schulze Method (Schulze, 2011) voting system which allows for a winner to be selected based on preferences. This means the voter only needs to indicate what proposals and amendments he or she likes and what proposals he or she dislikes - he or she can also rank them and support more than one proposal.

Another innovative feature of the method applied by LiquidFeedback is the transitive proxy voting in which stakeholders are able to delegate (and revoke) other stakeholders to propose alternatives and vote on their behalf in specific thematic areas and/or issues in which they are particular experts (De Cindio and Stortone, 2013).

Due to the applied functions LiquidFeedback can be used as an idea-gathering tool. Furthermore, its deliberative and collaborative nature supports the fair selection of submitted proposals and enabled co-operation and co-creation (De Cindio and Stortone, 2013). Although there are other supportive tools for idea gathering (e.g. ideascale.com), several contain weaknesses in the deliberative mechanisms to boost collaboration and co-design among stakeholders (De Cindio and Stortone, 2013)

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Title of the method: **1.3 RIS3 debate at a glance**
Applicable to the RIS3 phase: **1. Governance**

Background and rationale

Engaging stakeholders represents a key task for regions and nations in the process of smart specialisation (S3) for (re)designing and implementing research and innovation strategies (RIS). Furthermore, **facilitating discussions, debates and idea generation online** among stakeholders show vital potential to facilitate the **entrepreneurial discovery process** within a region. Because of different voices with more diverse point of views, the regions' aims for involvement with questions related to how and with whom is characterized by a dynamic process (Coffano and Foray, 2014). Thus, knowledge-based policy advice can take advantage of web-based debating platforms, such as **DebateGraph (**http://debategraph.org/**)**, to enhance not only the stakeholder involvement in RIS3 but also boost entrepreneurial ideas to strengthen potential areas for S3. The main goal of this method is to increase **transparency and legitimacy of an RIS3 debate at a glance,** characterised by the intensive engagement of a diverse set of stakeholders.

RIS3 faces **challenges**, such as increasing understanding and knowledge of how regions should approach the RIS3 design, identify key patterns as well as emphasis strengths and weaknesses in the RIS3 processes. Since brainstorming and debating represent vital methods to collect information and (entrepreneurial) ideas on a predefined topic, DebateGraph represents a supportive way of viewing the **"brainstormed" information while debating**. This method and application is utilized in a group. It is accessible from everywhere by everyone – open to all relevant stakeholders for a region or nation. The method and application of DebateGraph is **cloud-based** – so accessibility is given at any time. In addition, it is user-friendly and goal oriented, since everybody can easily access and use it. If someone wants to contribute an idea to the debate, for example after a meeting, he or she can do so very easily with this web-based tool (DebateGraph, 2016).

In addition, if every aspect and idea is noted in this tool, the result presents a full information source regarding the region and its potential for specialisation. It all appears in one place, and not across various pieces of paper. Stakeholders can **share their ideas** regarding the future directions of the region. Additionally, by viewing the graphs and different maps, everyone can see what the other participants want. For instance, the stakeholders know what the authorities need and suggest, as well as vice versa. Thus, in line with the latest report by The World Bank (2016) this crowdsourcing method via debating can be used to collect data within RIS's entrepreneurial discovery process. The method and application's main idea facilitates the idea behind crowdsourcing referring to be quick, efficient and simple. As recommended by The World Bank (2016) the method encourages a culture of public–private dialogue, expands public administration's online presence, including on social media and facilitates collaboration among stakeholders.

The main goal of this method is to **visualize the ideas and opinions of different stakeholders while debating and brainstorming for sharing a RIS3 debate at a glance**. It provides the users with a powerful way to learn about, deliberate and decide on complex challenges to overcome within a region (DebateGraph, 2016).

Description of the method

To start out, a stakeholder represents an individual who impacts or is impacting actions that can be in or outside of an organisation (Yamak and Süer, 2005). The cloud-based debating method can be applied to RIS3 since everyone can be involved in the debate. The debate maps benefit from the engaged community (Gatautis, 2010). The outcome of this method shows a better overview of the specific region's potential for specialisation at an early stage of designing RIS. Moreover, because of

the permanent communication the stakeholders will feel more involved in the development and thus more committed toward the implementation.

The brainstorming and debating method applied by DebateGraph offers a way to design, discover, and understand maps of (entrepreneurial) thoughts, dialogues, and debates by using complementary and cognitively enhanced visualizations. There are different types of visualizations with different strengths and weaknesses. The views can be altered to receive different debate maps (DebateGraph, 2016). This is beneficial for different point of views.

There are also other tools that focus on debating, such as, Debate.org (2017). However, this tool does not fulfill all requested requirements for ONLINE S3. Debate.org (2017) lets people ask questions, give feedback, etc.; nevertheless, it does not provide an overview of the whole project – "a big picture" – the tool just provide bits and pieces of certain parts of the project. Similarly to CreateDebate (2017), it does not possess sufficient options with respect to intensive stakeholder engagement. CreateDebate (2017) lets people only comment and vote on topics to gain feedback and information. Overall, DebateGraph appears to be the most appropriate tool with respect to ONLINE S3's approach.

The debating method via the tool DebateGraph regarding RIS3
This method and tool can be used for argument mapping to support policy makers and stakeholders to visualize and share networks of thoughts, making their reasoning clear and open to collaborative and iterative reflection. All in all, its usage will be best for brainstorming and debating ideas for the region's potential to specialise. The visualization of all the issues, problems and ideas result up to an adequate overview of the challenges to overcome. Because of the collaborative editing features, the collective knowledge and views can be shared among the stakeholders (Gatautis, 2010). Additionally, if someone finds a gap in the graph and wants to add a new idea, that person can add this idea at any time into the map so that then everybody else can see this also (Gatautis, 2010). As a result of the various different opinions, everyone can see what the other "teams" (stakeholders, authorities, …) want and suggest. Lastly, this argument visualisation platform is free of charge (Gatautis, 2010).

To **conclude** this debating method and tool entitled DebateGraph can be used to (Gatautis, 2010):

1. create a debate map to identify challenges to overcome,
2. create positions and sub-positions of the challenges,
3. write arguments – supportive and opposing,
4. include other scenarios and manage the graphs,
5. rank the arguments and ideas,
6. label the arguments and ideas by different people/stakeholders,
7. rate the significance and merits of the problems, positions and arguments,
8. pick out the arguments that are seen as weak and strong,
9. analyse, seek and relocate arguments around the map, and
10. direct arguments to external locations.

All in all, this debating method via DebateGraph facilitates stakeholder engagement and the entrepreneurial discovery process at an early stage within S3 processes.

Usability and impact

This method and tool is rather simple to use and does not really need an instruction manual as it is **mostly self-explanatory**. Since DebateGraph is an online tool, which is managed in a web browser, the user does not have to download anything or follow any installation process. **Anyone, at any given time** can use the method and tool.

Since there are stakeholders who are likely "silent", it would be easier for them to write down the ideas rather than speaking in front of an audience. As a result, the **ideas** of the quieter and louder participants **are equal**. Also, there will be more options, due to the fact that everyone gets a chance to "speak" – in this writing and debating process.

As part of the WAVE project (Gatautis, 2010), this debating method and tool seeks to impact the debate for understanding the chosen topic, and assessing challenges and potential ideas to overcome these challenges. Especially for policy makers and stakeholders this tool will impact the relationships among involved groups. The WAVE project (Gatautis, 2010) highlights that by collecting all this information the implementation will be enhanced. In addition, by implementing the different maps of thoughts on different sites, many stakeholders will be invited to participate the debate. This possibility of stakeholder engagement at an early stage represents a high potential for impact on anticipated results. Finally, it provides a better overview of the RIS's development process.

The implementation on onlines3.eu should be straighforward, since many websites have done so before (DebateGraph, 2016). To conclude, the impact of this method and tool is expected to be high as RIS3 at a glance can been facilitated via more intensive stakeholder engagement activities taking also entrepreneurial aspects into account.

Required data

The needed data consists of user data (email address, password, first name, surname) and information regarding RIS3 (ideas, opinions, arguments, ratings, entrepreneurial ideas, etc.). By registering, one accepts the terms and conditions and the privacy policy of DebateGraph (debategraph.org/Details.aspx?nid=218195 and debategraph.org/Details.aspx?nid=65028) (DebateGraph, 2016).

Furthermore, the more users are engaged in the brainstorming and debating method at an early stage of the RIS development, the more ideas and opinions will be recorded, improved and shared, which appears to be a vital component of the entire process.

The method and tool takes advantage of links to several social media platforms. The user can share information and maps via Twitter, Facebook, GooglePlus, LinkedIn, Reddit, and StumbleUpon. Additionally, for people who do not have such accounts the maps can simple be send via email. The map can also be embedded into other website with a so-called "iframe".

Relevant data sources

The most important data source regarding DebateGraph is the "Help" tab on the DebateGraph website (http://debategraph.org/). There one can find all the information how to write an idea and how to make a poster (DebateGraph, 2016).

Also the first page of the DebateGraph website (http://debategraph.org/) is very helpful. All in all, the core information source regarding DebateGraph is its website, since it is an easy method and tool to use.

Implementation roadmap

There are also other tools that focus on debating, such as, Debate.org (2017). However, this tool does not fulfill all requested requirements for ONLINE S3. Debate.org (2017) lets people ask questions, give feedback, etc.; nevertheless, it does not provide an overview of the whole project – "a big picture" – the tool just provide bits and pieces of certain parts of the project. Similarly to CreateDebate (2017),

it does not possess sufficient options with respect to intensive stakeholder engagement. CreateDebate (2017) lets people only comment and vote on topics to gain feedback and information.

Overall, DebateGraph appears to be the most appropriate tool with respect to ONLINE S3's approach. Before the user can create a map, he or she must create a user account. The data which has to be provided consists of the first name, last name, email, and a password. The user can also add optional information such as a website URL, the city, the country, and other background information. The user will receive an email with a registration verification link. By clicking on the link the email address is verified. The registration is therefore completed. After logging in with the user data, the user can create a new map ("Map > Start a new map"). The map's data and information can be added via the button in the bottom left corner "Add idea". The user can write the ideas, arguments etc. regarding RIS and its region. After adding more and more ideas, the maps will grow. The arrows connecting the ideas and arguments can be rated between 1 and 9 - the lower the number, the thinner the line gets and vice versa for a higher number and thicker line.

For different kinds of views, the user can press on the view menu and receives a list of formats the map can be displayed in. For more information regarding the various views, please visit DebateGraph's website (http://debategraph.org/.

To share maps with stakeholders etc. there are different options (in "Share"). Firstly, the user can share the data via a link ("Share > Link") which means, that the user can, for example, send out an email with this link to colleagues. The colleagues need to have an account to view and alter the map. Secondly, the ideas can be bookmarked ("Share > Bookmark"). Thirdly, the user can embed ("Share > Embed") the map into a Compact format ("Share > Embed > Compact format") and in a full format ("Share > Embed > Full format"). The compact format is an iframe (html tag) with a smaller format than the full format. This so-called iframe can be implemented into a website. Lastly, the map can be shared via social media ("Share > Social media"), such as Facebook, Twitter, GooglePlus, Reddit, LinkedIn, and StumbleUpon. Additionally, in "Share > Social media" there is also a link to send the map via email.

Another notable feature can be found in "Views > Send email digest" which will send the user an email with the latest changes on the map. This is a supportive feature to see if something new has been written on the map.

To implement the map on the onlines3.eu platform, the iframe is necessary via the share link the code offered.

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Title of the method: 1.4 RIS3 legal and administrative framework related to ESIF
Applicable to the RIS3 phase: 1. Governance

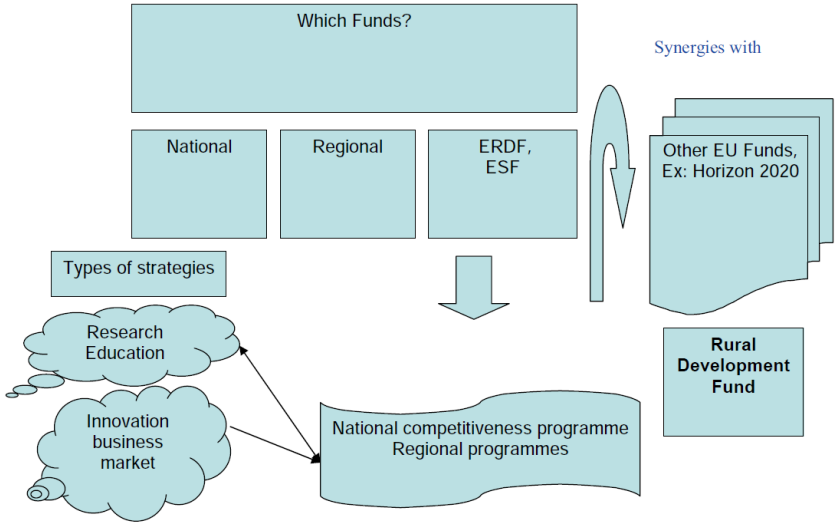
Background and rationale

Research & Innovation Strategies for Smart Specialisation (RIS3) are designed, implemented and monitored in the framework of a set of directives, regulations and communications at European Union (EU) level. The EU level acts are transposed or applied into national legal, regulatory and administrative laws, regulations and procedures. This creates a complex legal environment in which the management authorities responsible for ESIF as well as the public-private partnerships involved in RIS3 operate.

The Regulation (EU) 1301/2013 of the European Parliament and of the Council of 17 December 2013 is the legal base which defines a 'smart specialisation strategy'. ***'Smart specialisation strategy'*** *means the national or regional innovation strategies which set priorities to build competitive advantage by developing and matching research and innovation own strengths to business needs to address emerging opportunities and market developments in a coherent manner, while avoiding duplication and fragmentation of efforts. A smart specialisation strategy may take the form of, or be included in a national or regional research and innovation (R&I) strategic policy framework. Smart specialisation strategies shall be developed through involving national or regional managing authorities and stakeholders such as universities and other higher education institutions, industry and social partners in an entrepreneurial discovery process.*

The core legal acts related to RIS3 are those governing the European Structural and Investment Funds (ESIF), however, other EU level programmes and financial instruments provide complementary or related support to RIS3 and should be considered in the RIS3 policy cycle, as illustrated below.

Figure 1 Legal and financial framework of RIS3



Source: European Commission, 2012

ESIF instruments provide EU Member States with financial assistance to deliver the EU2020 strategy of Smart, Sustainable and inclusive growth, increasing economic activity and employment across the EU. The implementation of ESIF in Member States is set out in the EU Common Provisions and underpinned by other European regulations.

A national and/or regional RIS3 is an ex-ante conditionality for R&I investments under the European Regional Development Fund (ERDF) for the programming period 2014-2020. The ERDF focuses its investments on a limited number of 'thematic objectives' (TO) including Innovation and research (TO1); the digital agenda (TOX); support for small and medium-sized enterprises (TOX); and the low-carbon economy (TOX). ERDF resources allocated to these priorities depends on the category of region: in more developed regions, at least 80 % of funds must focus on at least two of these priorities; compared to at least 60% in transition regions; and 50 % in less developed regions. Furthermore, ERDF resources must be channelled specifically towards low-carbon economy projects as follows: more developed regions: 20%; transition regions: 15%; and less developed regions: 12%.

In addition to ERDF, other ESIF instruments, European Fund for Strategic Investments (EFSI), European Investment Bank (EIB), national/regional funding and private investments can be used to implement the RIS3. These include:

- European Social Fund (ESF): priorities in the field of employment, e.g. through training and life-long learning, education and social inclusion, and linking to the Youth Employment Initiative
- European Agricultural Fund for Rural Development (EAFRD): actions strengthening the links between agriculture, food production and forestry, and R&I; development of the knowledge base in rural areas
- Cohesion Fund (CF): funds priority Trans-European transport links and key environmental infrastructure projects. This has an indirect impact for RIS3 by improving location and providing opportunities for procurement of innovative solutions.
- European Investment Bank (EIB) instruments including the European Fund for Strategic Investment (EFSI) (see http://www.eib.org/efsi/what-is-efsi/index.htm).

Information on the legislative basis and secondary (implementing regulation) for other EU Funding instruments is available from the responsible directorate-generals.

In addition to legislation governing the use of the various European funds and instruments, the EU's State Aid regulations[23] provide an overarching framework on how financial support can be provided to enterprises and other organisations in the Member States.

Beyond the financial instruments, there are a set of regulations governing different legal options that impact on governance both at European and national levels. These include notably the legal forms that can be adopted by public-private partnerships, the possibility for public or academic bodies to take stakes in other private or not-for-profit entities, etc. At European or inter-regional level, partnerships can choose to adopt various legal forms such as:

- European Economic Interest Grouping (EEIG) - http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:l26015
- European Grouping of Territorial Cooperation (EGTC) – see http://ec.europa.eu/regional_policy/en/policy/cooperation/european-territorial/egtc/ and http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R1082
- European Research Infrastructure Consortium (ERIC) – in the field of research infrastructures partnerships working on European level can adopt this form. See http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009R0723.

At the current time, aside from eur-lex, the main information source on ESIF related regulation is the InfoRegio site of DG REGIO of the European Commission (http://ec.europa.eu/regional_policy/en/information/legislation/regulations/). DG REGIO has launched a wiki tool 'regiowiki' so that in addition to being able to download the full text of the

[23] http://ec.europa.eu/competition/state_aid/overview/state_aid_procedures_en.html

legislation on InfoRegio, it is now possible to alternatively log on to a specific application, which enables users to navigate through the primary legislation, secondary legislation, and guidance notes in a dynamic way. This new facility is available for English text only.

The S3 Platform[24] also has a knowledge repository but this mainly is a search tool function for publications developed by the S3 Platform itself. Various commercial sites also exist that track EU legislation often structuring the information by theme. An example is http://global.practicallaw.com/country/eu-law from ThomsonReuters.

Description of the method

This method will provide users with access to up to up to date information on legislative and related texts governing the smart specialisation design, implementation and evaluation process. The tool will provide a means of identifying, tracking and mapping (links between various legal acts, etc.) the legislation or related policy texts that provide a framework for the implementation of projects using the ESIF funds. This includes ERDF regulations and EU processes of selecting and funding projects in the framework of national / regional Operational Programmes (OPs).

Various standard tools could be used to help users access and analyse the most relevant up to date legal texts. The use of a wiki model (OnlineS3wiki) integrated with a RSS tool https://en.wikipedia.org/wiki/RSS) could be one option. Other possible tools could be include the use of webscraping (https://en.wikipedia.org/wiki/Web_scraping) methods to compile information on both European and national primary and secondary (https://en.wikipedia.org/wiki/Primary_and_secondary_legislation) legislative texts.

The possibility of developing visualisations that enable users to explore how one legislative act is linked to others (e.g. a primary legislative act and all related secondary legislation or synergies/linkages between primary legislative acts) should also be explored.

Usability and impact

The tool will enhance the understanding of RIS3 partnerships, and thereby improve governance, of the broad framework of EU legal acts, policy, decision making and where relevant case law (e.g. State Aid decisions). The impact is likely to arise from improving the timely adaptation of RIS3 to on-going legislative developments and by providing a simple, transparent, one-stop access for S3 stakeholders to all relevant legislation.

Required data

The data is of a text-based nature and relates to the collection of legislative, regulatory and administrative acts that govern the ESIF programming period, related rules concerning EIB/EIF funding, Horizon 2020, State Aid regulations.

The list of baseline legislation (non-exhaustive list at this stage) includes:

- ESIF legislation – see compilation at http://ec.europa.eu/regional_policy/en/information/legislation/regulations/
- The EFSI regulation: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.169.01.0001.01.ENG

[24] http://s3platform.jrc.ec.europa.eu/knowledge-repository

- State Aid legislation: http://ec.europa.eu/competition/state_aid/regional_aid/regional_aid.html (regional aid) and http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C:2014:198:TOC (R&D and innovation aid).

Relevant data sources

- The eur-lex database compiles all European legislative texts: http://eur-lex.europa.eu including those related to Structural Funds and other funding instruments

- The European Council website has a database of legislative acts under 'codecision' procedure: http://www.consilium.europa.eu/en/documents-publications/ordinary-legislative-procedure/

- The WikiRegio site covers both primary and secondary legislation relevant for ESIF: https://webgate.ec.europa.eu/esiflegislation/

- The publication on synergies between ESIF and other funds is also a useful basis for developing this method: http://ec.europa.eu/regional_policy/sources/wikiguidance/gn0098_guide_on_synergies_en.pdf

Implementation roadmap

To develop and elaborate this method and a relevant tool or set of tools, the following steps will be required:

1. Scope further the existing public and commercial legislative databases and examine the structure and content of these websites and the extent to which they can serve as sources for an S3 legislative mapping and analysis tool
2. Interview/consult with users (e.g. management authorities, RIS3 managers, etc.) in selected Member States to further understand the need for and the type of information required related to the legislative framework for RIS3
3. Examine the comparative advantages of developing a new tool or adding in material and legislative data/information to existing sites.

References

European Commission (2012) Guide to Research and Innovation Strategies for Smart Specialisations (RIS3).

Title of the method: **2.1 Regional assets mapping**
Applicable to the RIS3 phase: **2. Analysis of regional/national context**

Background and rationale

This method and online dashboard puts together information on key regional assets. The objective is to support data transparency that enables gap analysis in relation to regional assets. It works as a dynamic library that includes a short description of each of the assets (e.g. research services, equipment, etc.) and service portfolio documentation. It could also include details on scientific identification and scientific description, access and use, scientific activities, collaborations, human resources and training, data policies, impact, innovation, costs and funding.

Regional profiling is the most prevailing RIS3 method applied essentially by all regions, but with varying degrees of sophistication. Generally, regions use a variety of sources to map out a comprehensive 'picture' of regional assets. Integrating all relevant sources into a web-based dashboard could help RIS3 stakeholders to access basic information in a quick manner.

Description of the method

Regional policies aimed at promoting knowledge-driven growth and development and RIS3 in particular, should be underpinned by a thorough understanding of the regional economic structure and competitive position of the economy in the national and international context (Gianelle et al., 2014). In this regard, according to the Guide to Research and Innovation Strategies for Smart Specialisation (onwards 'RIS3 Guide'), *"RIS3 needs to be based on a sound analysis of the regional economy, society, and innovation structure, aiming at assessing both existing assets. […] The analysis should cover […] regional assets, such as technological infrastructures"* (Foray et al., 2012).

In terms of definition, regional profiling and assets mapping refers to *"the set of analyses that should be implemented and the associated evidence that should be collected in order to construct a source of knowledge to inform strategic choices and actions" (Gianelle et al., 2014)*. Profiling indicators could be defined as *"the set of statistical indicators covering demographic, socio-economic, institutional and connectivity features of territories with the purpose of shaping the relevant characteristics of regional economies in terms of smart growth"* (Martínez, 2013).

In the RIS3 Guide it is made clear that, although the assessment of existing regional assets implies looking 'inside' the region, for the development of a substantial smart specialisation strategy, it is essential to also gauge its position relative to other EU regions, for the purposes of maximizing complementarities, transferring know-how and avoiding 'blind' investments' duplication. This implies that the RIS3 approach requires looking beyond the regional administrative boundaries, accounting for the external context (national and international), paying attention to inter-regional and international cooperation in innovation policies and ultimately keeping a focus on what kinds of inter-regional cooperation frameworks can be established with the goal of enhancing regions' ability to compete in the global economy (Foray et al., 2012, Gianelle et al., 2014).

Regarding the application of the Regional Mapping method, from the RIS3 literature we extract the following principles:

- Mapping/Profiling indicators should be used in a way that adds constructive insights about the determination of niches of competitive advantages, rather than simply describing the current state of innovation (Martínez, 2013)
- Mapping/Profiling indicators need to be selected having in mind that they should be able to be used as monitoring and evaluation indicators, too; hence they should use information that is constantly monitored and is routinely made available across a maximum number of regions
- The sum of necessary information to build a regional assets profile includes numerical (quantitative) indicators, categorical/ordinal (qualitative) indicators, as well as qualitative descriptive data that

altogether map the general assets profile of the Region. Examples of descriptive data include institutional components, such as the number and features of knowledge-based organisations (universities, research centres, etc.) within the region.

A number of researchers have developed more advanced methods that can be used in a Regional Mapping/Profiling exercise. Kroll et al. (2011), for example, developed an advanced methodology for the profiling of regional economies. Beginning with a large set of regional economy indicators, the authors performed a factor analysis to reduce them to a final set of recommended indicators which capture the most important regional characteristics.

Usability and impact

The profiling or baseline indicators that are used in RIS3 development are especially important, because they establish both the features of the regional economy which are relevant to the policy decision-making process and also the baselines from which any subsequent policy interventions will be evaluated (Nauwelaers et al., 2015). Regional Mapping, being the very first exercise to take place in the context of the development of a RIS3 strategy, sets the tone upon which the succeeding methods and applications will unfold. Hence it should be comprehensive and integrated enough to provide food for thought regarding the Benchmarking, Related Variety, SWOT and other analyses to follow. For the Regional Mapping method that will be developed for ONLINE S3, all of the above imply that we need to account for data and indicators that are measurable and available –and hence comparable- across the maximum possible number of Regions.

Required data

In examining the actual use of indicators in a random sample of eight existing S3, we observed the usage of indicators and qualitative information in the following categories: Table 1 Categories of used indicators in a sample of eight RIS3 (author's elaboration)

Region	Category					
	Geography	Demography & Society	Economy & Labour	Sectoral structure	Business Characteristics	Innovation System
Oulu, FI			X	X		
South Ostrobothnia, FI	X	X	X	X	X	X
Luxemburg, LU			X	X		X
Northern Netherlands, NL		X	X	X		X
Western Netherlands, NL			X			X
Estonia, EE			X			X
Flanders, BE			X			X
Galicia, ES		X	X		X	

Information and indicators related to the regional economy and labour, as well as indicators about the regional innovation system are considered essential. Information about the regional demography and economic sectorial structure are also common. Less common are indicators related to the local characteristics of businesses and the business sector in general, as well as regional geography.

From the above analysis, we consider the following key areas of interest relevant to the Regional Mapping exercise:

- **Geography:** They point to the indicators that reflect the basic regional characteristics that are essential to develop a region's profile; they are also determining factors in terms of regional attractiveness (Kroll et al., 2011). They hint to the existing regional assets that can be used as a basis for promoting smart growth (Martínez, 2013). They also provide evidence on the connectivity potential of the region, due its current geomorphology, administrative boundaries and major built structures.

- **Demography and Society:** Population characteristics and density are determining factors for regional growth (McGuire, 2013). They point to the indicators that reflect the basic regional characteristics that are essential to develop a region's profile (Kroll et al., 2011).
- **Economy and Labour:** Baseline indicators for economic specialisation are essential in profiling a region (OECD, 2013). Labour force mobilization and employment indicators are important innovation-related factors, contributing to regional growth. Human capital and skills, such as education, for example, are also important (McGuire, 2013). They point to the indicators that reflect the basic regional characteristics that are essential to develop a region's profile (Kroll et al., 2011).
- **Sectoral structure:** Provides information on the intensity of the service-based economy, and the rate of the de-industrialisation of the region.
- **Business Characteristics:** Provides information on regional entrepreneurial activity, especially activity that is related to the birth of innovation ideas, and whether and how they are converted into profitable businesses (Martínez, 2013). They point to the indicators that reflect the basic regional characteristics that are essential to develop a region's profile (Kroll et al., 2011).
- **Innovation System:** Baseline indicators for science and technology are essential in profiling a region (OECD, 2013). Technological infrastructures and regional assets related to regional innovation are key (Foray et al., 2012). Profiling indicators must provide information on the intensity of regional entrepreneurial activity, especially those related to the birth of innovation ideas and how they are converted into profitable businesses (Martínez, 2013). They point to the indicators that reflect the basic regional characteristics that are essential to develop a region's profile (Kroll et al., 2011). Each of the above areas are analysed further into indicators that could serve the Regional mapping exercise, provided in the tables at the end of this section.

Nevertheless, one should keep in mind that all regions have specific characteristics that render them unique. These characteristics may call for special handling and techniques. Low-density regions are a characteristic example of the sort; some useful implications for the design of RIS3 in low-density regions are mentioned by McGuire (2013).

In our case, we will focus on the core areas of interest to the Regional Mapping method and the most representative indicators within them, so that we provide a broadly applicable tool. The indicators with respect to each area are included in the following tables:

1. Geography			
Sub-category	**Variable Name**	**Recency**	**Link**
1.1 Typology (NUTS3)	Urban-rural including remoteness	2015	http://ec.europa.eu/eurostat/statistics-explained/index.php/Regional_typologies_overview
	Metro Region	2015	http://ec.europa.eu/eurostat/statistics-explained/index.php/Regional_typologies_overview
	Border Region	2015	http://ec.europa.eu/eurostat/statistics-explained/index.php/Regional_typologies_overview
	Mountain Region	2015	http://ec.europa.eu/eurostat/statistics-explained/index.php/Regional_typologies_overview
	Island Region	2015	http://ec.europa.eu/eurostat/statistics-explained/index.php/Regional_typologies_overview
	Sparsely-populated Region	2015	http://ec.europa.eu/eurostat/statistics-explained/index.php/Regional_typologies_overview
1.2 Major infrastructure	Air Transport: Major commercial airports	-	
	Air Transport:	2013	http://ec.europa.eu/eurostat/web/transport/data/database

	Passengers carried per annum		
	Maritime transport of passengers	2013	http://ec.europa.eu/eurostat/web/transport/data/database
	Maritime transport of freight	2013	http://ec.europa.eu/eurostat/web/transport/data/database

2. Demography and Society			
Sub-category	**Variable Name**	**Recency**	**Link**
2.1 Population Size and dynamism	Total Population	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Population aged 20-34 years	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Population aged > 65 years	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Crude rates of natural change of population	2014	http://ec.europa.eu/eurostat/web/population-demography-migration-projections/population-data/main-tables
	Dependency Ratio, Elderly (% 65+ over population 15-64)	2014	http://stats.oecd.org/Index.aspx?datasetcode=REG_DEMO_TL2
2.2 Education	Population completed tertiary education	2015	http://ec.europa.eu/eurostat/web/regions/data/database

3. Economy and Labour			
Sub-category	**Variable Name**	**Recency**	**Link**
3.1 Economy	Gross Domestic Product (GDP)	2014	http://ec.europa.eu/eurostat/web/regions/data/database
	Gross value added	2014	http://ec.europa.eu/eurostat/web/regions/data/database
3.2 Labour	Economically active population	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Employment	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Unemployment	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Growth rate of employment (%)	2014	http://ec.europa.eu/eurostat/web/regions/data/database
	Human resources in science and technology (HRST)	2015	http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database
	Employment in medium-high and high tech manufacturing and knowledge-intensive services as percentage of total employment	2014	manually from http://ec.europa.eu/DocsRoom/documents/17824

4. Sectoral structure			
Sub-category	**Variable Name**	**Recency**	**Link**
4.1 Agricultural Statistics	Agriculture (A-Div.01), Production value at basic price	2014	http://ec.europa.eu/eurostat/web/agriculture/data/database
4.2 Structural Business Statistics	Mining and quarrying (B), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Mining and quarrying (B), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Manufacturing (C), Number of persons	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database

	employed		
	Manufacturing (C), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Electricity, gas, steam and air conditioning supply (D), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Electricity, gas, steam and air conditioning supply (D), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Water supply; sewerage, waste management and remediation activities (E), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Water supply; sewerage, waste management and remediation activities (E), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Construction (F), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Construction (F), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Wholesale and retail trade; repair of motor vehicles and motorcycles (G), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Wholesale and retail trade; repair of motor vehicles and motorcycles (G), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Transportation and storage (H), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Transportation and storage (H), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Accommodation and food service activities (I), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Accommodation and food service activities (I), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Information and communication (J), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Information and communication (J), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Financial and insurance activities (K), Number	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database

	of persons employed		
	Financial and insurance activities (K), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Real estate activities (L), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Real estate activities (L), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Professional, scientific and technical activities (M), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Professional, scientific and technical activities (M), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Administrative and support service activities (N), Number of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Administrative and support service activities (N), Number of local units	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database

5. Business Characteristics			
Sub-category	**Variable Name**	**Recency**	**Link**
5.1 Enterprise demography	Population of active enterprises	2013	http://ec.europa.eu/eurostat/web/regions/data/database
	Number of employees in the population of active enterprises	2013	http://ec.europa.eu/eurostat/web/regions/data/database
	Avergage company size: "Number of employees in the population of active enterprises" divided by "Population of active enterprises"	2013	
	Net business population growth	2013	http://ec.europa.eu/eurostat/web/regions/data/database
5.2 High growth and innovating enterprises	Number of high growth enterprises measured in employment (growth by 10% or more)	2013	http://ec.europa.eu/eurostat/web/regions/data/database
	SMEs introducing product or process innovations as percentage of SMEs	2015	http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey
	SMEs introducing marketing/organisational innovations as percentage of SMEs	2015	http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

6. Innovation System			
Sub-category	**Variable Name**	**Recency**	**Link**
6.1 Critical	Knowledge	-	

Institutions	Organisations (Universities, Research centers etc)		
6.2 R&D	Human resources in science and technology	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Employment in high-tech sectors	2015	http://ec.europa.eu/eurostat/web/regions/data/database
	Total intramural R&D expenditure	2013	http://ec.europa.eu/eurostat/web/regions/data/database
	Researchers, all sectors	2013	http://ec.europa.eu/eurostat/web/regions/data/database
6.3 Patents	PCT Patent Applications	2011	http://stats.oecd.org/Index.aspx?datasetcode=REG_DEMO_TL2
	Patent applications to the European patent office	2012	http://ec.europa.eu/eurostat/web/regions/data/database
	High-tech patent applications to the European patent office	2012	http://ec.europa.eu/eurostat/web/regions/data/database

Relevant data sources

For the appointment of the most relevant indicators within selected sections (see Step 2 below), data needs come down to the indicators that are required to describe a region's (i) Geography, (ii) Demography & Society, (iii) Economy & Labour, (iv) Sectoral structure, (v) Business Characteristics and (vi) Innovation System (NUTSII level). The foremost data sources include:

1. Eurostat's Regional Statistics indicators (http://ec.europa.eu/eurostat/web/regions/data/database)
2. the Regional Innovation Scoreboard 2016 indicators (http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en)
3. the Regional Demographics Statistics of OECD (http://stats.oecd.org/Index.aspx?datasetcode=REG_DEMO_TL2)

For the description and explanation of results (see Step 3 below), data needs are region-specific. Potential sources of information include policy documents and other literature sources, as well as consultation with key persons, which will help the RIS3 designer to assess the analytical results of Step 2 and reach sensible and cohesive conclusions.

Implementation roadmap

Step 1. Appointment of most relevant sections among the sections (i) Geography, (ii) Demography & Society, (iii) Economy & Labour, (iv) Sectoral structure, (v) Business Characteristics and (vi) Innovation System.
Remarks:

- It is advised to use as many sections as possible –if possible, all of them- in order to get the most complete view of the regional assets profile
- At least sections (iii) Economy & Labour, and (vi) Innovation System should be selected, as they are by definition the most relevant to RIS3.

Step 2. Appointment of most relevant indicators within selected sections. The Regional Mapping tool of Online-S3 offers the capability to select a subset from approximately 100 indicators across all sections. In creating the regional assets profile, one will be called to select the most relevant ones, depending on the strategic priorities of the RIS3 (if they have been already set) and the particular characteristics, strengths and weaknesses of the region. The Regional Mapping tool will provide the results with respect to the selected indicators.
Remarks:

- the appointment of indicators also depends on data availability (some indicators may not be available for all regions)

- although the majority of indicators are quantitative, some of them are qualitative.

Step 3. Description and explanation of results. Building on the results related to the indicators, the RIS3 developer will be called on to provide qualitative and quantitative explanatory information, for example in identifying major strengths and weaknesses or explaining major indicator fluctuations across years in combination with policy decisions or major economic events. Descriptions and explanations may either regard each section individually or several section at a time.
Remarks:

- this step requires critical thinking and interpretation on the side of the RIS3 developer
- this step may require research in literature, policy documents and databases in order to interpret the results.

Step 4. Regional Profile Overview. Using the results of steps 2 and 3, the RIS3 developer will be called on to provide an overview of the region's profile. In doing so, they will combine the collected and worked out information about the region, and point strengths and weaknesses with regards to the profile.
Remarks:

- this step requires critical thinking and interpretation on the side of the RIS3 developer

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Title of the method: 2.2 Research infrastructure mapping
Applicable to the RIS3 phase: 2. Analysis of context

Background and rationale

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. Four types of RI are commonly distinguished: 1) single-site facilities; 2) distributed facilities; 3) mobile facilities; and 4) virtual facilities.

While RIs are designed for research needs, the impacts of these facilities reach beyond fuelling scientific excellence. The advanced technical opportunities, and the concentration of skilled human capital and know-how can foster innovation, create new or expand the existing markets, attract inward investment, increase economic activity and potentially have an impact on the social and cultural life in a particular region. In this regard RIs can be viewed as focal points for continuous interaction between scientific, technological and socio-economic development (Rizzuto, 2012).

RIs have a prominent place in the advancement of the European Research Area and aim to make a significant contribution towards boosting European research and innovation potential. The development of pan-European RI and their regional partner facilities is considered an important driver for knowledge-based growth in Europe (Quintana, 2013). RIs are also directly related to European technological competitiveness since construction, upgrades, maintenance of infrastructures and instrumentation require involvement and boost of the most advanced industries that can become niche market leaders at global level (ESFRI Roadmap, 2016).

ESFRI, the European Strategy Forum on Research Infrastructures, was initiated in 2002 to support a coherent and strategy-led approach to policy-making on RI in Europe, and to facilitate better use and development of RI, at EU and international level. Under the ESFRI initiative EU Member States have been urged to develop national RI roadmaps as vital blueprints which allow countries to set national priorities and to earmark funds for their development and participation in pan-European RI activities.

Due to their impact on the economy, the Commission expects significant investment in RI from the funds of the new Structural Funds programming period (Quintana, 2013). National and regional authorities across Europe are required to draw up their RIS3 and include the ESFRI related RI and/or other facilities with a regional or national relevance, so that the EU's Structural Funds can be used more efficiently. The risk of duplication of R&D efforts is very costly within a context where resources to invest in highly innovative technologies are limited.
In order to include RIs in RIS3, the prerequisite is to envision a clear logic in how supported RIs will stimulate research and innovation as key instrument for regional development. Business involvement in the use of RI hence becomes a more prominent issue. It is expected that this approach of using synergies of ESIF and other funding sources “will reinforce the capacity of less favoured regions to host and participate in RI of pan-European and international interest” (Righi-Steele, 2013).
Countries that have applied RI mapping in RIS3 development include Austria and Hungary. Austria launched a RI inventory survey to support its prioritisation and policy mix design phase. Hungary has implemented a comprehensive National Research Infrastructure Survey and Roadmap project already in 2011 independently from the smart specialisation process. This work resulted in a database that identifies the infrastructures of high importance for Hungary in each scientific discipline. Using this background work a designated RI Working Group compiled a shorter RI priority list that was used as input material to RIS3. Data have been requested from the domestic stakeholders also regarding respective foreign research infrastructures seen as strategic for RIS3 design.

Description of the method

In order to include specific research infrastructures as part of RIS3, the businesses, researchers and policy makers have to identify the need for such RI in the region and consider the expected impact of RI on the regional economy. Issues such as links with local industries, potential for generating spin-offs and the capacity to form clusters around RIs should be explored and analysed in detail. It is also vital to identify whether similar research facilities already exist elsewhere and if so, if they are accessible and affordable for regional researchers and businesses. This aspect is of particular importance given the aim of avoiding duplication and redundancies in the use of EU Structural Funds.

A comprehensive and up-to-date mapping of the existing and planned research infrastructures across the EU regions will provide basic background information for regional policy makers in their RIS3 process. Since there is a large variety of instrumentation, the database should include only those RI that are of pan-European and pan-regional significance, meaning that they are selected as strategic in terms of size and uniqueness, and provide open access services to users from other regions/countries.

Taking into account the fact that setting-up or upgrading RI usually requires a considerable level of financial investment and a long-term operation strategy, it is equally important to provide policy makers access to information about European research facilities that are in construction/development or investment planning phase. Data on international H2020 and FP7 projects that have addressed/are addressing RI development should be well accessible and provide information about the available facilities and their location and transnational access opportunities.

During RIS3 contextual analysis policy makers can use this mapping information to determine how the current research facilities available in the region benchmark against those of neighbouring regions and how unique the regional RI equipment is on the European scale. This information can feed into the analysis of the existing research potential. Further mapping information can be exploited at priority setting and policy mix design stage assessing the need and feasibility for new RI investment, as well as calculating opportunity cost in the case of non-investment.

Usability and impact

The use of research infrastructure mapping would lead 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 would enhance and optimise 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 would help making strategic choices and support a coherent and strategy-led approach to RDI competence development in European Research Area.

Required data

Data requirements for including RI mapping approach in RIS3 process include:

- Inventory of existing RIs in all European countries categorised by:
    1. Country
    2) Type of RI
    3) Scientific domain
    4) Societal challenge addressed

Each enlisted facility should include information on:

1) Hosting organisation and RI location

2) Short description of the facility and the available equipment
3) Open access status
4) List of provided services and pricing, where available
5) Average number of users per year (national, European, international) and average rate of usage, where available
6) Keywords for identifying the facility in general search option.

- A database of supported RI projects under H2020 and FP7

- Overview of prioritised ESFRI level RI categorised by scientific domain and societal challenge addressed

- Data on planned ESIF investments in RI development

Relevant data sources

1. **ESF MERIL database** (Mapping of the European RI landscape): http://www.esfri.eu/maps-ris

The MERIL portal provides access to an inventory of openly accessible research infrastructures (RIs) of more-than-national relevance in Europe across all scientific domains. RIs included in the database have been evaluated through a national or European process on the basis of commonly agreed criteria and recognised as being of the highest standards and relevance to research in Europe. Inclusion in the database is thus a label of quality. One of the main goals of MERIL is to allow policy-makers to assess the state of RIs throughout Europe to pinpoint gaps or duplications and make decisions about where best to direct funding, therefore it can be considered a policy-making tool.

2. **RIs Observatory:** http://observatory.rich2020.eu/rich/

The Observatory is a single access point to all information on H2020 and FP7 projects related to RI development. The National Contact Points for H2020-RI programme gather, organise and provide access to information on RI projects, their transnational access opportunities, policy issues, stakeholders, national and regional initiatives on RIs, etc. The information covers all countries and all thematic fields.

3. **The European eInfrastructures observatory**: http://www.enventory.eu/

Enventory is an on-line platform, offering several interactive and user-driven visualisation tools and an extensive set of benchmarking indicators to facilitate multidimensional and polymorphic monitoring/analysis, support fact-based policy/learning and disseminate achievements of electronic and digital infrastructures in Europe.

4. **ESFRI Roadmap 2016**: http://www.esfri.eu/roadmap-2016

The updated roadmap includes six new pan-European RIs in addition to the 15 ongoing RI projects identified in earlier years. The online document provides information on all 21 ESFRI projects, comprising both distributed and single-sited facilities across all domains of science. ESFRI documents also include separate in-depth publications on networks of RI in Life Sciences, Environmental Sciences, Materials and Analytical Facilities, Physics and Astronomy, Social Sciences and Humanities, Energy and Engineering.

Implementation roadmap

In order to create an online service for mapping of RI as part of RIS3 process it would be necessary to:

- Explore all technical details of the current RI inventories that exist at the European level and determine how comprehensive and granular is the information gathered under these initiatives

- Develop concise online guidance material that explains how best to exploit RI mapping for RIS3 development
- Explore whether there is a need for any data linking and extra visualisation options or links to the existing databases can simply be embedded as part of the developed guidance material.

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Title of the method: 2.3 Clusters, incubators, and innovation ecosystem mapping
Applicable to the RIS3 phase: 2.3 Analysis of context

Background and rationale

Over the last thirty years the study of regional innovation systems has been one of the most prolific areas of economic thought. Economic studies have progressively acknowledged the territorial dimension of industrial development and technological innovation shifting the focus from the national to the regional and local dimension (Muscio, 2005).

Great emphasis has been put on "bottom-up" processes of economic development, such as on the conditions generating geographical clusters of innovative firms and research centres, and on the impact of incubating facilities on regional capacities to create innovative start-ups. Central to the argument in favour of cluster development is the concept of knowledge spillovers, which are a fundamental source of innovation (Baptista and Swann, 1998). The ease with which knowledge is communicated at the local level has been proposed as a general explanation for the existence of clusters and for their sustained economic success (Malmberg and Maskell, 1997; Maskell, 2001). Clusters often entail strong interactions between several actors systematically engaged in interactive learning (Asheim and Isaksen, 2002; Cooke, 1998; Morgan, 1997) and benefit from knowledge externalities of local research centres, which are usually engaged in continuously renewing the local innovation ecosystem.

The economic relevance of clusters in several countries has stressed how local policies can play a key role in fostering learning processes. Local innovation policy initiatives can support technological cooperation, the creation of business networks, business incubation and start-up, staff training and, thanks to the exploitation of agglomeration economies, the identification of collective needs, common opportunities and promote collective action.
European policy has long acknowledged the importance of clusters and the need for nourishing innovation ecosystem for the purpose of regional development and competitiveness. Several European regions and countries have in the past promoted two programming periods initiatives in the area cluster development. In terms of theoretical framing, these initiatives can be roughly framed in two bodies of thought: regional economics and economics of innovation. Although the overlapping between these two areas is frequent (Muscio, 2006), while initiatives appealing to the first framework see the promotion and strengthening of geographical agglomeration of SMEs in all manufacturing sectors, the latter type promotes technological bottom-up processes, kick-started by research and support institutions (TTOs, incubators, etc.). Accordingly, the RIS Guide (EU, 2012) sets as one of the four key leading elements (four 'Cs') of a RIS3 design process, which can help in defining the novelties introduced by smart strategies when compared to past experiences, the area of "Connectivity and clusters". The EU invites regions to: "develop world class clusters and provide arenas for related variety/cross-sector links internally in the region and externally, which drive specialised technological diversification".

Description of the method

Most existing clusters are market-driven phenomena. They emerge without the help of specific policy, as a result either of the spontaneous accumulation of competitive advantage or simply by chance. However, evidence of their positive impact on regional performance has attracted policy-makers and led to formulation of cluster policies to foster or replicate their development (Oxera, 2005).

Since the resurgence of local development models, almost every country in Europe has adopted specific strategies for cluster development (Council on Competitiveness, 2007; European Commission, 2008b; OECD, 1999). The EU, while encouraging Member States and regions to promote strong

clusters as part of their economic reform strategies,[25] has revised the State aid framework allowing certain targeted support measures for cluster development,[26] and has launched a series of initiatives to improve cluster policies, favour trans-national networks, promote the excellence of cluster organisations, and improve the integration of innovative SMEs into clusters (European Commission, 2008a). To understand the similarities and differences among these policies we need to consider a variety of features. First, if we define a cluster initiative as all the practical (conscious) cluster strengthening actions taken by private business, public bodies and academic institutions within a regional and sectoral system (Solvell et. al., 2003), not all cluster initiatives are necessarily based on a formulated cluster policy.[27] Actual cluster policies differ primarily in their scope. They include framework policies and specific cluster programmes. While the former sets general political objectives through publication of strategic policy documents (i.e., White Papers), the latter allocates funding and organisational responsibilities and defines specific rules for participation in the programme.[28]

The empirical literature on clusters and, more generally speaking, innovation ecosystems, targets:

1) the performance analysis of whole productive systems which often specialise in advanced manufacturing sectors (aerospace, biotechnology, high tech, etc.), where the main actors are large groups of medium and large enterprises, as well as groups of small firms;
2) the performance analysis of research systems and intermediate institutions.

In the last 20 years we have witnessed an important development of infrastructures created to assist the formation and development of new high-tech ventures (incubators, techno-poles, science parks and so on) and/or manage clusters. Economics and management literature on the topic has tended to focus on the determinants of human capital (HC) (e.g. entrepreneurial capacity development in founding teams) and of financial capital (formal and informal networking assets) (Hackett and Dilts, 2004), paying less attention the importance and the development of relational capital and in the role played by incubators.

Systematic efforts in establishing and cementing links between local universities and businesses combined with other factors, such as support for technology transfer, early financial and technical support for new ventures is regarded as central to the development of clusters (Saxenian, 1996). In this respect, relational and cultural components are important for developing intensive science and technology intensive clusters, but it is difficult to exploit and measure these elements (Lazzeroni, 2010). It follows that cluster monitoring has generally focused on quantitative business indicators. In fact, the analysis and measurement of the internal and external relations of a cluster often requires specific case studies (see Saxenian, 1996; Bresnahan and Gambardella, 2004). According to this, the RIS3 Guide (EC, 2012) identifies cluster case-studies among the several methods that can be used to support the identification of potential niches for smart specialisation. The EC encourages the preparation of 'Cluster' in-depth qualitative case studies on activity domains where a region shows relative specialisation.

[25] See Community Strategic Guidelines on Cohesion for the period 2007-2013.

[26] In the Community framework for State aid for research and innovation (C 2006/C 323/1) section 5.8, Aid for innovation clusters' lays down specific rules for investment aid and operating aid to promote clusters.

[27] In 2005 more than 1,400 cluster initiatives around the world were identified, implemented mainly through a bottom-up approach and managed by specialist cluster organizations (Ketels et al., 2006).

[28] Cluster policies can be distinguished according to their policy objectives: facilitating policies which target the elements of the microeconomic business environment to increase the likelihood of clusters emerging; traditional framework policies which use the cluster approach to increase the efficiency of specific instrument such as industry and SME policies, research and innovation policies, and regional policy; development policies, aimed at creating or strengthening a particular cluster (European Commission, 2008a). Only the last ones can be defined as real cluster policies (See also Landabaso and Rosenfeld, 2009).

A report developed since the late 1980s from Oxford Research covering 150 cluster programmes in 31 European countries, identifies a series of characteristics that might identify a cluster programme (Oxford Research, 2008). They include geographic coverage, policy area in focus, cluster lifestyle orientation, target groups, attention to SMEs and R&D, modality of selection, source of funding, type of support, and features of the cluster organization. Policies can be designed and implemented at local, regional or national level, with national programmes generally having a wider focus. Geographic coverage and also authority (responsibility for implementing the policy) vary.

Cluster policies are designed mainly to promote innovation. In their policy sector focus, nearly half of European cluster programmes are related to industry and enterprise policy or science and technology policy and only one in four programmes is related to regional policy. All European cluster programmes are aimed at private businesses, with a particular focus on SMEs. The other major target group is research institutions and most cluster policies include measures supporting R&D. Finally, although cluster programmes do not always focus on clusters in a particular lifecycle, around half are aimed at emerging and embryonic clusters, which tend to be the most innovative.

As stressed in the analysis of mapping RIS3 methodologies, around one third of the reviewed regions have **set up a dedicated networking/cluster platforms** to drive/support RIS3 governance. Equally, also almost one third of the mapped regions have used online stakeholder forums and discussion boards in the RIS3 design process. Clusters and other organised interest groups have been included in stakeholder consultation workshops by almost 80% of all mapped regions. Among the online tools employed, various EU level and international platforms are mentioned, including Business Innovation Observatory, European Cluster Excellence Scoreboard, Global Innovation Index, Global Competitiveness Index. Austrian and German regions in particular have made use of their cluster platforms in the RIS3 design process.

In several cases the selection process is top-down, being the outcome of specifically targeted regional and national policy initiatives. However, most often the selection and definition process is bottom-up oriented. Not all clusters involve a managing organisation, and sometimes businesses simply rely on the managing efforts of local industry associations. Overall, cluster monitoring and data collection is easier in those cases where a managing organisation is present. However, quite often, endogenous clusters (i.e. those clusters generated by pure bottom-up development processes) lack these kinds of organisations. While quantitative data still represent the best part of information used to monitor clusters, little attention has been paid to social aspects, mostly because of the difficulties in collecting reliable data. Social aspects are key, not just in monitoring the intensity of “co-opetition” at the local level, but also to determine the durability, the leveraging of resources and the overall impact of eventual cluster initiatives. In fact, as suggested by Schmiedeberg (2010) and Giuliani and Pietrobelli (2011), a cluster can be conceived as a social network of vertices (cluster members) and edges (relations among cluster members) and social network analysis is recommended (Wassermann and Faust, 1994) to evaluate clusters.

Usability and impact

The use of cluster and incubator mapping tools would lead to a better definition of those niches in which regions have a competitive advantage, and a better definition of local business needs. This would allow 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.

Support for clusters and for the creation of innovative eco-systems is an important element of innovation policy with an increasing number of national and regional plans promoting not just cluster creation and support schemes but also R&D projects in collaborative networks. This is promoting a need to monitor and assess clusters and the effectiveness and efficiency of these policies. Several methods and techniques have been proposed, but standardised approaches have not yet emerged.

While there is large availability of quantitative indicators in the literature, recent publications have highlighted the importance of non-economic effects and their measurement. A comprehensive information base about clusters in Europe is key in:

- identifying the key performers in specific sectors and technologies
- enhancing and optimising the demand for targeted technological innovation
- promoting research partnerships between European clusters in European-funded research schemes such as Horizon2020
- improving access to scientists and innovation developers
- easing the process of innovation diffusion and tackling societal challenges.

Required data

Data requirements for including clusters, incubators, and innovation ecosystem mapping approach in RIS3 process include:
Inventory of existing clusters in all European countries categorised by:

1. Country
2. Type of innovation eco-system (industrial cluster? Technological district? Research-based innovation hotspot?)
3. Type of products/industry/technology
4. Scientific domain
5. Availability of a managing organisation, and type of governance
6. Each enlisted cluster should include information on:
7. Location, size (e.g. n. businesses), geographical diffusion (highly clustered? Region-based clusters?)
8. Industrial sector/s of specialisation
9. Hosting organisation
10. Economic, research and innovation indicators (e.g. patents, case-study material)
11. Relevant recent changes in the local R&I system (e.g. creation of competence centres, incubation facilities, etc.)
12. Availability of complementary research institutions and their specialisation
13. Short description of the facility and the available equipment
14. Average number of users per year (national, European, international) and average rate of usage, where available
15. A database of participation in RI projects under H2020 and FP7
16. Information about ongoing (regional and national) support policy schemes.

Relevant data sources

- **EU Cluster Portal:** https://ec.europa.eu/growth/smes/cluster_en

The EU Cluster Portal provides tools and information on key European initiatives, actions and events for clusters and their SMEs with the aim of creating more world-class clusters across the EU.

- **European Cluster Observatory:** http://www.clusterobservatory.eu/index.html

The European Cluster Observatory provides information, mapping tools and analysis of EU clusters and cluster policy. It also informs about events and activities for clusters.

- **Community Innovation Survey:**
  http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

The CIS is a survey of innovation activity in enterprises. The harmonised survey is designed to provide information on the innovativeness of sectors by type of enterprises, on the different types of innovation and on various aspects of the development of an innovation, such as the objectives, the sources of information, the public funding, the innovation expenditures etc. The CIS provides statistics broken down by countries, type of innovators, economic activities and size classes. Appropriate geographical classification of data can provide useful information on technological specialisation of clusters and their innovation performance.

- **PATSTAT:**
  https://www.epo.org/searching-for-patents/business/patstat.html#tab1

PATSTAT contains bibliographical and legal status patent data from leading industrialised and developing countries. This is extracted from the EPO's databases and is provided as raw data or online.

- **RED Database:**
  http://ismerieuropa.com/en/

The Red database was developed and is constantly updated by Ismeri Europa. The database contains regionalised (NUTS2) information on FP7 project budgets, type and name of partner organisations involved, geographical location of partners and key research areas and technologies developed through the projects. As FP7 projects are classified by CORDIS by call, Ismeri developed a classification of some 150 enabling technologies promoted by the FPs with the support of a peer review process led by experts in each technology field.

- **Ad-hoc qualitative surveys**

Survey data remains the most appropriate source of information on contexts such as clusters, which rely heavily on social capital and intangible assets.

Implementation roadmap

In order to create an online service for mapping of RI as part of RIS3 process it would be necessary:

- Identify regional and national clusters with the support of national stakeholders
- Explore all technical details of the data currently available at the European level and determine how comprehensive and granular is the information gathered in the databases listed above
- Develop appropriate statistical matching tools
- Develop concise online guidance material that explains how best to exploit cluster mapping for RIS3 development.

Title of the method: 2.4 Benchmarking
Applicable to the RIS3 phase: 2. Analysis of context

Background and rationale

Benchmarking is the process of improving performance by continuously identifying, understanding and adapting outstanding practices and processes found inside and outside an organisation (company, public organisation, university, etc.). The increasing competition among countries and regions stemming from globalisation has led to the progressive transfer and application of benchmarking approaches to the territorial context, not only to national governments, but also to European Union policies and regions (Koellreuter, 2002).

Many regional strategy-building and development initiatives contain some form of benchmarking in order to establish or further regional economic and innovation strategies (Huggins, 2008). Regions use international benchmarking practices as a tool to found their priority setting process (OECD, 2013). As it has been shown in the mapping exercise of RIS3 strategies, benchmarking is one of eight most common methods used across RIS3 strategy design. More than 60% of regions have used benchmarking during the context analysis phase and 30% also during the phases of vision building and/or policy mix. Some regions conduct systematic comparisons at a national and international regional level in order to diagnose their current situation and improve their ranking, and others implement a benchmarking process in specific sectors or a combination of them.

Among the regions that have applied benchmarking in RIS3 development, are: Wien (AT), Wallonia (BE), Bayern (DE), Central Macedonia (EL), Eastern Macedonia (EL), Midi-Pyrenees (FR), Noord-Holland (NL), Zuid-Holland (NL), Warmińsko-Mazurskie (PL), Centro (PT), East Sweden (SE), Stockholm (Sweden) and Northern Ireland (UK).

Description of the method

Between 1980 and 1990, benchmarking was one of the most popular and widely adopted management methods, and helped many organizations to improve their competitive advantage (Adebanjo et al. 2009). There are several publications that provide a broad review of the literature on benchmarking (Yasin 2002; Kumar and Chandra 2001; Wainwright et al., 2005). The benchmarking process involves comparing one's organization performance within a set of measurable parameters of strategic importance against that of another organization that is known to have achieved the best performance using the same indicators (Kelessidis, 2000).

However, regional benchmarking differs considerably from business benchmarking where the transfer of best performances or best practices can be applied more easily. Unlike companies, territories do not have the ultimate goal of seeking to maximize profit. On the contrary, they are characterised by frequent trade-offs among multiple goals that public policies try and/or are compelled to pursue simultaneously (Schuldi, 2003). Regional benchmarking can be a very helpful tool for making strategic decisions within the process of the design and implementation of regional Research and Innovation Strategies for Smart Specialisation (RIS3) (Navarro et al., 2014). Through comparative analysis, it can provide us with useful information about the position of a region with respect to other regions as well as facilitate policy learning based on the transfer of good practices across borders.

This report aims at providing a methodology for the development of a generic benchmarking tool that will support the design and implementation of regional Research and Innovation Strategies for Smart Specialisation. This method allows for the comparison of the performance of a regional

or national entity with respect to other similar entities for a specific aspect. Benchmarking must involve the following elements:

Selection of regions with which the region under examination wants to be benchmarked
Based on the idea that a comparison is likely to be more valuable when it is carried out between fundamentally equivalent entities, it makes sense to select regions that have similar structural features, such as regions that specialise in the same industries or that have similar demographic characteristics. However, it can be also useful to compare neighbouring regions for issues of transregional complementarities, competition and cooperation. The basic options for using benchmarking could be to compare:

- Neighbouring regions
- Regions in the same country
- Regions willing to cooperate and learn from each other
- Regions with similar profile and/or facing similar problems or challenges
- Regions with best performance or best practices

Thus, the selection of the benchmarked regions depends on the overall scope of the benchmarking exercise and its specific objectives. The JRC has developed an interactive tool for regional benchmarking[29] based on structural similarities between regions. More specifically, the comparison is realised according to a synthetic index of structural distance that takes into account various regional characteristics, such as geo-demography, educational level, technological specialisation, etc. However, in this case users do not choose the compared regions; they only select one region, and the structurally similar examples for comparison are automatically provided.

Comparison of the performance of the chosen regions in a specific aspect
Performance benchmarking could cover a wide range of different aspects: economic development, environmental issues, demographic characteristics, social dimensions etc. These aspects could be generic, such as the aforementioned examples, or specific, for example employment per industrial sector, CO_2 emissions per capita or even ICT patent applications. In the event that a generic aspect is chosen, a series of indicators that represent this aspect must also be selected. It is important to choose indicators that, when combined, reflect adequately the complex nature of the benchmarked element. In the case of the benchmarking tool developed by JRC, all regional characteristics are combined into a single synthetic index and regions are compared as a whole and not in specific aspects.
Analysis and interpretation of the obtained results
Once the collection of all the necessary data for the benchmarking process is done, data analysis is conducted. Through the performance of calculations on selected indicators, basic statistical metrics are obtained (minimum, maximum, mean, mode, quartiles etc), in order to rank the regions according to the aspect that is examined. Comparable information and statistical measures are essential for the development and implementation of coherent and comprehensive policy strategies. Therefore, the benchmarking exercise in this context concludes with the critical review of the obtained results and the elaboration of a complete structured benchmarking report which highlights the observed performance and provides useful insight regarding the practices that are responsible for this performance.

[29] Benchmarking Regional Structure, Smart Specialisation Platform, Source: http://s3platform.jrc.ec.europa.eu/regional-benchmarking, [Access 22 August 2016].

Usability and impact

Benchmarking is considered a useful tool that can help to identify the strengths and weaknesses of territories (OECD, 2005). More specifically, it can be a valuable tool for the identification of regional specialisation patterns and the comparison of economic activities, including agriculture, as well as strengths with other regions in the EU. Together with other tools like cluster analysis, benchmarking can be used for starting the assessment of regional specialisation patterns and comparing statistical findings among regions (Foray et al. 2012).

Moreover, understanding factors underlying regional performance can provide useful knowledge that can be applied to strategic planning and policies. Benchmarking is an exercise generating applicable in-depth knowledge about the regional economy focusing on its comparative advantages and disadvantages (Iurcovich et al. 2006). The benchmarking process should be part of a holistic approach for strategic policy. This means that it should be conducted in coordination with other tools such as regional foresight and regional assets mapping.

Required data

The Benchmarking tool covers all key regional indicators that characterize a regional profile. These indicators can be considered to represent the key dimensions of a region as presented in the Regional assets mapping, which are:

- **Geography:** basic regional characteristics and connectivity
- **Demography and Society:** population, density, education etc.
- **Economy and Labour:** employment, GDP, growth rate etc.
- **Sectoral structure:** distribution of economy and industry including agriculture, business, manufacturing etc.
- **Business characteristics:** active enterprises, company size etc.
- **Innovation System:** knowledge institutions, R&D etc.

However, it should be remarked that some statistical data at the level of region are not always available across the EU and, therefore, additional efforts should be made by some regions to complement existing data sets by more detailed quantitative and qualitative information.

Relevant data sources

For the identification of the indicators for benchmarking (see Step 2 below), various possible sources of information can be found. The primary data sources include among others:

- Eurostat (demography, geography, education, economy, industry): http://ec.europa.eu/eurostat/web/regions/data/database)
- OECD Regional Statistics and Indicators: http://www.oecd.org/gov/regional-policy/regionalstatisticsandindicators.htm
- Regional Innovation Scoreboard: http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_es
- Regional Innovation Monitor: https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/
- European Social Survey (Human values, politics, social aspects): http://www.europeansocialsurvey.org/
- National or regional statistical offices.

It should be remarked that some statistical data at the regional level are not always available across the EU and, therefore, additional efforts should be made by some regions to complement existing data sets by more detailed quantitative and qualitative information.

Implementation roadmap

An analytical roadmap regarding the steps for the implementation of the benchmarking process is presented below (Figure 1). The blue colour represents steps that involve input processes and orange indicates output processes.

Step 1. Objective and scope of the benchmarking exercise. It is important to define the overall scope of benchmarking, in order to plan appropriately the process and obtain useful insights.

Step 2. Selection of regions to compare. The European regions of member states are already defined in the platform and the user has a drop-down list to choose which of them will be benchmarked. The number of selected regions is open to the user.

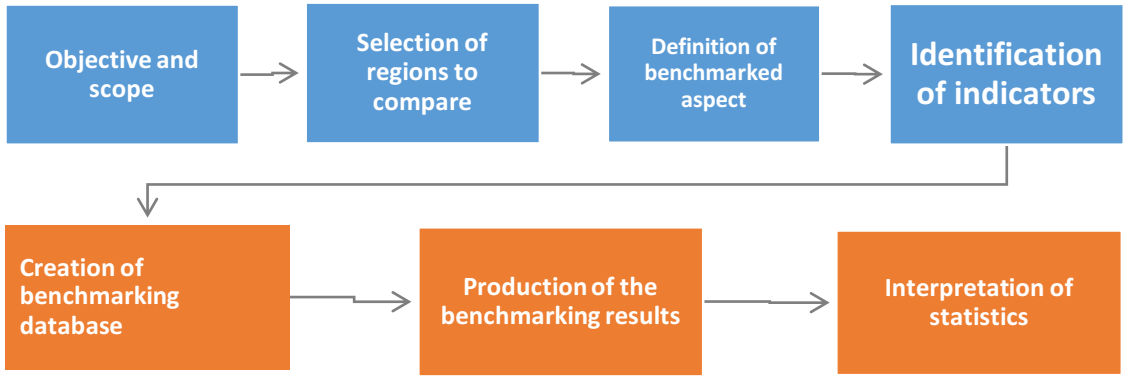
Step 3. Definition of the aspect(s) to be benchmarked. The user can define the aspect to be benchmarked either selecting from an existing pool of aspects (drop-down list) or inserting the element manually.

Step 4. Identification of indicators. The indicators that are selected should reflect the multifaceted nature of the benchmarking element more appropriately. For example, GDP is not a sufficient variable for the economic development of a region. Similarly with the previous step, the user can define the indicators either from an existing pool of indicators and variables (drop-down list) or inserting additional ones manually.

Step 5. **Creation of the benchmarking database.** Having obtained the above data, the necessary information is gathered and stored in the platform.
Step 6. Production of the benchmarking results. Calculations on selected indicators from different regions, providing the main statistics and graphs for the statistically significant indicators (minimum, maximum, mean, mode, quartiles). Based on the results, the region in focus is positioned within the statistical range of these statistics and the user can choose between different types of visualizations. The obtained results can be either exported by the user in the form of tables and figures, or integrated in the final benchmarking report produced by this application.

Step 7. Interpretation of statistics. Fields for the interpretation of statistics, which show cause and effect in terms of the observed performance and the practices that are responsible for this performance; the fields will be part of a complete structured benchmarking report and will have to be filled by the regional authorities experts.

Figure 1 Roadmap for the implementation of the benchmarking process



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Title of the method: **2.5 Regional scientific production profile**
Applicable to the RIS3 phase: **2. Analysis of context**

Background and rationale

According to the RIS3 mapping exercise, bibliometric analysis and benchmarking is used in around half of all the reviewed RIS3 processes (55% of total). However, the mapping information also shows that the bibliometric analysis used by regions is usually simple, and very few regions have a forward view of emerging areas, using predictive analysis or building on hypotheses of potential regional changes or emerging areas for the future. There is a need to increase the understanding of knowledge produced and available in regions. This is relevant for later linking to the demand for knowledge and identifying emerging areas of activity and specialisation.

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.

Description of the method

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). These indicators generally include (European Commission, 2013):

- Number of publications. Number of peer-reviewed scientific publications written by authors located in a given geographical or organisational entity (e.g. the world, a country, a NUTS2 region, a university, a Research Performing Organisation (RPO) or a company). Publication counts based on full and fractional counting at the level of author addresses.
- Growth Index (GI). Measure of the increase in the number of publications or co-publications in a field obtained using fractional counting of publications. A GI value above 1 means that a given region experienced an increase in its output in this research area; and index value below 1 means the contrary. The GI value for a given region can be compared to the GI calculated for the world or other benchmark regions in this research area to ascertain whether the increase experienced by the region has kept pace with the world/benchmark regions increase in this research area.
- Specialisation Index (SI). Indicator of research intensity of a given entity (e.g. a country, a NUTS2 region or an institution) in a given research area (e.g. a research field), relative to the intensity of a reference entity (e.g. the world, the EU28, or the entire output as measured by a database) in the same research area. In other words, when a region is specialised in a field, it places more emphasis on that field at the expense of other research areas. Specialisation is said to be a zero-sum game: the more a region specialises somewhere, the less it does elsewhere. An index value above 1 means that a region/entity is specialised relative to the reference entity, whereas an index value below 1 means the contrary.
- Total number of citations. Total number of citations received by each publication counted from the year of publication plus a three-year citation window. The total number of citations for a NUTS2 region is obtained by totalling the number of citations of the publications that were assigned to the region.
- Average of Relative Citations (ARC). A field-normalised *direct* measure of scientific impact, (which also considers the publication year and document type of scientific contributions in the normalisation process) based on the citations received by an entity's papers. To account for different citation patterns across fields and subfields of science, each publication's citation

count is divided by the average citation count of all publications that were published the same year in the same subfield to obtain a Relative Citation count (RC). The ARC of a given region is the average of the RCs of the papers belonging to it. An ARC value above 1 means that a region is cited more frequently than the world average, while a value below 1 means the contrary.

- Average of Relative Impact Factors (ARIF). A field-normalised measure of the scientific impact of publications produced by a given entity (e.g. a NUTS2 region) based on the impact factors of the journals in which they were published (also taking the publication year of scientific contributions into account in the normalisation process). The ARIF is an indirect impact metric reflecting the average citation rate of the publication venue instead of the actual publications. It serves as a proxy for the 'quality' of the research performed by a region. When the ARIF is above 1, it means that a region scores better than the world average; when it is below 1, it means that on average, an entity publishes in journals that are not cited as often as the world level.
- Highly cited publications. Percentage of papers in the 10% most-cited papers in a given reference database, making use of the relative citation (RC) scores of publications computed using a three-year citation window.
- Number of co-publications. Number of co-publications (full-counting) from a NUTS2 region in which co-authors are from at least two different regions. The collaborations of a NUTS2 region can be broken down by the regions in which the co-authors are located to draw collaboration maps or aggregated to count the total number of co-publications of a region with other regions within the EU28.
- Collaboration Index (CI). Scale-adjusted metric of scientific collaboration comparing the observed number of co-publications of an entity (e.g. NUTS2 region) to that expected given the size of the scientific production of the region. When the indicator is above 1, a region produces more publications in collaboration than expected based on the size of its scientific production, while and index value below 1 means the contrary.

Usability and impact

Effective and efficient research and innovation systems are those that succeed in producing strong scientific and technological outputs, both in terms of quality and relevance (European Commission, 2016). Understanding the scientific performance of regions, including impact and collaboration patterns, allows for a comprehensive analysis of the evolution, interconnectivity, performance and impact of regional research and innovation systems in the EU. They also help in providing an overall view of regional strengths and weaknesses in knowledge production across fields and subfields of science.

Required data

The elaboration of scientific profiles is based on publication data. The most common sources of publication data are:

- Scopus
- Web of Science (WoS) and
- Google Scholar.

Several advantages and disadvantages exist for each of them. The most commonly source used in the European context is Scopus. Web of Science is known for having restricted coverage (see table below) and marked predominance of papers in English. In contrast, Scopus has greater coverage and through its tool '*Scimago Journal and Country Rank*', it allows for the realisation of free bibliometric analysis (although with restricted indicators). Finally, Google Scholar has a much wider coverage, no linguistic biases, and is free. However, it is not as sophisticated and accurate as WoS or Scopus when performing more advanced bibliometric analysis. The table below provides a comparison of Web of Science, Scopus and Google Scholar.

Table 1 Comparison of features in WoS, Scopus and Google Scholar

	Web of Science	Scopus	Google Scholar
Indexing and abstracting	Yes	Yes	No
Years covered-journals	1900 to present (Science) 1956-present (Social Science) 1975-present (Arts and Humanities)	1966 to present for some journals, but many date back to 1996 to present	Not revealed
Years covered-citations	1900 to present	1996 to present	Not revealed
Fee-based	Yes	Yes	No
Contents	9300 journals (Science, Social Science and Arts and Humanities)	15,000 journals (Science and Social Science)	Not revealed

Source: Bakkalbasi et al., 2006

Although national sources are also relevant, and those provided directly by the universities and academic organisations, these do not necessarily allow for benchmarking, unless the benchmark is done at the level of organisations or specific disciplines.

Relevant data sources

Scientific production profiles at national and regional (NUTS2) level have been produced by DG Research and Innovation (DG RTD) of the European Commission (EC) for several years. Between 2010-2014, Science-Metrix was selected as a provider of bibliometric indicators for DG RTD. They were collecting, analysing and updating all bibliometric data that was integrated into the EC's evidence-based monitoring of progress towards the objectives set by the Lisbon framework and the post-Lisbon Strategy of the European Research Area (ERA). The analyses provided by Science-Metrix to the EC focused on the scientific performance – including impact and collaboration patterns - of countries, regions and research performers such as universities, public research institutes and companies. The statistics and indicators produced by Science-Metrix are based on a series of indicators designed to consider national and sector specificities, as well as to allow an analysis of the evolution, interconnectivity, performance and impact of national research and innovation systems in the EU. They also provide an overall view of Europe's strengths and weaknesses in knowledge production across fields and subfields of science. All Science-Metrix reports are available here: http://science-metrix.com/en/news/the-european-commission-publishes-six-reports-produced-by-science-metrix

Science-Metrix has also built a journal-based, mutually-exclusive classification scheme (i.e. taxonomy) to delineate the main fields and subfields of science. This taxonomy is available here: http://www.science-metrix.com/en/classification. Moreover, they have also matched subfields (and, where necessary, journals) to 17 FP7 thematic priorities and 22 industrial sectors, allowing for further analysis along EU priorities and economic activities.

For the period 2016-2018, CWTS and INCENTIM (KU Leuven) were selected by DG RTD to produce and update a wide range of bibliometric data and performance indicators[30]. In addition, dedicated methods, metrics and indicators will focus on 'open access' publications, gender equality and research mobility.

To our knowledge, the data for producing scientific profiles for several NUTS2 regions already exists and has been thoroughly processed by DG RTD's contractors. In the Science-Metrix reports, selected NUTS2 regions include the 50 regions which published the largest number of peer-reviewed publications over the 2000-2011 period. This work could be potentially extended to all EU28 NUTS2 regions, for which further data would require data collection and analysis. It would be however

[30] See: https://www.cwts.nl/news?article=n-q2v274&title=cwts-as-data-producer-for-eu-research-and-innovation-policies

necessary to agree with DG RTD if this data could be used in an online tool and updated accordingly by their current contractors in an annual/regular basis.

Additionally, and based on this data, DG RTD produces every year the "Science, Research and Innovation Performance of the European Union" report that looks at the performance of EU countries in research and innovation. The report usually includes one chapter of science and technology outputs, in which country strengths and weaknesses on scientific production are highlighted[31].

The Essential Science Indicators from Clarivate Analytics[32] is a tool (formerly the IP & Science business of Thomson Reuters) that analyses top research output and research fronts, by revealing emerging science trends as well as influential individuals, institutions, papers, journals and countries/territories in different fields of research. It produces a compilation of science performance statistics and science trends data that is based on journal article publication counts and citation data from Web of Science. This tool is for-profit and requires paying a subscription fee.

Finally, *Publish or Perish* (http://www.harzing.com/resources/publish-or-perish) is an open-source software programme that retrieves and analyses academic citations. It uses Google Scholar and Microsoft Academic Search to obtain raw citations, which are analysed and then several metrics are produced. The metrics include the total number of papers and total number of citations, the average citations per paper, citations per author, papers per author and citations per year, as well as different variations of impact factor. This tool is useful for analysing individual focal authors of interest, or group of authors in which scientific strengths have been revealed.

Implementation roadmap

As discussed above, ideally it would be best and most efficient to work in collaboration with DG RTD (and their contractors) already producing scientific profiles for EU countries and regions, and simply use the data that is being produced and integrate it into an online tool, where regions can easily benchmark their performance to other preferred EU regions. Below, we present a full roadmap of what would be necessary to implement and develop such a tool from scratch (assuming no collaboration with DG RTD is possible). In case DG RTD makes available the data and analysis being done over the years in producing science profiles, the roadmap presented below would then start in Step 4.

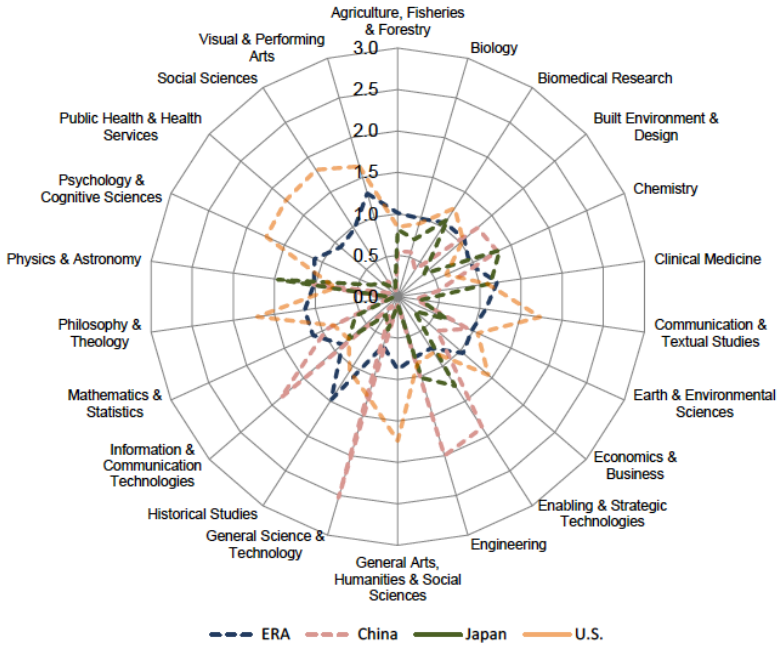
1. Data collection. Publication data for all EU28 regions should be collected using Scopus, Web of Science, Google Scholar or all (or alternatively only one source of choice).
2. Data regionalisation. All data collected should be regionalised to produce regional bibliometric indicators.
3. Data analysis and production of indicators. All bibliometric indicators (or a selection of these) listed in section "Description of the method" are produced.
4. Graphic representation of data. Once data is analysed, several types of graphical representation could be considered to ease the visualisation and interpretation of bibliometric data, such as radar graphs and dashboards.

An example of a **radar graph** from the EU scientific production profiles is presented below. Radar graphs are useful for interpreting relative strengths and weaknesses of a region/country.

[31] See: https://ec.europa.eu/digital-single-market/en/news/presentation-report-science-research-and-innovation-performance-eu-2016

[32] See: http://ipscience.thomsonreuters.com/product/essential-science-indicators/?utm_source=false&utm_medium=false&utm_campaign=false

Figure 1 Scientific specialisation index by main scientific fields for the ERA, China, Japan and the US, 2000-2010



Source: Science-Metrix based on Scopus data in European Commission, 2013

Dashboard tables could be used to present several indicators side-by-side, often in the form of micro charts, using small graphics inserted in the table. This type of tables allows for rapid comparisons between entities, and/or for the easy interpretation of trends over time. An example of dashboard table is presented below.

Figure 2 Publications in Telecommunications by country, 2000-2011

Group	Country	Code	Pubs (FULL)	Pubs (FRAC)	Pub Trend	Growth Index	CI	SI	ARC	ARIF	% in top 10% most cited pubs
EU-27	Austria	AT	4,704	891		1.19	1.28	0.75	1.23	1.08	12.1%
	Belgium	BE	6,852	1,361		1.15	1.38	0.80	1.50	1.28	15.8%
	Bulgaria	BG	1,523	223		0.74	1.35	0.87	0.85	1.04	7.3%
	Cyprus	CY	531	84		1.82	1.44	1.67	1.11	1.11	10.0%
	Czech Republic	CZ	3,709	768		1.50	0.81	0.71	0.80	0.91	8.3%
	Denmark	DK	3,776	647		1.20	1.48	0.57	1.56	1.47	15.6%
	Estonia	EE	248	54		1.52	0.83	0.48	0.89	0.87	8.1%
	Finland	FI	7,314	1,592		1.00	1.11	1.37	1.14	1.09	12.3%
	France	FR	32,547	6,268		1.17	1.45	0.79	1.17	1.16	12.4%
	Germany	DE	42,913	8,845		1.14	1.35	0.82	1.26	1.12	13.3%
	Greece	EL	6,839	1,403		1.13	1.07	1.15	1.26	1.49	13.7%
	Hungary	HU	1,769	348		0.96	1.05	0.51	0.99	1.42	9.6%
	Ireland	IE	3,945	759		1.05	1.22	1.21	1.22	1.29	11.7%
	Italy	IT	24,759	4,795		1.14	1.26	0.77	1.31	1.35	13.7%
	Latvia	LV	247	43		1.36	0.66	0.81	0.42	0.64	3.6%
	Lithuania	LT	684	121		0.70	0.88	0.69	0.80	1.03	8.8%
	Luxembourg	LU	210	31		2.78	1.46	1.10	0.92	1.30	7.9%
	Malta	MT	88	24		2.05	0.49	1.90	0.64	0.59	4.9%
	Netherlands	NL	9,912	1,991		1.12	1.55	0.62	1.49	1.26	15.6%
	Poland	PL	7,898	1,467		0.80	0.81	0.60	0.61	0.86	5.9%
	Portugal	PT	3,818	766		1.43	1.02	0.89	0.95	1.08	9.3%
	Romania	RO	4,896	898		1.60	0.90	1.50	0.68	0.81	6.1%
	Slovakia	SK	716	139		1.94	0.81	0.40	0.65	0.91	6.2%
	Slovenia	SI	717	163		1.05	0.75	0.49	0.49	0.95	5.2%
	Spain	ES	16,625	3,329		1.20	1.30	0.67	1.15	1.30	12.6%
	Sweden	SE	8,627	1,734		1.17	1.48	0.81	1.61	1.39	16.4%
	United Kingdom	UK	35,978	7,816		1.08	1.40	0.69	1.24	1.28	12.6%
Total EU-27			203,956	46,559		1.14	0.00	0.77	1.14	1.17	11.9%

Source: Science-Metrix based on Scopus data in European Commission, 2013

5. Online tool. Once the data is analysed and presented in a visually attractive way, all should be collected and organised into an online tool that is accessible to the public. This tool should be

interactive, and allow the selection of benchmark regions. Science profiles should be shown of the focal region and its benchmarks, allowing to make comparisons and further analyses.

6. Continuous data update. All data should be continuously updated and added to the online tool.

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Title of the method: 2.6 Specialisation indexes
Applicable to the RIS3 phase: 2. Analysis of context

Background and rationale

The definition of priorities at national or regional level takes place within a series of activities and technology domains that are potentially competitive and able to generate new business in a global context faced with competition from other regions.

On the basis of 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/citations 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.
An example of the application of the method in the RIS3 development of regions can be found in Lithuania, which has used International Trade Centre UNCTAD/WTO - Trade Competitiveness Map which is used to benchmark national and sector trade performance. SCOPUS SCImago Journal and Country Rank tool are also frequently referenced for bibliometric analysis. The Centro region in Portugal has employed bibliometric analysis using a tool that analyses open access publications. Other regions (mostly Germany, Austria and Belgium) have made use of various national online statistical tools providing insights on patents and inventions.

Overview, key statistical analysis and qualitative assessment are the first methods used by all regions in Step 1 of the RIS3 process. Bibliometric analysis and benchmarking is used by regions in approximately half of the mapped RIS3. Collaboration and networking analysis and value chain analysis are only used in around one third of the mapped RIS3.

Description of the method

Empirical research on international specialization patterns uses a wide array of statistical tools, ranging from simple descriptive indicators to complex econometric techniques.

Positioning in value chains, the OECD's (2013) work on global value chains, in addition to the methods implemented by regions, suggests using other indicators of science, technology and economic specialisation for place-based growth. This includes longitudinal analyses and the comparison of patterns in scientific, technological and economic specialisation; and relative indicators that are important from a benchmarking perspective.

In this context, for the identification of the technological and economic specialisation of regions, three indicators will be described: the Activity Index (AI) for scientific activities (publications/citations), the

Revealed Technological Advantage (RCA) for patents and the Revealed Comparative Advantage (RCA) for economic activities (trade/exports). Visualisation of indicators using an interactive dashboard will be also described.

Scientific Activity Index (AI) (note that this is developed separately under method 2.5 Science and technology profile and performance)
The index quantifies the academic performance of researchers, such as measuring the scientific performance based on the number of publications or the citation index (bibliometric indicators). Publication and citation counting techniques are tools used to illuminate and evaluate scientific activity, and can provide a comprehensive regional research profile.

Other scientific activity techniques are used for measuring the collaboration activities of researchers and community collaboration activities (e.g. co-authorship, co-partners in projects, and co-cited publications). At a regional level, publication and citation data are also patterns of research collaboration: they identify sub-fields that reflect specializations, assess and map research collaborations in terms of joint publication efforts, or assess the publication impact of institutions and their research fields. Affiliation and co-affiliation data from scientific publications can also be used to infer mobility patterns and to conduct diachronic network analyses to identify the mobility of people among locations over time.

At the regional level, data on the proportion of scholars that are “sent” or “received” can be also calculated by analysing the directionality of mobility events. The total number of scholars provides a capacity indicator for the region, which can be also used to calculate normalised shares both for sending and receiving regions/countries to demonstrate the flow of scholars between EU regions.

Revealed Technological Advantage (RCA)
The revealed technology advantage (RTA) index provides an indication of the relative specialisation of a given country in selected technological domains, and is based on patent applications filed under the Patent Cooperation Treaty. It is defined as a country’s share of patents in a particular technology field divided by the country’s share in all patent fields. The index is equal to zero when the country holds no patent in a given sector; is equal to 1 when the country’s share in the sector equals its share in all fields (no specialisation); and above 1 when a positive specialisation is observed. Patent counts are based on the priority date, the inventor's residence and fractional counts.

There are two kinds of data related to patenting activities: (a) patenting activities of a country's/region's assignees, and (b) patent applications by a country's/region's inventors:

(a) Statistics on applicants allow for a more detailed and precise analysis of a country or region's patenting than those based on inventor patent data. When analysing the patenting activity of assignees at the national level, proper allowance must be given for the structure of assignees, e.g. the size of assignees, their origin and field of operations; this is especially true when using European Patent Office (EPO)databases. It is the primary path in a significant number of technological specialisation studies, as it presents the "clearest" analysis of technological activities across countries, of individual firms and patent applicants within countries, and of the ambitions and participation of firms and individuals in international (or internal) technology markets.

(b) Data on inventor patents provide a better ‘‘picture’’ of the technological activities of developing countries than assignee patents. The advantage of studies based on inventor data is that a country's inventors are more visible in the patenting process than a country's assignees. A large number of these types of patent data allow calculations to be made, and the data to be more accurately analysed. However, the results drawn from inventor-based analysis are not as significant as the results and outcomes from an analysis of assignees data. This is because applicants companies and individuals are more interconnected with their country of origin than inventors.

For the study of the dynamics of patent development, two to three periods of three to five years (chosen from the comparable steady state period until the last available period in the database) can

be analysed. This provides reliable data. At the same time it allows for smoothing and, to a certain degree, the elimination of random fluctuations in patenting dynamics.

Revealed Comparative Advantage (RCA)

RCA is an index used in international economics for calculating the relative advantage or disadvantage of a certain country or region in a certain class of goods or services as evidenced by trade flows. It is measured by the relative weight of a percentage of total export of commodities in a nation over the percentage of world exports in that commodity. The RCA is equal to the proportion of the country's exports that are of the class under consideration (E_{ij} / E_{it}) divided by the proportion of world exports that are of that class (E_{nj} / E_{nt}). A value of less than unit implies that the country has a revealed comparative disadvantage in the product. Similarly, if the index exceeds unity, the country is said to have a revealed comparative advantage in the product.

The concept of Revealed Comparative Advantage is similar to that of Economic Base Theory, which is the same calculation, but considers employment rather than exports. It most commonly refers to an index introduced by Béla Balassa. Measures of RCA have been used to help assess a country or region's export potential. The RCA indicates whether a country is in the process of extending the products in which it has a trade potential, as opposed to situations in which the number of products that can be competitively exported is static. It can also provide useful information about potential trade prospects with new partners. Countries with similar RCA profiles are unlikely to have high bilateral trade intensities unless intra industry trade is involved. RCA measures, if estimated at high levels of product disaggregation, can focus attention on other nontraditional products that might be successfully exported.

Interactive Dashboard

A critical phase of the research process is the presentation of results. This is typically done in a variety of ways, including the use of tables and charts in reports and slide presentations. One of the more accessible and engaging means to present research results is through the use of online interactive dashboards with information about local specialisation profiles, past growth and future prospects.

"A dashboard is a visual display of the most important information needed to achieve one or more objectives which fits entirely on a single computer screen so it can be monitored at a glance." It is also a customized, interactive display that is used to explore data. Dashboards can be connected to live data that are automatically updated in real-time, or based on a completed survey project or other finite datasets. For example, we can sort and rearrange data in an interactive grid, perform manipulations on the data to display only the information one is interested in, and display visual representations of the data in the dashboard to make the data easier to interpret.

In short, the method uses a collection of different visual elements -- usually charts -- arranged on a single web page, providing a summary of the most important results or findings related to a particular subject. The process for the creation of a dashboard is described in more detail in the implementation section.

Usability and impact

Indicators to measure specialisation in science, technology and exports may help policy-makers in identifying strengths, weaknesses, complementarities and mismatches with respect to scientific, technological, innovative and economic capabilities.

Longitudinal analyses of patterns in scientific, technological and economic specialisation and potential lags or interdependences between the different components can provide policy-makers with background information to assess the sustainability of traditionally strong sectors or, to consider providing public support to those areas where research capacity is strong but economically weak. Likewise, comparisons of technological and economic specialisation may show economically strong domains where technological activity is relatively weak or vice-versa. In such cases, policy-makers may

want to consider whether stimulation for technological advancements or international collaborations would contribute to the sustainability of these sectors.

Relative indicators, such as the Activity Index (AI) for scientific activities, the Revealed Technological Advantage (RTA) for patents and the Revealed Comparative Advantage (RCA) for economic activities in exports, are used to avoid biases and to compare countries and regions on an "equal basis". For example, relative specialisation indices integrate a comparison of profiles of a focal country/region to profiles of reference countries/regions. They can hence be used to answer questions like "where does a country (or region) stand in various sciences/technologies/economic domains, compared to other countries or regions".

References contained in each patent application to previous relevant patents can provide information on the interrelatedness of various technological domains. In the same way, references contained in each patent application to research papers reporting results on which the invention is based, can be used to map the science - technology nexus. This can point to interesting opportunities for technology development and to gaps in the regional or national scientific profile. In addition, patents linked to universities and public research can help provide statistics regarding the role of universities in technological development (e.g. by compiling counts of the patents universities were granted, their forward citations, funded by a company or other source).

Techniques combining citation-linked and text-based approaches allow for the monitoring of the evolution of scientific and technological domains, and for the detection of new, emerging topics within existing fields. International and interregional collaborations in science and technology development can be mapped by studying co-authorship or co-inventorship patters between countries, regions and their respective institutions as articulated in the Triple Helix concept.

Required data

A selection of required data per specialisation field are listed below:

Scientific Activity (bibliometrics)

- Data on the number of publications and citations on specific fields for indentifying the regional research profile
- Measuring collaboration of researchers through joint publications
- Affiliation data from scientific publication
- Measuring collaboration of researchers through co-partnership in research projects
- Data on co-cited publications
- Data on publications of institutions in research fields
- Data on scholars flow and mobility.

Revealed Technological Advantage (patents)

It is important for the design and interpretation of patent indicators to have value issues in mind. Major findings related to an approach that attempts to cast light on the value of patents by using patent information are mainly provided by bibliographic sources. Required patenting data at regional level are:

- Data on the patents of a region’s assignees
- Data on the patents of a region’s inventors
- Share of patents in particular technology fields divided by the region's share in all patent fields
- Patents linked to universities and public research
- Firms patent activities
- Patent data to study the geographical properties of inventive processes—e.g. the role of local actors in regional or national innovation (universities, small companies, large

companies, etc.), their interactions and the profile and impact of regional technological specialisation.

- Patent data to investigate researcher mobility (across companies or countries), differences in researcher profiles across fields, and linkages across researchers and others).
- Benchmarking patent data of a region with other regions at national or EU level in technological or sector fields.

Revealed Comparative Advantage (exports)

- Data of a country's/region's exports of a commodity (or industry)
- Data of a country's/region's total exports
- Data of corresponding exports to a set of countries
- Share of Product in Total Exports, i.e. the share of each export product (at a chosen level of disaggregation) in the country's/region's total exports.
- Share of Market in Total Exports, i.e. the share of exports sold in each foreign country in the home country's/region's total exports.
- Hirschman Herfindahl Index, i.e. the sum of squared shares of each product in total exports. A country/region with a perfectly diversified export portfolio will have an index close to zero, whereas a country which exports only one product will have a value of 1 (least diversified).

In addition to publications, patents and economic performance indicators, other data are relevant for assessing a country's or a region's STIE potential. Some examples include expenditures on innovation and research and development in specific sectors, the availability of human capital for certain scientific, technological and economic areas, the presence of IT-infrastructure in specific sectors, etc. On a national level, some sector specific datasets are available. Unfortunately, it is very difficult to find regional data that are sufficiently detailed in terms of relevant underlying fields, and that are comparable across different regions.

Relevant data sources

A selection of existing databases and tools relevant for the application of the method's indexes are listed below:

Trade and Exports

- EU Trade tool. A fully interactive web-based application for the visualisation of inter-regional trade flows and the analysis of regions' competitive position of regions: http://s3platform.jrc.ec.europa.eu/s3-tools
- Trade Centre UNCTAD/WTO. A trade Competitiveness Map that allows for benchmarking of national and sector trade performance: http://tradecompetitivenessmap.intracen.org/TP_EP_CI_HS4.aspx
- OECD, Inter-Country Input-Output (ICIO) Tables. Presents matrices of inter-industrial flows of goods and services produced domestically and imported: https://www.oecd.org/sti/ind/input-outputtablesedition2015accesstodata.htm
- The OECD ORBIS Database, for firm-level data: http://www.oecd-ilibrary.org/economics/the-oecd-orbis-database_5kmhds8mzj8w-en

Publications/Citations (Bibliometric analysis)

Bibliometrics includes several different measurement methods. Data sources and publication data are recorded in most databases, both nationally and internationally. For data sources in more detail please see method 2.5 Regional scientific production profile.

Patents

There are many tools and databases available for patents, and many of them are free to access. The website http://www.irossco.com/patentsearching.htm contains the links for all free patent databases. The website https://www.patentinspiration.com provides various analytics of patent data.

The most comprehensive and frequently used patent databases are provided by the European Patent Office (EPO), the United States Patents and Trademarks Office (USPTO), the Organisation for Economic Co-operation and Development (OECD), the Japan Patent Office (JPO), the World Intellectual Property Organization (WIPO), Questel Orbit, and Eurostat, although data from domestic patent offices are often analysed for supplementary purposes too. However, the most complete patent data are contained in the EPO Pat stat database. The United States Patent Classification can be used in studies based on USPTO patent data only.

Implementation roadmap

Step 1. Collection of data

In this step the collection of the needed data and existing indicators on the technological/scientific/economic specialisation of the region should be completed. In case that the existing indicators are not cover all the fields, development of new indicators is needed (see above required data).

Step 2. Indicator analysis

Analysis of indicators should cover three main dimensions: regional assets, linkages with the rest of the world and the position of the region in the global economy. For example, technology specialization (and specialization in general) is a relative measure and can be specified through two different comparisons:

- A comparison between the relative weight of the reference variable (scientific knowledge, research, technology outputs, patents and/or productive areas) within the same country, e.g. specialization in ICT, biotech, electrical engineering etc.,
- A comparison, respectively, between (for example) the above national technology specialization patterns to similar figures of third countries or areas.

Comparisons of specialisation indicators over time, changes in scientific, technological or economic specialisation should also be analysed. Some examples for indicator analyses are:

Analysis of Absolute and Relative specialisation

Analysis of the absolute positions of countries and regions on the indicators developed. Absolute specialisation indices give evidence on how the degree of specialisation of one specific area changes over time, regardless of the development of other areas. Absolute positions are also important since they signal a presence or lack of critical mass in the fields subject to prospective specialisation studies. A nation or a region can have a strong relative position in a certain area, though upon further inspection (and given the mathematical nature of the relative indicators) it may still lack a distinctive critical mass in that area.

Relative specialisation reveals a countries'/regions' comparative advantages in relation to a reference group of countries/regions. The average economic structure of countries under study is taken as the benchmark for relative specialization measures. Specialization indices of this kind provide data on the dissimilarity in the technology composition of each region compared with the structure of the selected reference level.

Relational indicators' analysis

Interesting insights can also result from the study of relations between scientific, technological and economic specialisations, which can be mapped using conversion tables. Relative indicators are important from a benchmarking and evolutionary perspective. Examples include two dimensional mappings of technological and economic specialisation indicators, or of scientific and economic

specialisation that generate insights into the past, present and future endeavors. For example, it is questionable whether a historically important economic specialisation can be expected to last if scientific and technological strengths in underlying areas are absent. Similarly, strong scientific or technological positions that do not translate into economic performance raise policy questions regarding knowledge transfer.

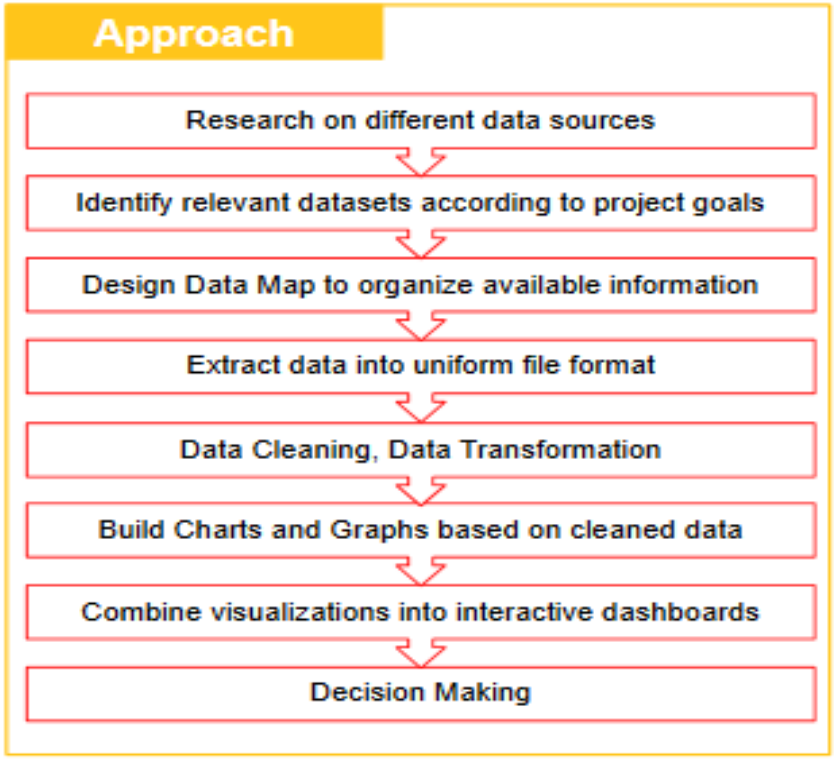
Analysis in this field can also include concentration indices, measuring the weight of n more important sectors (n can take the value of 1, 3, 4, 6, etc) to the total relevant figure for a specific technology variable (e.g. R&D, patents). Alternatively an analysis of an index of technological specialisation that shows how much any particular country or region adapts its relative high to low tech products trade structure to changing patterns of world trade in high and low technology products or matching patent information with other information at the firm level, such as R&D, innovation, stock market value.

STEP 3. Create an Interactive Dashboard

This concerns the visualisation of data using open data Interactive Dashboard. The process to create an on-line interactive dashboard is the following:

- Data upload
- Data cleaning
- Creation of variables
- Cross tabs
- Charts
- Power Point export
- Dashboard
- Key findings

Figure 1 Implementation roadmap



Title of the method: 2.7 SWOT analysis
Applicable to the RIS3 phase: 2. Analysis of context

Background and rationale

SWOT analysis is a tool used to help identify opportunities and weaknesses. SWOT analysis is a very widely used method for analysing regional context during RIS3 process. The mapping exercise showed that 87% of the selected regions used SWOT analysis in determining regional assets and region's relative positioning. It is important to ensure that the results of SWOT analysis are shared amongst all members of the quadruple helix (academia, business, public administrations, and civil society) to achieve a common understanding of regional strengths, weaknesses, opportunities and threats among all RIS3 stakeholders.

Description of the method

SWOT analysis identifies strengths, weaknesses, opportunities, and threats. Strengths and weaknesses can be considered internal factors. The strength section answers questions such as: "What advantages does the region have?" and "Where does the region perform best?" The weakness section answers questions such as "What should the region avoid?" or "What obstacles are there for innovation-based economic growth?" These sections analyse the intrinsic assets of a region, such as the areas in which the region performs well and the areas in which it falls short against the global competition.

In contrast, the opportunities and threats sections are designed to consider external factors. The opportunities section is used to identify areas where a region could expand its activities based on its strengths. This section answers questions such as: "What are the relevant global trends?", "What advantages could new technologies and innovations developed in the region offer?", and "What options do regional strengths open up?". In contrast, threats identify areas that may negatively affect the region. This section answers questions such as: "What obstacles to innovation-based economic growth does the region face?", "What is the global competition?", and "What threats do regional weaknesses expose the region to?" These sections analyse how well a region could expand in new directions, or develop further in existing areas based on the strength and weaknesses of the company.

SWOT analysis are normally displayed in a grid, such as the one below:

This method is helpful as a basis for the analysis of a regional/national context in order to identify key areas which need to be appraised in greater detail through other methods. The goal is to assist in achieving a holistic assessment of the impact of the mix of helpful and adverse influences affecting the potential of a region to achieve structural transformation of its economy. SWOT essentially

enables RIS3 stakeholders to evaluate at glance the prospects of smart specialisation and determine how well it can build on the regions strengths and advantages, as well as growth in leading areas of research and innovation.

SWOT analysis is simple to implement and can be easily distributed amongst stakeholders. Once completed it would be possible for the relevant stakeholders to cross-reference other SWOT analyses done in their region. This could help to identify strengths or weaknesses that they had not yet considered, enabling stakeholders to work together and share the outlook by identifying areas of opportunity for all of them.

Usability and impact

A SWOT analysis is a useful basic method in the RIS3 design process. This methodology could make it easier for regions to identify areas of opportunities for research and innovation based economic growth. Improved design processed and the communication of SWOT analysis results can improve understanding among regional stakeholders the areas that need to be explored. The benefit of this method is its simplicity and further usability of the results in more advanced analysis of specific specialisation areas.

Required data

This method will require research into generic strengths, weaknesses, opportunities, and threats that regions or countries experience with regards to structural transformation of the economy. The SWOT analysis process can be used to encourage regions to consider aspects that they may not previously considered. Furthermore, some prompts may be required to help regions interpret the results of their SWOT analysis. It is crucial that the stakeholders understand differences between strength and opportunities, as well as weakness and threats. For this reason, clear instructions are required outlining and detailing the purpose of each section of SWOT analysis and how it can be useful. Furthermore, a structured template may be needed to aid stakeholders in completing their SWOT analysis, which should be coupled with the aforementioned prompts.

Relevant data sources

These sources provide more detail about SWOT analysis:

- https://www.smartdraw.com/swot-analysis/
- https://www.mindtools.com/pages/article/newTMC_05.htm

Furthermore, the above links also include SWOT analysis worksheets that can be used to aid in completing each section of analysis.

Implementation roadmap

1. Identify a good template for SWOT analysis and effective prompts for each section of the analysis. Some form of decision support may be useful for this section. For example, a form of survey in which the stakeholder fills in the blanks and then is able to view a rough analysis of their results to better help them draw conclusions from what they have inputted.
2. Determine a method to display and distribute the SWOT analysis tool
3. Decide on or develop a method by which stakeholders can share and discuss the results of their SWOT analysis. This is possibly achievable through the exploitation of

SciCafe 2.0 Platform integrating the Citizens' Say Knowledge Exchange tool (www.SciCafe2-0.eu) as a simple 'discussion table' or via a modified version of a World Café online.

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https://hbr.org/1979/03/how-competitive-forces-shape-strategy

Title of the method: 3.1 Collaborative vision building

Applicable to the RIS3 phase: 3. Strategy formulation – Shared vision

Background and rationale

This method will allow for creating a vision for the region by gathering views from all stakeholders through a set of structured questions about the future. The method can integrate a link to iKnow platform (outcome of FP7 project on foresight http://wiwe.iknowfutures.eu/iknow-description/), which aims at interconnecting knowledge on issues and developments potentially shaking or shaping the future of science, technology and innovation (STI) in Europe and the world.

The RIS3 mapping exercise found that the following RIS methods were aligned with "Collaborative vision building":

- Stakeholder interviews were conducted by 37% of the regions
- Working groups/Focus groups were conducted by 97% of the regions
- Horizon scanning activities were employed by around 27% of the regions
- Foresight type of exercises were mentioned by 30% of the regions
- Delphi survey(s) were undertaken by only 3% of the regions.

The mapping exercise showed that Noord-Holland in the Netherlands (incorporating the provinces of Drenthe, Fryslân and Groningen) undertook the majority of these "collaborative vision building" techniques. Noord-Holland carried out all the methods except 'Foresight' and 'Delphi Survey'. The Noord-Holland region is categorised as 'Strong' in the RIS ranking.

Description of the method

Observations

John et al. (2015) describe visioning as the "process of constructing desirable future states". In expanding upon this definition, they suggest "The current state of the art converges on a visioning practice that accounts for systemic relationships, ensures coherence and adopts advanced sustainability concepts, while allowing all relevant stakeholders to provide inputs. Incorporating such visioning practice into regular planning processes allows city administrations to avoid conflicting and suboptimal development, unintended consequences of development with adverse impacts, and stakeholder resistance due to lack of ownership and accountability".

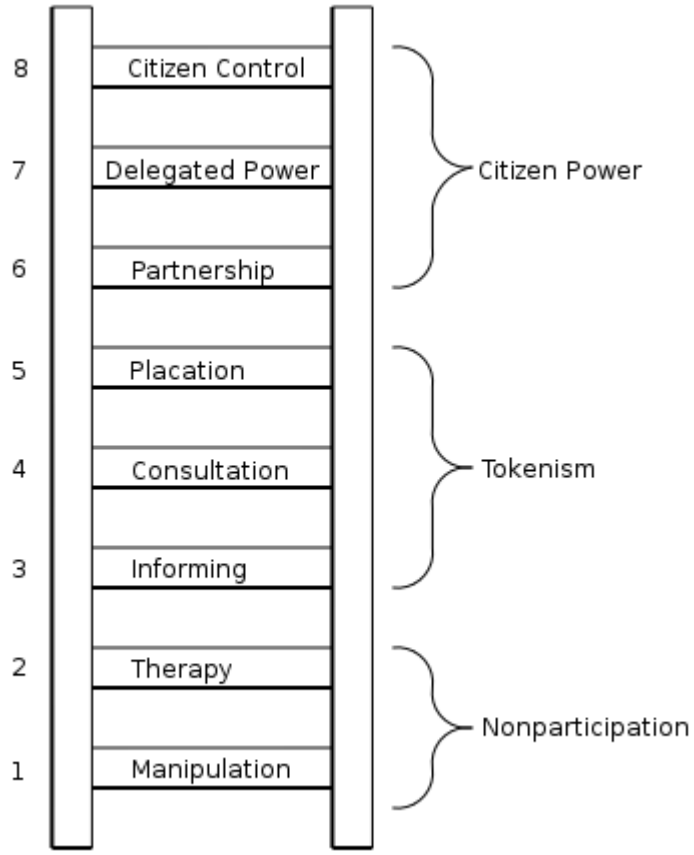
The EC (2012) provide the following observations on the visioning process:

- The visioning process should develop a shared and compelling vision on the economic development potential of the region and the main direction for its international positioning.
- The visioning process should mobilise power. It should attract stakeholders to participate in a process in which they feel they can add value to and also benefit themselves.
- Visions are often most effective when directed by a 'grand figure' such as a politician, industrialist, leading academic who can help promote the process on a larger scale.
- Visions are often generated during times of crisis, when the need is most acute.
- Visions should be ambitious but remain credible. Over-ambitious visions will undermine the RIS3 and fail to connect with stakeholders.
- There should be a willingness to reach a consensus and work towards the transformation.
- The vision should be bold, with realistic priorities and specific development paths.
- The vision should identify possible paths for the economic renewal and transformation of the region.
- The vision should also include justifications for its relevance in terms of meeting societal challenges.

The empowerment of participants

Participation is key to the collaborative visioning process. Arnsteins (1967) seminal work identified different levels of participation using the analogy of rungs on a ladder. Arnstein identified 8 levels of participation, ranging from manipulation to citizen control.

Figure 1 Ladder of participation



Source: Arnstein, 1969

Critical insights

To help us understand the complex visioning process, Nam (2013) provides a critical analysis of tacit assumptions underlying visioning:

Tacit assumptions underlying vision	**Critical analysis based on reality**
1. Visioning is a new and innovative technique.	• How new and which aspect of visioning is supposed to be new? • What is novel and original in participation, long-term strategic thinking, and the creation of motivational images?
2. A clear image or vision of the future acts as a beacon to guide actions until that vision is reached.	• Is it always possible and necessary to have a visual image of the future? • Is our need to know where we're going always strong?
3. If you have a clear vision you will be inexorably drawn towards it.	• The accounts of success with visioning and the claim that a vision will act as magnet pulling you towards it are tautological.

	• There is no clue of what a good vision is in advance because one may say ex post that it was a good vision if it works or it wasn't a good enough vision if it doesn't work.
4. The clearer the picture of the future, the better it will be as a guide.	• When a whole community is involved in a goal setting and visioning exercise, clarifying collective goals is not an easy task.
5. A clear image of the future will inspire and motivate purposeful action.	• How motivational can a vision statement really be? • In actual practice, vision statements may have little impact on decision making.
6. A strong, shared community vision is possible to articulate.	• Efforts to create a shared community vision face the physical and social complexity inherent in community planning. • Who really participates in creating a shared community vision?
7. The more people are involved in creating a vision the more they will accept it and be motivated by it.	• There is little evidence that participating in goal setting strengthens commitment to achieving the goals.
8. The broader the involvement in creating vision goals the more effective those goals will be in bringing about social harmony and well-being.	• In reality, broader involvement does not mean active participation of all isolated communities.
9. People who might not otherwise be included in planning will be involved in visioning.	• Those who take part in visioning do not necessarily represent the diverse segments not usually represented as participants in planning. • Participatory visioning cannot be a process for direct democracy because it requires a minimum level of knowledge and commitment.
10. All people are equally capable of creating future images, are equally interested in the pursuit of a positive future, and inclined to be motivated by future images	• The ability to create future images is not universal. • Not all people are motivated by concepts of future states.

Source: Nam (2013) Adapted from Shipley (2002)

The "Collaborative vision building" method can integrate a link to iKnow platform (outcome of FP7 project on foresight http://wiwe.iknowfutures.eu/iknow-description/), which aims at interconnecting knowledge on issues and developments potentially shaking or shaping the future of science, technology and innovation (STI) in Europe and the world.

The iKnow platform is particularly useful at addressing issues that have often remained of the policy radar and, so far, have received little attention in forward-looking activities: the identification and analysis of Wild Cards and Weak Signals (WI-WE) and their effects on European and global science, technology and innovation (STI) policy.

- Wild Cards are the kind of issues that can potentially shape our future.
- Weak Signals relate to issues that are currently shaping it.

iKnow has used Foresight and Horizon Scanning (FHS) approaches to support the research and technology development (RTD) agenda associated with each objective.

Usability and impact

In their study on visioning in Phoenix, Arizona, Iwaniec and Wiek (2014) identified the following impacts:

- A systemic, coherent and sustainable vision
- Building capacity:
    - A professional competency for facilitators
    - A civic and societal capability.

O the process of capacity building Iwaniek and Wiek (2014) state:
"This required pursuing explicit capacity building opportunities. The planners were trained and coached throughout the project in team meetings and workshops. For the capacity building with the general public, the research team developed a progressive model from mapping diversity of preferences (van de Kerkhof, 2006) in early stages (vision drafting) to negotiation and consensus building (Susskind et al., 1999) at later stages (revisions of drafts)."

Required data

Data is collected primarily through stakeholder interviews and working groups / focus groups.

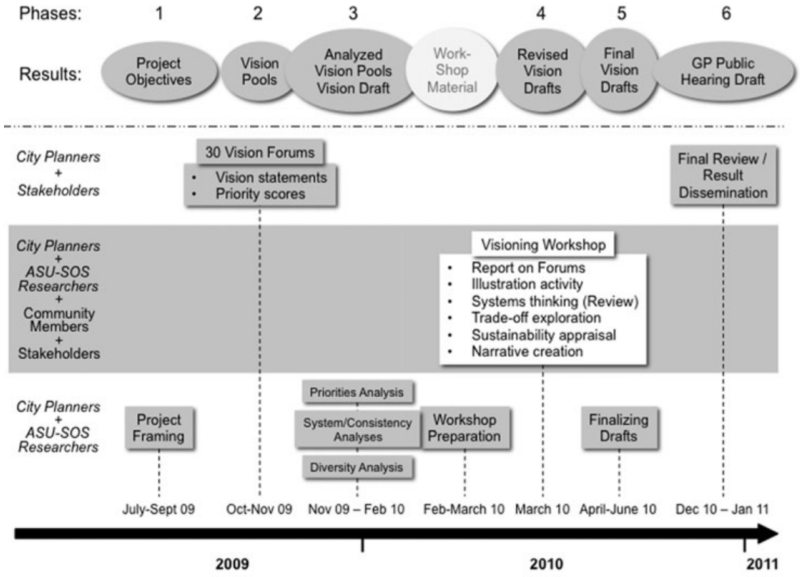
Relevant data sources

1) iKnow report summary: http://cordis.europa.eu/result/rcn/54661_en.html
2) iKnow final report: http://cordis.europa.eu/publication/rcn/14342_en.html
3) iKnow reports:
http://community.iknowfutures.eu/mod/file/all.php?domain=categories&filter=Reports

Implementation roadmap

Iwaniec and Wiek (2014) have adopted a six-phase implementation roadmap for collaborative visioning (Figure 1) which has been used to support of the City of Phoenix's General Plan Update. This approach is based on the SPARC methodology (Iwaniec et al., 2013). As suggested by the iWork experience, ICT-enabled solutions can effectively support and facilitate the implementation of this roadmap.

Figure 1 Storyboard of the Phoenix's visioning process which is based on the six-phases of the SPARC methodology



Source: Iwaniec and Wiek (2014)

Phase 1: Framing the visioning process
The first phase makes it possible to orient and frame the visioning process. *"Framing aspects [includes] process function, domains of interest, temporal scope, spatial boundaries, visioning methodology and participatory design. The main framing [take places] at the beginning, but some framing aspects [can be] reconsidered and revised at later stages"*. Moreover, the framing depends on legislative requirements and the and domains of interest. As suggested by the SPARC methodology, during this phase, public participation should not be considered. Only governmental representatives of the region subjected to the visioning process need to work at this stage (Iwaniec and Wiek, 2014).

Phase 2: Eliciting Vision Statements and Priorities (Vision Forums)
Participatory meetings are organized and conducted *"to elicit and organize vision statements from community members"*. In the case of Phoenix, for example: *"over 750 […] individuals participated in […] 30 Forums (13 – 40 participants/Forum) [which] were public events"*. The meetings should be designed *"to introduce the visioning process, and elicit vision statements as well as priority scores from the participants. After an initial discussion based on the guiding questions […], the core visioning activity"* need to focus the attention on how participants image the region in a distant future. Participants are therefore asked to provide *"future-oriented, value-based statements […]. The vision statements [are] then prioritized in a voting activity"*. Moreover, as suggested in the SPACR methodology, participants need *"to provide overall narratives based on their individual vision statements"*. The finals result should be a list of prioritized vision statements organized by application domain (Iwaniec and Wiek, 2014).

Phase 3: Analysing the vision pools and drafting a vision
During the third phase, the vision statements are *"deconstructed and standardized"*. Looking at the Phoenix example, standardization means: *"for example, the vision statement 'abundance of drought tolerant trees for shade' was assigned the standardized elements: vegetation, xeric, trees, landscaping, water management, shade. Standardized value propositions or 'normative qualifiers' (e.g., abundant, affordable, diverse, responsible, strong, superior) were assigned to each element"*. Therefore, *"a vision element is composed [by] a standardized element and associated value propositions. Descriptive codes [can be] utilized to specify actors' role, impact, location and spatial scale […] Results [need to be] visualized and formulated with the public engagement of the subsequent phase in mind"*. The result of this phase is an initial narrative for the vision (Iwaniec and Wiek, 2014).

Phase 4: Reviewing and revising the vision draft (Visioning Workshop)
A Visioning Workshop is organized to discuss the results achieved during the Vision Forums and collectively revise the draft of the vision. All participants of the Forums are invited to the workshop, however, additional recruitment should be conducted. The workshop starts with a plenary session during which the outcomes of the Vision Forums are discussed and the preliminary city vision is presented. Participants are then divided into small groups coordinated by one or more facilitators. The groups are requested to discuss the draft or specific part of it. The workshop ends with a plenary session with a final discussion of the groups' work. *"Feedback forms [are] collected from the participants"*. The main output of this phase is the final narrations of the vision (Iwaniec and Wiek, 2014).

Phase 5: Finalising the vision
After the Visioning Workshop, a report with the vision is produced (Iwaniec and Wiek, 2014) by the governmental authority.

Phase 6: Final review and dissemination
The final vision is approved and presented publicly (Iwaniec and Wiek, 2014).

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Title of the method: 3.2. Scenario building

Applicable to the RIS3 phase: 3. Strategy formulation – Shared vision

Background and rationale

The scenario method is likely one of the principle concepts and most widely used methods in Foresight. The term scenario was introduced by Herman Kahn in the 1950s in connection with military and strategic studies conducted by the Rand Corporation. Kahn used the term for issues related to US public policy, international development and defense. Shell was a pioneering company in the area of scenario building in 1970s and became the benchmark for corporate scenario planning. Shell's scenario planning enabled it to anticipate the rise and subsequent fall of oil process in 1973.

Scenario building is an exploratory activity for widening the perspective of the involved parties to identify, interpret and anticipate upcoming issues. It can assist them in preparing for potentially surprising developments, stimulating dialogue and forging a common vision between different stakeholders, from both public and private sector.

Scenario building is a bottom-up / participatory exercise to involve the invited participants to develop scenarios, alternative predictions of the future together. Scenarios are commonly formed in a workshop, which is facilitated by a workshop facilitator. Scenario building fosters future-orientation and creativity.

Based on RIS3 mapping exercise (Task 1.2.) scenario building is a common method for RIS3 development (31% of studied 30 regions have utilized it). Scenario building in RIS3 supports also the identification of regional opportunities and risks related to scenarios, and preparing actions for region to realize the opportunities and to minimize the risks.

Description of the method

A **scenario** is a "story" illustrating visions of a possible future or aspects of a possible future. Scenarios are not predictions of the future but rather similar to simulations of some possible futures. Scenarios are used as an exploratory method or as a tool for decision-making, mainly to highlight the discontinuities from the present. They can also reveal the choices available and their potential consequences.

Scenario building starts with determining the scope for work. Which specific question is addressed? What is the time horizon? Who are key stakeholders in the exercise? A relevant question for RIS3 strategy development building is “How the region/nation will develop during the next 20-30 years.” It is important to project far enough into the future. Although it is challenging to project that far into the future, the long perspective also gives freedom for thought in scenario building, as basically anything can happen in that long time frame. Typically, the stakeholders in RIS3 development consist of regional quadruple helix partners of the region (university, industry, public organizations and citizens), possibly also a few key experts outside the region.

The scenario work is typically organized as a one-day workshop. It is also possible to organize it through an online tool. The work starts with the identification of key trends and uncertainties affecting the region in the next 20-30 years. After the identification, the uncertainties are to be ranked according to their level of importance and the level of uncertainty. The focus should be on those that are of high importance and high uncertainty. The main goal (and challenge) is to end-up with just few scenarios that whose difference make a difference for the decision-maker. If only two uncertainties are selected, the four scenarios can be illustrated in a form of a scenario matrix. Otherwise the scenarios can be illustrated through a future map of alternative scenarios.

Once the scenarios have been selected, they must be described and developed. There are five useful criteria that can help in describing the scenarios:

- **Plausibility**: The selected scenarios must be plausible, this means that they must fall within the limits of what might conceivably happen.
- **Differentiation**: They should be structurally different, meaning that they should not be so close to one another as to simply become variations of a base case.
- **Consistency**: They must be internally consistent. The combination of logics in a scenario must not have any built-in inconsistency that would undermine the credibility of the scenario.
- **Decision making utility**: Each scenario, and all scenarios as a set, should contribute specific insights into the future that will allow for the decision focus that was selected.
- **Challenge**: The scenarios should challenge conventional wisdom about the future.

There are many ways to develop scenarios. Typically, it consists of the development of the following features:

1. **A highly descriptive title:** short enough to be memorable, descriptive enough to be transmitting the essence of what is happening in the scenario.
2. **Compelling 'story-lines':** scenarios are narratives of how events might unfold between now and the selected time-horizon. In simple terms the scenario should tell a story that is remarkable, convincing, logical, and plausible.
3. **A table of comparative descriptions:** This provides planners and decision makers with a sort of 'line item' description that details what might happen to each key trend or factor in each scenario. This is to encourage returning to the list of key drivers to ensure their inclusion. As such, the table provides the back-up material that gives the scenarios their nuances and texture.

Finally, as scenarios are ready it is time to begin turning the scenarios into strategy. The scenarios are then analyzed in detail through asking the following RIS3 related questions:

1. What strengths and weaknesses the region has in each scenario?
2. What are the opportunities and threats for the region in different scenarios?
3. What options do the scenarios suggest for the region?
4. What strategies and actions should the region take to realise the opportunities and to minimize the risks present? Which actions are beneficial independent of scenarios?

Usability and impact

Scenario building provides regional partners with increased understanding of the different alternatives for future development and what implications these have for the region. As a concrete result, the regional partners build a common plan how together to prepare for the future.

The key deliverables of the scenario building are 1) scenario descriptions and 2) the plan for the region to prepare for different future scenarios. This plan should be referred and taken into use also in the later stages of RIS3 development in priority setting, action plan implementation and monitoring and evaluation.

When defining the priorities for the region, the decision-makers should look into the scenario descriptions and see how the priorities look like in different scenarios, what scenarios are especially positive for the priority area, which not and why. Then again in the action plan setting, the decision-makers should look at the scenario plan and see what actions from there should be taken to the final action plan in order to work towards the development of a positive environment that takes the region towards scenarios that boost innovativeness related to priority areas. Furthermore, the decision-

makers should monitor the environmental changes, and how these contribute to the development of the certain type of scenarios and what are the related consequences for priority areas.

As a whole, the impact of scenario building for RIS3 is to be able to see different alternatives for future and to prepare for different future scenarios. It supports decision-makers to understand the implications of different scenarios to selected priority areas and the implementation plan, and to adjust the implementation plan if required.

As an example, Helsinki-Uusimaa region has utilized scenarios in the development of the regional plan, and also in the development of smart specialization strategy. Their process has been used as a benchmark in the development of this method description. From this experience, it can be concluded that in relation to RIS3 the key issue apart from in-depth scenario development and descriptions is to make sure that the scenarios are assessed and analyzed together with a wide participation of regional quadruple helix partners. This is to make sure that the knowledge gained from scenario building is actually taken into use in additional steps of RIS3 process when defining RIS3 priorities and their implementation.

Required data

Required data for scenario building:

- List of key trends and uncertainties influencing the future development of the region/nation
- Ranking of trends and uncertainties based on their level of importance and their level uncertainty (scale: high-medium-low)
- Analyses of scenarios, the opportunities in them for the region and the plan to prepare for different scenarios

Key trends and uncertainties can be collected partly prior to workshop through desk research or expert survey. Ranking and assessment of them can be done through expert survey. Forming the scenarios, describing and elaborating on them can be done by members of regional council or other RIS3 facilitators. The analyses of scenarios and their implications for RIS, and developing a shared plan for future preparation can be done in form of a workshop or expert survey.

Alternatively, all the required data may be collected through an online platform involving a Delphi survey to collect it from experts, and a collective assessment of it. The online platform stores this information in an online database and provides basic analytical tools to analyze the trend data, and to build scenarios based on it. Thereafter, the collaborative online tool, utilizing stakeholder inputs, could be used to draw conclusions on scenarios and to develop a plan to prepare for future scenarios.

Relevant data sources

Trend data:

- Statistics (e.g. Eurostat), http://ec.europa.eu/eurostat/web/regions/data/database
- European Cluster Trend Report, https://ec.europa.eu/growth/smes/cluster/observatory/european-cluster-trend-report_en

Data about uncertainties:

- Wild cards and weak signals (iKnow database), http://wiwe.iknowfutures.eu/

The iKnow platform is particularly useful at addressing issues that have often remained off the policy radar and, so far, have received little attention in forward-looking activities: the identification and analysis of Wild Cards and Weak Signals (WI-WE) and their effects on European and global science, technology and innovation (STI) policy.

1. Wild Cards are issues that can potentially shape our future.
2. Weak Signals relate to issues that are currently shaping it

Online forms to develop surveys:

- e.g. Google forms or Webropol, http://w3.webropol.com/news-4/
- eDelfoi, online Delphi survey form

Implementation roadmap

- Determine the scope and the key question for scenario work e.g., the development of the nation/region in the following 20-30 years, select the participants to represent quadruple helix partners from the region, possibly also a few key experts outside the region.
- Collect the input related to the key trends and uncertainties affecting the region, either through desk research, expert survey or a workshop
- Assess the uncertainties based on their level of importance and the level of uncertainty, get the data through expert survey or a workshop
- Formulate scenarios based on the 2-5 uncertainties with highest importance and highest uncertainty. Describe and develop the scenarios to provide the necessary input for understanding them properly.
- Prepare for a scenario workshop or use an online collaborative tool for identifying scenario implications and forming a plan for future preparation.
- Write down the results from the workshop or the online collaborative scenario tool: 1) scenario descriptions and 2) the plan for the region to prepare for different future scenarios
- Incorporate the results of scenario building in the next phases of RIS3 – priority, setting, action plan and implementation, monitoring and evaluation, in order to make sure that the different alternatives of future and the related consequences are taken into account when developing and implementing regional smart specialization strategies.

References

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Examples

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Title of the method: 3.3 Delphi - Foresight

Applicable to the RIS3 phase: 3. Strategy formulation – Shared vision

Background and rationale

The Delphi method was developed by Project RAND during the 1950-1960s. It has been used ever since, together with various modifications and reformulations. Today, the online Delphi method has gained popularity as it makes the data collection and analyses faster and easier.

The Delphi method is typically used when long-term issues (up to 30 years) have to be assessed. It is a useful means of predicting and assessing emerging developments where there is no empirical database, where external factors are likely to have a determining effect and where social arguments may dominate economic or technical considerations.

The goal of a Delphi study is to collect and synthesize opinions from experts in the field and to achieve a degree of convergence. The Delphi method is based on structural surveys. The key features of Delphi survey are giving *feedback,* and the *anonymity* of the participants. Therefore, the experts from the second round are under the influence of their colleagues' opinions, which is what differentiates Delphi from ordinary opinion surveys.

The RIS3 mapping exercise showed that around 24% of studied 30 regions have used foresight related analytical approaches in RIS3 development. Only a couple of countries e.g. Lithuania, Poland and Romania have used Delphi surveys in the development of RIS3 (see references at the end of this document). Lithuania has not specified how they are using Delphi in the referred document, however the Delphi usage of Poland and Romania is briefly described under the title "Usability and Impact" in this document.

Description of the method

The Delphi exercise begins with the selection of the subject for the data inquiry. In the context of RIS3, the method can be used e.g. to scenario building, development of scenarios and the assessment of scenario implications. If this is the selected focus, the first round of Delphi may be used to identify key trends and uncertainties affecting the national/regional development in the next 20-30 years. These trends and uncertainties can be grouped according to PEST categories to be political, economic, social and technological related. Moreover, the experts can be asked to also provide brief qualitative remarks related to the major national/regional implications of the trends and uncertainties they have chosen.

In the second round the Delphi method may be used to rank the trends according to their importance, and the uncertainties according to their importance and the level of uncertainty. It can thus be utilized for defining the bases for scenarios. The aim is to identify the two or three factors that are the most important and the most uncertain. These will be then selected as the scenario axes. The main goal (and challenge) is to conclude with just a few scenarios whose differences can inform the decision-maker.

Typically, the number of participants in Delphi survey is not high, as it is not necessarily meant to produce statistically relevant results. With regard to RIS3, it is important to ensure the participation of different kinds of parties representing all quadruple helix partners. Moreover, before an expert agrees to take part in a Delphi inquiry, he/she should understand the purpose of the inquiry, and should be aware that his/ her expertise should be made available in different rounds of the inquiry. It is preferable that the same person should administer and manage the questionnaire and communicate results to the experts.

With the online Delphi method, the responses of the first round can be either given after or during the first round to the panel members to review. In both cases, it is good to structure the responses and to remove the duplicate responses before providing them in the second round for the experts to evaluate. In the second round, it is also possible to ask for a brief justification from panel members for their opinion. The questionnaire can circulate until a consensus is reached, but a Delphi inquiry should not have more than four rounds.

Usability and impact

The Delphi method forces people to think about the future. In relation to workshops or focus groups, Delphi gives participants the opportunity to think in more depth and gather further information between the rounds. It is an efficient method to develop in-depth analyses, ranking and priority-settings among the experts based on together developed consensus.

Correctly focused, and with the full cooperation of participants, the Delphi method may potentially have a high impact on the quality of RIS3. Special attention is required for the selection criteria of expert participants and to ensure that the participants understand both the purpose of Delphi inquiry and that they are required to participate in all data collection rounds. In the description part, the Delphi method was utilised to collect the input needed for Scenario building and assessment. This is a typical and commonly applied use for Delphi study. Other possible focus areas are for example the below described cases of Romania and Poland, which have applied Delphi study in the connection of smart specialization:

Romania utilized Delphi method in 2013 to assess existing RDI programs, and to evaluate whether these fit with the criteria for smart specialization, and to get argumentation around this. Thus, the Delphi study in Romania was used to:

- narrow down the short list of candidate smart specialization fields
- provide a set of arguments for and/or against the prioritization of several research and innovation fields.

Poland utilized Delphi study to finalize the composition of the Science-Economy-Technology Concordance Matrix for Development and Implementation of Regional Smart Specializations. The in-depth objective of the Delphi survey was the identification and assessment of the strongest connections between science, economy, and key technologies of the region with 5-point Likert scale. Thus, Poland utilized expert survey of Delphi to finetune the development of the concordance matrix around key areas for innovation.

Required data

Key data are collected through expert surveys. Also desk research may be used to provide the initial input for the survey, those for which there are clear evidence existing. Then, the experts may be used to provide additional input for the areas that would not be able easily identified with pure desk research.

Relevant data sources

Trend data:

- Statistics (e.g. Eurostat), http://ec.europa.eu/eurostat/web/regions/data/database
- European Cluster Trend Report, https://ec.europa.eu/growth/smes/cluster/observatory/european-cluster-trend-report_en

Data about uncertainties:

- Wild cards and weak signals (iKnow database), http://wiwe.iknowfutures.eu/

The iKnow platform is particularly useful at addressing issues that have often remained off the policy radar and, so far, have received little attention in forward-looking activities: the identification and analysis of Wild Cards and Weak Signals (WI-WE) and their effects on European and global science, technology and innovation (STI) policy.

3. Wild Cards are issues that can potentially shape our future.
4. Weak Signals relate to issues that are currently shaping it

The data from experts can be collected through an online Delphi tool such as eDelfoi https://edelfoi.fi/

Implementation roadmap

1. Define the purpose of the Delphi exercise in the context of RIS3
2. Create the Delphi survey questionnaire specified to RIS3 purpose to include region-specific statements and questions and adapt the language if needed
3. Select and invite experts to participate in a Delphi survey.
4. Run the first round of survey, process results of first round, provide feedback and then repeat this for second and potentially third round of a survey
5. Process and critically assess final survey results
6. Incorporate the results to RIS3.

References

For-Learn, http://forlearn.jrc.ec.europa.eu/guide/4_methodology/meth_delphi.htm, [viewed 2016-11-08].

Case Examples

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Title of the method: 4.1 EDP focus groups
Applicable to the RIS3 phase: 4. Priority setting

Background and rationale

EDP Focus Groups provide a roadmap for the implementation of EDP, including the definition of industry activities and groups, the selection of stakeholders and business leaders to be involved in the EDP process, 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. The mapping exercise found the following method relevant in the process of identifying priorities for action.

Focus groups are a key method for RIS3 priority setting. The mapping exercise showed that 93% of the selected regions have used this method in refining their priority lists. Moreover, a large share of regions outline this as the only method used during this phase.

Description of the method

EDP Focus Groups are an important tools that public authorities can use for facilitating the EDP's progressive development. These events are instrumental in generating a collective debate, integrating the divided and dispersed knowledge belonging to different actors, and setting common priorities for intervention. The two EDP 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 structure and development process of EDP Focus Groups. Both approaches are discussed in the following paragraphs.

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) began developing its Smart Specialization Strategy (S3) 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 decided to collaborate and develop a series of four EDP Focus Groups, *"each focused on one of the region's S3 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 S3 priorities are Wine, Meat & Dairy, Tourism, and Marble & Non-Metallic Minerals. EDP Focus Groups took place between November 2014 and May 2015. The organization of the four events required 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 1. 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 is composed by two plenary sessions and some interactive parallel sessions (Table 2). The plenary sessions took place at the beginning and end of the event and include *"an introduction to the regional RIS3 and to the project, one or two presentations from reputable international speakers, and time for open discussion".* The parallel sessions cover *"different segments of the value chain of each sector"* and include also *"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 are 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 is selected by considering the need to have *"sufficient time for full parallel discussion [and enhance] the general networking opportunity of the event"*.

Table 1 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)

Table 2 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 optimization of the marble production chain	Management of marble quarries & aggregates - Waste & environmental impacts		

Source: Boden et al. (2015a)

Participants to the parallel sessions are grouped in consideration of their expressed preferences but at the same time there is also a mix of stakeholders from: within and outside the region; different counties; the public and private research sectors; organizations working in different sections of the sector's value chain. Moreover, the groups are set up by considering the knowledge background and skills of each stakeholder to balance the presence of people with different perspectives, which are linked to four areas: policy perspective; strategic perspective; scientific perspective; and technological perspective (Santini et.al., 2016; Boden et al., 2015a).

The parallel sections are composed of five main phases, which are described in Table 3, 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). Moreover, a moderator is assigned to each discussion group and is asked to: manage the debate; report the session's outcomes to the plenary; and carry out some follow up activities. These activities include informing participants about future steps by sending emails and updates on the website of the REMTh's managing authority with information and news related to the EDP Focus Group (Boden et al., 2015a).

Table 3 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)

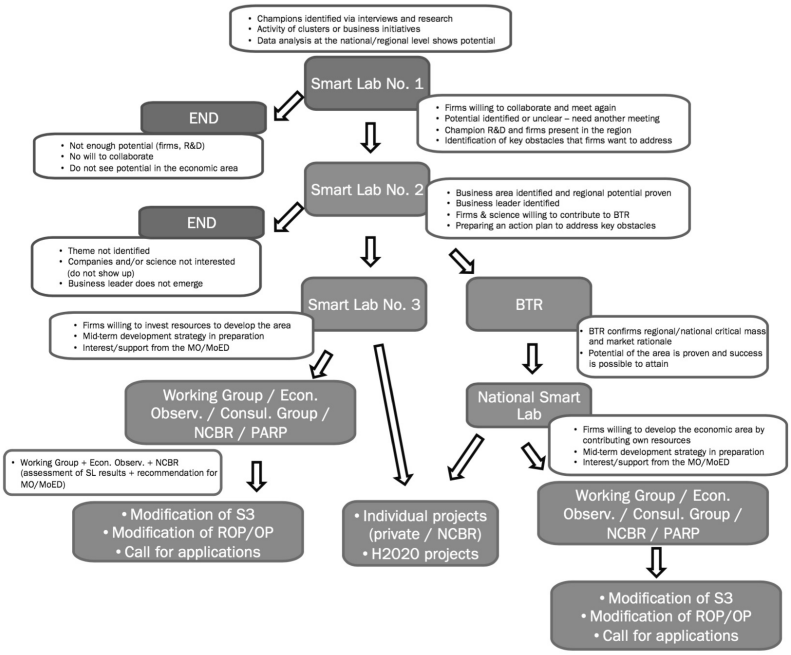
The main outcomes produced by the EDP Focus Groups are a set of entrepreneurial ideas. After the four events, these ideas are systematically collated and then further explored and analyzed during two Project Development Labs and an open online consultation (Haegeman, 2016). As explained by Marinelli 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 S3, ESIF and state-aid regulations, and representatives of regional higher-education and research organizations. 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"*.

Case study 2: Poland

The report published by Piatkowski et al. (2015) shows that in Poland, the World Bank has adopted a similar approach for the implementation of the EDP Focus Groups, called Smart Labs. Even in this case, a preliminary phase based on desktop research is conducted, together with a high number of semi-structured interviews. These activities are aimed at identifying and analysing potential economic areas for Smart Specialization, identify champions and relevant stakeholders with an entrepreneurial knowledge about such areas. Champions represent regional businesses with a high innovation-based growth potential in one of the potential Smart Specialization areas and a strong interest in supporting its development.

The Smart Labs are then implemented to discuss and validate the potential of each business area and prepare a midterm strategy for its future development. This is achieved by following the procedure shown in Figure 1, in which the Smart Lab process is described. Here each potential Smart Specialization's area is explored progressively, thanks to a sequence of focus groups the continuance of which depends on the results achieved with the previous one.

Figure 1 The World Bank's Smart Lab Process.



Source: Piatkowski et al. (2015)

During the first Smart Lab, members define the business area and prepare a SWOT and/or a value-chain analysis (VCA). Moreover, they are asked to identify the key success factors. *"Participating companies are [then] asked to indicate their R&D needs and perceived market trends"*. The answers are used to set up the second Smart Lab, which *"showcases 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 identified by companies participating in the initial [Smart Lab]"*. This second meeting can also be used to better define the purpose of the Smart Lab process and *"should 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) is subsequently prepared by an external expert(s) in collaboration with a [Smart Lab] business leader. The BTR analyzes market and technology trends for the business area and proposes a roadmap for development based on R&D and innovation. The third Smart Lab is organized […] to verify the BTR's proposed development vision for the business area. Additional […] Smart Labs are organized, if needed"*. (Piatkowski et al., 2015).

Each Smart Lab has a maximum duration of four hours, is moderated by a regional consultant, and is comprised of between 15 and 20 participants: 8-10 entrepreneurs, 3 universities/ research institutions, 3 business support institutions, and representatives of the regional and national government. Entrepreneurs are selected considering the champion companies identified during the interview process. Representatives from universities/research institutions are instead selected among those with sufficient experience in working with business. The Labs are attended only by those who have been invited.

The follow up activities implemented after each Smart Lab include: preparing a report with proposals for next steps; publishing the report online to share knowledge even with actors not involved in the Lab; capturing participants' ideas for cooperation and their evaluation of the focus group with a survey.

Usability and impact

The EDP Focus Groups help identify and test potential business areas for Smart Specialization and prepare a midterm strategy for their development by using a bottom-up and participatory approach.

The activities undertaken by World Bank and the JRC-IPST made it possible to codify a possible approach for implementing these events in an effective way, which can be replied in any regional context (Santini et al., 2016; Marinelli et al., 2016; 2017; Boden et al., 2015a; 2015b; Piatkowski et al., 2015). This approach is presented in the final section and is structured combining the insights and empirical knowledge gained from both case studies.

The main impacts generated by using this method are: network building by connecting innovation stakeholders regionally and internationally; raised awareness; increased trust among stakeholders; promoted culture of public-private partnership; increased collective intelligence and social capital; improved capability of a region to move from a holistic strategy to concrete actions by identifying both short term and long-term steps to be taken and the monitoring and impact indicators necessary to continuously assess progress; increased awareness of future investments areas and priorities for action (Marinelli et al., 2016; Piatkowski et al., 2015).

Required data

No specific data to be considered for applying this method is discussed in the current literature. However, based on the two case studies, during the desktop-based research phase, it is important to acquire the data necessary to analyse and select the potential economic areas for Smart Specialization to be discussed during the focus group process and to identify champions and relevant regional, national and international stakeholders with an entrepreneurial knowledge about such areas. This data can be captured by analysing regional statistics and conducting a stakeholder analysis supported by semi-structured interviews, as demonstrated by the Poland case.

Relevant data sources

No relevant data sources can be identified for this method.

Implementation roadmap

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), two possible implementation roadmaps for EDP Focus Groups can be defined. Both roadmaps are explored below and, despite some differences, they present a similar structure which can be spit in three macro-phases: 1. Preliminary research; 2. Implementation; 3. Follow-up activities

Roadmap 1 (JRC-IPST Approach)

Phase 1. Preliminary research

Based on the potential R3 area of the region, a desktop-based research phase is conducted which aims to analyze their value chain and identify both the main topics for discussion and the relevant regional, national and international stakeholders to be invited to participate in the EDP Focus Group process. These stakeholders can belong to industry, academia and national/regional administrations. These activities are implemented for each R3 area that needs to be subjected to a thematic EDP Focus Group. After being identified, the stakeholders are contacted to establish their willingness to participate. The template-agenda described in Table 1 is used to plan each thematic EDP Focus Group. A moderator for each parallel session of the event is identified and a set of guiding questions is set up for each parallel session to guide the debate and stimulate participants in proposing ideas.

Phase 2. Implementing the thematic EDP Focus Groups - Part 1

The 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 of actors from: within and outside the region, and different countries also; public and private research sectors;

organizations working in different sections of the sector's value chain. 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 and two days.

Phase 3. Implementing the refining EDP Focus Groups - Part 2

The ideas acquired during the thematic EDP Focus Groups are systematically collated and further explored and analyzed during two transversal meetings. During these meetings, 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 get new suggestions not only from participants but also from those actors which have not been directly involved in the EDP Focus Groups process.

Phase 4. Follow-up activities

Reports are produced and shared online. Participants are informed about future steps via email, and updated with information and news related to the EDP Focus Groups using digital tools. Participants' evaluation of the EDP Focus Groups is captured with a survey.

Roadmap 2 (World Bank Approach)

Phase 1. Preliminary research

A preliminary research phase is conducted based on desktop research and interviews. The goal of this phase is to: identify and analyze potential R3 actors; identifying business champions and other relevant regional, national and international stakeholders belonging to industry, academia and national and regional administrations to be invited to the EDP Focus Groups. These activities are implemented for each R3 area that is to be subjected to a specific EDP Focus Group. After being identified, the stakeholders are contacted to establish their willingness to participate. Only a restricted number of actors are invited to participate. The ideal group is composed of 15-20 participants: 8-10 entrepreneurs (business champions), 3 universities/research institutions, 3 business support institutions, and representatives of the regional and national government.

Phase 2. Implementing the EDP Focus Groups

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 halted 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 establish 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 should 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.

Phase 3. Follow-up activities

A report with proposals for next steps is produced after each EDP Focus Group and published online to generate public knowledge and reduce the coordination failure among the sector's stakeholders. Next steps are clearly communicated to participants, and their evaluation of the EDP Focus Group is captured with a survey.

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Title of the method: 4.2 Extroversion analysis
Applicable to the RIS3 phase: 4. Priority setting

Background and rationale

The main objective of the priority setting phase in RIS3 is to identify areas that present a competitive advantage for the region in focus; this exercise will facilitate a highly targeted channelling of resources towards investments that present the highest potential for positive impact on smart specialisation at a later stage of the S3 strategy (Foray et al., 2012). To this end, extroversion analysis is a method applied in order to detect possible industry sections in which the region already presents increased extroversion and/or accordingly possesses increased future potential. Extroversion, in this exercise, refers to the characteristics and specifications of a region's trade connections with other regions. On the Smart Specialisation Platform of the Joint Research Center (JRC) there already exists a tool for extroversion analysis, titled 'S3 Inter-regional Trade and Competition Tool'. This tool has been jointly developed by the Joint Research Centre, the European Commission's in-house science service and the PBL Netherlands Environmental Assessment Agency (Thissen and Gianelle, 2014).

Description of the method

Extroversion analysis is an important methodology for priority identification because it contributes to the definition of concrete and achievable objectives. It helps to determine the areas of present competitive advantage and regional excellence potential (Foray et al., 2012).

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 with enable the development and advancement of economies of scale and scope, as well as local knowledge spillovers with regards to the selected sectors. The presented sectors/areas must not be too broad or generic (for. ex. agrifood, tourism or healthcare), but they should rather be more precise and, if applicable, cross-sectorial (Foray et al., 2012). A vis-à-vis comparison of the region with its other competitors, included in an extroversion analysis, is also very important, because it allows us to apprehend the potential of the region's outward elements in absolute terms (Gianelle et al., 2014a, Gianelle et al., 2014b). Key questions addressed by the extroversion analysis method include (Thissen et al., 2013):

- What are the links of regional economies with other regional economies in terms of global trade? Are there pronounced or underlying trade patterns?
- Where are the products produced in one region consumed? In the same region, a nearby one, or a remote one?

It should be clarified here, that although all of the following methods represent the 'external' dimension of the region, Extroversion analys differs from value chain analysis and collaboration and networking analysis. It is also different from product-space modelling, as it refers to the current status of the region's extroversion.

Extroversion Analysis should respect the key criteria for selecting a limited number of priority areas that demonstrate increased potential for smart specialization. According to the RIS3 Guide (Foray et al., 2012), these criteria include:

- the existence of key assets and capabilities, including specialized skills and labor pools for the area selected, and ideally, a novel combination among these, for example cross-sectorial and cross-cluster
- the diversification potential of these sectors, cross-sectors and domains

- critical mass and/or critical potential within each sector
- the international position of the region as a local node in global value chains

With regard to extroversion analysis, a key challenge to address is the absence of the necessary data to reflect bilateral relationships of regions (i.e. between regions) in terms of trade. Given the fact that extroversion analysis targets the characteristics and specifications of a region's trade connections with other regions, there is a major information gap with respect to the data needed, hindering the ability to arrive to a comprehensive mapping of inter-regional flows of goods (as well as knowledge and human resources). In most cases, trade flow data are available only at the national level. Unilateral regional trade flow data are of no use either, if there is no data from other regions to compare it with. Some answers to the above challenges however, have been provided by researchers who have attempted to perform analyses related to extroversion using indirect methods for filling the information gap.

The research of Thissen et al. (2013) is predominantly built an analytical methodology for mapping regional trade in Europe, which is suitable for use in regional development analysis and predominantly smart specialization strategies. In detail, Thissen et al. (2013) developed a methodology for mapping interregional trade between 256 EU NUTS2 regions for the year 2000. Their methodology stays as close as possible to observed data, without imposing geographical patterns. For their methodology, they combined several different data sources (for example national accounts' Supply and Use Tables), which they first regionalised and normalized to ensure consistency, credibility and sense-making. Their method provides results about regional trade flows (imports and imports), consistent with national accounts, regional accounts, and international trade flows, and is substantiated through interregional flows for 59 product categories including services.

A parallel methodology for identifying and comparing inter-regional trade networks of agricultural and processed food products in the EU25 (250 NUTS2 regions) was used by Gianelle et al. (2014a) and Gianelle et al. (2014b). The goal of their proposed methodology was to provide a basis for the analysis and comparative assessment of regional economies and their embeddedness in inter-regional and international trade networks. The tool (Thissen and Gianelle, 2014) determines not only the economic strength of a region with different EU markets, but it also allows the identification of competitor regions.

The Extroversion Analysis method can vary from simple to very sophisticated. Possible features to be calculated for a region include:

- Competition, i.e. with which regions the region under focus competes, on what (i.e. which sector), and where it stands comparatively with its competitors (i.e. its rank)
- Regional trade flows (imports and exports) between regions, and possibly distinguishing trade flows between regions of the same country and with other countries

Trade network features, for example the variety of export markets served, the magnitude of the region's exports in the EU market, analogies of exports/import characteristics, the participation in trade clusters of specific characteristics.

Usability and impact

Extroversion analysis is an important methodology in the context of the RIS3 Step "identification of priorities" because it contributes to the definition of concrete and achievable objectives. It is a kind of analysis which is substantial for RIS3, as RIS3 by definition represents a **highly targeted and selective** type of research and development strategy for regional innovation (Gianelle et al., 2014a, Gianelle et al., 2014b). Hence extroversion analysis contributes substantially to the identification of areas of present and future competitive advantage and regional excellence potential (Foray et al., 2012).

Furthermore, RIS3 emphasizes the **outward dimension** and **external affairs** of the region in focus, both in national and international frameworks. RIS3 specifically calls for the enforcement of a region's position within interregional value chains, international collaboration and regional economic specialization in sections that are promising in terms of value added. Regional connectivity relates to, among others, transactions associated with trade, transportation and financial flows that start, pass through, and end in a region (McCann and Ortega-Argilés, 2015). In addition, by contributing to the appointment and exploitation of regional competitive advantages, Extroversion Analysis contributes to the prioritization and channelling of public investment in sectors that exhibit increased potential for innovation and regional cash flow generation. It enables insights in potential areas of technology diversification, and attraction of international investment (Gianelle et al., 2014a, Gianelle et al., 2014b).

Overall, Extroversion Analysis is a methodology which is useful for developing more successful RIS3, taking advantage of inherent potential, capitalising on synergies among sectors and regions, and ultimately enforcing the economic position of a region within the globalized web of interregional economies and connections.

Required data

The basic requirement in terms of data for the application of the Extroversion Analysis method is trade between regions on the EU (and global) level. Although Eurostat publishes key regional statistics on a wide breadth of subjects, there is no published data on trade between regions. In addition, there is no data comprehensively describing interregional trade flows in terms of product categories, either. Although some regional trade data about specific sectors is available (for example agriculture), overall there is no comprehensive matrix representing all trade flows in Europe (Gianelle et al., 2014a, Gianelle et al., 2014b, Thissen et al., 2013).

Relevant data sources

Relevant data sources include:

- International trade in goods based on the data collected by Feenstra et al. (2005)
- Data on services based on Eurostat trade statistics taken from the balance of payments (Eurostat, 2009a)
- National Supply and Use Tables, providing information on total imports and total exports, per product (Eurostat, 2009b)
- COMTRADE database, United Nations Statistics Division (UNSD) - http://unstats.un.org/unsd/comtrade
- Data on regional production, investment and consumption (Cambridge Econometrics, 2008)
- Freight transport data from the Dutch Ministry of Infrastructure and the Environment (2007)
- Business flight data from MIDT (2010)

Implementation roadmap

Step 1. Selection of Region to be analysed for extroversion. The user selects the EU Region to be analysed in terms of extroversion.

Step 2. Selection of year of reference. The user selects the reference year for which the Extroversion Analysis will be performed.

Step 3. Selection of extroversion-related business sector. The user selects one of the extroversion-related business sectors for which the extroversion analysis will be performed (for ex. regional production, food, agriculture, financial and business services, high-tech manufacturing, medium-tech manufacturing, low-tech manufacturing, chemicals, electrical devices, machinery)

Step 4. Selection of function to be performed in the framework of the analysis. The user selects one of the functions related to the Extroversion Analysis to be performed (for ex. Competition, Regional Trade flows -imports and/or exports-, Trade network features).

Step 5. Description and interpretation of Extroversion Analysis results. The user is asked to describe and critically interpret the results of the Extroversion Analysis with respect to each region, year, sector, function etc.

Step 6. Regional Extroversion overview. The user provides an integrated overview of the region's extroversion, and points to overarching strengths, weaknesses, opportunities and threats. This step requires critical thinking and interpretation on the side of the RIS3 developer.

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Title of the method: 4.3 Related variety analysis
Applicable to the RIS3 phase: 4. Priority setting

Background and rationale

Related variety is a key concept in evolutionary economic geography that links knowledge spillovers to economic development, new growth paths and economic renewal (Asheim et al., 2011). It refers to the variety of industries within a region that are cognitively related (Frenken et al., 2007) and maximise the potential for learning opportunities and growth of existing industries as well as the local sources of growth for new industries (Boschma, 2014).

The concept of related variety has been developed in the recent literature as an attempt to respond empirically to the controversy known as MARS versus Jacobs, i.e. the theories of Marshall-Arrow-Romer on agglomeration externalities based on specialisation (localisation economies) that view spillovers to occur mainly within a single industry, versus Jacob's theory of external economies being more evident in places where there is a variety of sectors (inter-industrial spillovers) (Glaeser et al., 1992). Localisation economies generally arise from labor market pooling in a given sector within a given area and subsequent increases in labour productivity in that specific sector which allow the emergence of knowledge spillovers. Jacob's externalities, on the other hand, emerge due to savings in large-scale institutional operations (urbanisation economies) and the interactions among firms in different sectors that are in close geographical proximity to each other. Such interactions allow for the recombination of knowledge, ideas and practices among heterogeneous industries.

Frenken et al. (2007, 688) argued that spillovers within a region are expected to primarily occur "among related sectors, and only to a limited extent among unrelated sectors". Jacob's view of innovation is closely linked to Schumpeter's concept of recombining pre-existing knowledge or artefacts in novel ways to create new products and services. In this sense, inter-industry spillovers are expected to be present mainly among sectors that draw on similar knowledge (either this refers to technology, to markets, institutional conditions, etc.) or have some degree of cognitive proximity (related variety) that will secure effective communication and interactive learning (Nooteboom, 2000).

The discourse on related variety also evolved around the relation of sectoral variety (unrelated variety) and regional economic resilience. Derived from business economics and portfolio theory, the existence of sectoral diversification reduces the risk of interdependent, sector-specific asymmetric shocks that trigger long term unemployment and economic decline (Boschma and Iammarino, 2009; Bristow et al., 2010).

In the recent literature, related variety associated with Jacobs-type externalities among related sectors appear to have a significant effect on regional employment growth and economic development (Frenken et al., 2007; Boschma and Iammarino, 2009; Neffke et al., 2011, Van Oort et al., 2013). Although empirical studies on unrelated variety provide mixed results (Content and Frenken, 2016), one should take into account not only quantitative approaches using indexes, but also qualitative studies on economic crisis and the resilience of regions.

Based on this discussion, the main question that arises is this: what is the best possible composition of industries within a region that will create most spillovers and will secure stability and economic growth?

Description of the method

Related/ unrelated variety is a relatively new concept to the scientific discourse and –so far- there is not a perfect way to measure it with the data that are already available at a cross-regional level. Existing measures of inter-industry relatedness include –but are not limited to- entropy indicators based on SIC-codes, co-occurrence of products within firms, input-output linkages (e.g. trade data)

and the intensity of labour reallocation between industries (Boschma and Gianelli, 2014). Below, we provide a brief review of the main indicators used in empirical studies, along with some comments on their pros- and cons- and we continue with the selected indicator for the development of the online tool for the ONLINE S3 exercise.

Empirical measurements

At an empirical level, related variety has been mostly measured through country-level studies, and less in wider areas, mainly due to data limitations[33] (Van Oort et al., 2015). Frenken et al. (2007) in their seminal study measured related variety as the average entropy across employment in five-digit industries within each two-digit class using the Standard Industrial Classification, and unrelated variety as the entropy in employment across two-digit classes. Applying these measures to 40 Dutch NUTS3 regions they find that related variety positively affected employment growth and that unrelated variety was negatively related to unemployment growth. Other studies show the same results on other growth-related indicators such as value-added growth (Boschma et al., 2012) and labour productivity (Boschma and Iammarino, 2009).

Boschma and Iammarino (2009) estimate related variety by means of sectoral (3-digit) trade data in Italy by country of destination/origin, using data from ISTAT. They argue that extra-local linkages are essential in bringing new knowledge into the region, a fact which has been overlooked by the MARS vs. Jacobs literature. Their findings show that related variety (both at the regional level and through inter-regional trade linkages) positively affects regional growth although related and unrelated variety per se, do not affect regional growth.

Van Oort et al. (2015) extend the study of related variety to a pan-European level where they also distinguish between smaller and larger regions to account for differences in agglomeration forces. They conclude that variety has a positive effect on employment growth especially for small and medium sized urban regions.

Alternative measures of related variety include branching studies such as Hidalgo et al. (2007), which argues that the existence of exporting capabilities of a country/region in a specific group of related products increases the potential to export a related product that does not export yet. The difference here is that the focus is not on aggregate regional growth but on explaining the diversification into new products and industries. This increasing literature of studies (Klepper and Simons, 2000; Tanner, 2011; Neffke et al., 2011) showing that new industries branch out of existing related industries and that this branching process increases the possibility of new industries to survive has received attention. Finally, another method has recently been applied to measure relatedness (skill-relatedness) via the number of people changing jobs between two industries (Neffke et al., 2011, Neffke and Henning, 2013).

Although the abovementioned studies vary widely in their approach, for example, in terms of time period covered and spatial scales examined, as well as in terms of measures of relatedness and control variables, they seem to conclude that related variety has a positive effect on economic growth. There is also both quantitative and qualitative evidence collected through case studies, that technological competences accumulated through time affect diversification opportunities over time (Boschma and Gianelle, 2014).

Related/ Unrelated variety indicators

From the above exercise it is evident that the measurement of a region's diversification over sectors is sensitive to the indicators applied. Existing measures of related variety present drawbacks as they lack systematic measurement in low levels of spatial analysis, or they over-emphasise industrial over service sectors (Frenken et al., 2007). However, following the majority of the empirical works, we will use an entropy measure, which can be decomposed at each sectoral digit level.

[33] For a detailed review of the empirical studies see Content and Frenken (2016) and Content et al. (2016)

The index will compare 2-digit and 5-digit sector shares (%) and will estimate the entropy index for a regional / national entity. Assuming that all five-digit sectors i fall under a two-digit sector S_g, where g=1, …, G, we derive the two-digit shares P_g, by summing the five-digit shares p_i:

$Pg = \sum_{i \in S_g} p_i$ and that $H_g = \sum_{i \in S_g} \frac{p_i}{p_g} log_2(\frac{1}{\frac{p_i}{p_g}})$,

$RV = \sum_{g=1}^{G} P_g H_g$,

$$UV = \sum_{g=1}^{G} P_g \, log_2(\frac{1}{P_g})$$

In this context, the method will allow for calculating the Related/Unrelated variety entropy indexes. Related variety is concerned with the concentration of industries that present some form of similarity, It stimulates economic growth because it enhances effective interactive learning and innovation.

Unrelated variety concerns sectors that have no substantial complementary competences. They are beneficial for economic growth because they spread risks of sector specific shocks.

Usability and impact

Related variety has been used as a method to define regional diversification or the degree to which a region's different industries have commonalities that allow knowledge exchange and spillovers to occur. RIS3 strategies are promoting regional diversification in that they assist in developing new areas of specialisation and new growth paths for the future (Boschma and Gianelle, 2014). Both concepts focus on relatedness in order to identify unused potentials and promising activities, while they also promote policies adjusted to the specific needs and available resources of the regions (Boschma, 2014).

In terms of policy making, the concept of related variety was used as an attempt to identify pathways to innovate and construct regional advantage in non-high tech regions which benefit less from policies that focus on R&D. Within the smart specialisation policy context, related variety is about learning and focusing on the context-specific intangible assets of a region, as existing specialisations and knowledge bases in a region provide the options for future diversification, while also bringing together industries and other areas of expertise (Boschma, 2014). At the implementation phase, related variety is a key method for assessing the potential industry branching towards new activities and niche markets.

Given that, 'the theoretical notions of specialisation and variety seem too simplistic to capture the varied effects of an economy's composition on its further development' (Content et al., 2016), the degree of related variety should be considered along with a number of different tools that provide information in relation to the level of connectedness of a region, specialisation analysis, a detailed analysis of the economic history of a region etc.

Required data

Relevant data to measure industrial specialisation in terms of related variety is any system that classifies industries by –at least- a four-digit code. Such systems include:

- the Standard Industrial Classification (SIC) code system that classifies industries by four-digits
- The North American Industry Classification System (NAICS code) that classifies industries by six-digits

The International Standard Industrial Classification of all economic activities (ISIC), the international reference classification of productive activities into four digit classes.

Relevant data sources

A number of existing databases and tools relevant for the application of the methods' indicators are listed below:

- National Statistical Offices
- Geo-coded AMADEUS micro data (provided by Bureau van Dijk) on European firms aggregated into European regions
- European Regional Database of Cambridge Econometrics
- Eurostat
- OECD database
- LISA database on employment data
- UN Comtrade

The analysis is based on the data used by existing empirical studies and does not necessarily reflect availability.

Implementation roadmap

Implementing a tool on related variety means to create and use of a tool that estimates regional specialisation in technologically related sectors. The outcome should not only provide numerical answer on the fields and levels of specialisation among related sectors but should give a schematic representation of the connections among industrial sectors. The process for implementing such a tool is the following:

Step 1. Selection of an area of analysis
Select areas of interest and level of analysis as related specialisation in lower spatial levels provide different results.

Step2. Automatic data collection and data normalisation
Examine non-normality of variables and perform the necessary corrections and transformations (log-transform or correct outliers). The step is conducted automatically by the tool without intervention of the user.

Step 3. Calculation of related/unrelated variety indexes
Calculate the indexes for the selected area based on the available data.

Step 4. Visualise results
Demonstrate results in terms of statistical information, network graphs and figures.

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Title of the method: **5.1 RIS3 intervention logic**
Applicable to the RIS3 phase: **5. Policy mix – Action plan implementation**

Background and rationale

Intervention logic is a representation of clear and well-thought-out understanding how planned policy actions are expected to lead to desired outcomes. By identifying causal links among inputs, activities, outputs, and longer-term outcomes of a specific policy intervention, it allows to develop a more comprehensive theory of change. Essentially, the intervention logic clarifies how a change induced by policy action at the micro-level (e.g. firms, households) leads to a desired change at a higher-level (e.g. specific sectors, whole economy), and eventually how this change contributes to the achievement of strategic goals at regional or national level.

Smart specialisation represents a complex policy intervention with the aim to foster regional/national economic transformation. Hence it is important for the regions to carefully design their RIS3 intervention logic linking objectives, targets, inputs, actions, outputs, results and longer-term outcomes. The building of this logical model is particularly important to define further a tailored RIS3 monitoring and evaluation (M&E) framework, which has been set as an ex-ante conditionality for receiving ESIF support. "Explicitly identifying expected changes is equivalent to setting specific objectives for the RIS3 and is hence a fundamental element of the monitoring system" (Kleibrink et.al., 2016). There is an inherent correlation between an intervention logic and the design of M&E framework. On one hand, intervention logic forms a skeleton for M&E system; on the other hand, findings from continuous monitoring and evaluation exercises feed back intelligence that may alter the initial assumptions about certain causal links and thus call for adjustments in the defined theory of change of RIS3.

Regarding the current approaches to RIS3 intervention logic design, it appears that there are important gaps in the existing practices to devise sound theory of change for smart specialistion. The mapping exercise results show that intervention logic charting exercises during a policy mix design phase have been highlighted only by around 40% of the selected regions. Given that intervention logic should form the backbone for setting the overarching goals of smart specialisation, this seems to be a surprisingly small share. Either regions are not well acquainted with the approaches to intervention logic design or they do not explicitly document their assumptions about causal chains of RIS3 policy intervention.

A recent study (Kleibrink et.al., 2016) has looked at the issue how regional and national policy-makers in charge of RIS3 perceive the constituent elements and functions of monitoring. In the scope of this study a comprehensive survey among policy makers has been carried out, including also issues about intervention logic set-up. The study team obtained 96 complete responses, 80 from regional policy-makers representing 68 regions, and 16 from national policy-makers representing 12 countries in Europe, corresponding to a total response rate of 22%. The survey results indicated that there is a diverging pattern among regional and national policy-makers in describing the RIS3 intervention logic. "At the regional level, the majority of respondents (64%) report a direct link between the expected changes identified in the strategy and each of the RIS3 priorities. This result is consistent with an intervention logic that is highly priority specific, which accords with the smart specialisation approach. At the national level, respondents related expected changes only to overall RIS3 objectives, showing that national RIS3 are mostly not priority specific" (Kleibrink et.al., 2016).

Moreover, the study results showed that "only 26% of regional and 19% of national respondents made an explicit connection between result and output indicators, despite evidence of their understanding and application of the RIS3 logic of intervention" (Kleibrink et.al., 2016). The authors point that, if this indication is confirmed, it means that there is an incomplete understanding or misinterpretation of the policy logic of intervention among regional and national policy makers that goes beyond the context of smart specialisation. The weak monitoring of the last phase of policy cycle means that there is no robust 'implementation theory' yet in place (Weiss, 1998).

Description of the method

Designing intervention logic starts with understanding both the problem to be addressed and the desired outcomes to be achieved, specifying the program logic, and building stakeholder consensus related to this theory of change. Once this agreement is in place, stakeholders can focus on selecting appropriate indicators to measure intended outputs and outcomes, setting baseline and target values, and exploring the relevance of available data and data collection methods.

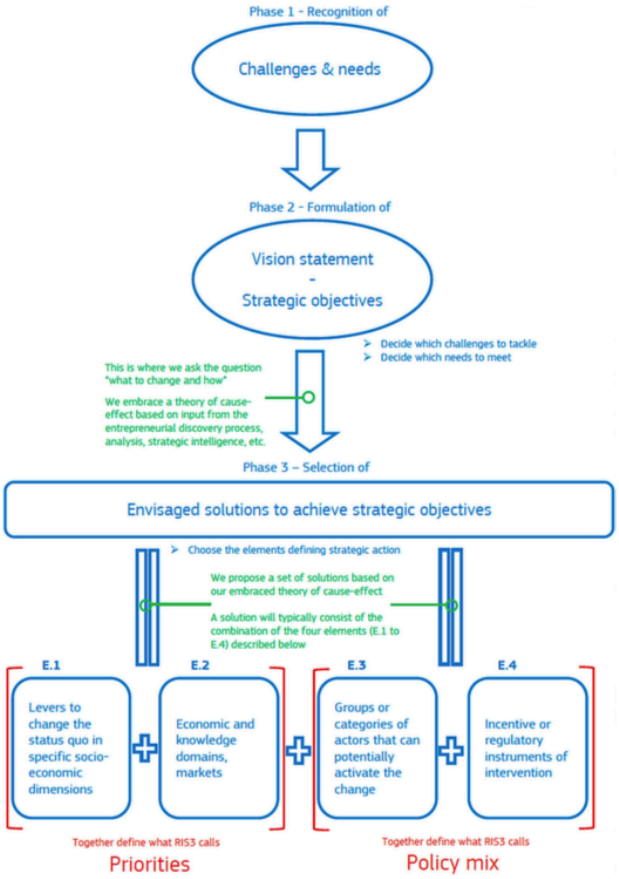
In order to communicate the logic of intervention, the visual representation of the intervention can take various forms. The design should help practitioners understand not only the intended outcomes of an intervention but also the inputs and activities needed to achieve them. An intervention logic can be designed as a series of boxes (inputs->processes->outputs->outcomes->impacts), a table, a flowchart, or even a circular sequence.

Gianelle and Kleibrink (2015) have made the first effort to conceptualise the RIS3 logic of intervention by identifying the key building blocks and setting out their causal logical linkages (see Figure 1). They highlight three phases that constitute the minimum necessary steps of any strategic approach:

1. Detection of needs and challenges, i.e. identification of problems - Phase 1
2. Decision on the desired transformations, i.e. selection of the most urgent needs and their reframing in terms of strategic objectives - Phase 2
3. Definition of the responses to put in place in order to meet the objectives, i.e. formulation of solutions to selected problems - Phase 3.

Further the authors elaborate that "the responses to meet strategic objectives consist of specific combinations of four elements: (E.1) levers to change the existing state of affairs in specific socio-economic dimensions; (E.2) economic or knowledge domains, specific markets; (E.3) groups or categories of subjects that can potentially activate the change; (E.4) economic or regulatory instruments of intervention" (Gianelle and Kleibrink, 2015). Figure 2 provides a practical example of this conceptualisation of an intervention logic by applying it to agro-food sector.

Figure 1 The logic of intervention in innovation strategies for smart specialisation



Source: Gianelle, C. and Kleibrink, A. (2015)

Figure2 An illustration of the logic of intervention in agro-food

Phase 1 – Recognition of challenges and needs

Economic stagnation; predominance of traditional SMEs with limited presence in international markets; unexploited potential of internationally renowned territorial assets

Phase 2 – Formulation of strategic objectives

Address specific bottlenecks preventing access to international markets: increase diffusion of frontier technologies in traditional SMEs to lower production costs and enhance territorial branding

Phase 3 – Selection of possible solutions to meet the objectives

PRIORITIES		POLICY MIX	
E.1 Levers	**E.2 Domains/Markets**	**E.3 Actors**	**E.4 Instruments**
Process innovation to enhance fresh products preservation	Agro-food	SMEs; R&D centres	Vouchers for accessing high-value-added R&D services; competitive grants for SME consortia + R&D centres

Source: Gianelle, C. and Kleibrink, A. (2015)

To facilitate the process in defining causal links and ensuring that policy measures are coherent with the vision and objectives of the region/country, an information support tool will be developed. This tool will categorise all possible types of policy measures relevant to RIS3 implementation, specifying respective beneficiary target groups and possible effects (outputs, results and longer term outcomes).

A dashboard type of functionality will enable regional and national policy makers to steer the design of an intervention logic for each specific priority. It will allow to select priority domains/markets and, using an online guidance with key questions and issues to be considered, help define specific lever(s) in these priority domains. Further, taking into account the information on the enlisted effects of all types of support measures, users will be able to add policy instruments tailoring a specific policy mix to influence the identified lever(s). The intervention logic design dashboard should be easily extracted as PDF and Word files enabling communication of the rationale behind RIS3 policy intervention among all involved stakeholders. The tool should form an integral part of approaches developed under 6.1 RIS3 monitoring and 6.2 Definition of RIS3 output and result indicators.

Usability and impact

Charting of RIS3 intervention logic should form the backbone of policy approaches for steering smart specialisation, yet as the available evidence indicates there is still an incomplete understanding or misinterpretation of the policy logic of RIS3 intervention. The application of the intervention logic information tool should help to elucidate to regional and national policy makers possible logical linkages among the identified priority sectors, key levers, main actor target groups and eventually the specific policy instruments. This support will help to make RIS3 policy assumptions more explicit. Clearer and more detailed intervention logic models will help RIS3 managers to 'plan with the end in mind', rather than just limiting their focus on inputs, implementation activities and immediate outputs.

Using the logic model policy makers can also more easily back cast the intended results and longer-term outcomes of a particular support programme (e.g. during a mid-term evaluation) and identify the necessary corrective actions to achieve all desired results. In other words, intervention logic together with a feedback loop from M&E system serves as a living management tool fostering consensus on planned activities, guiding corrective actions, facilitating the coordination of development efforts, charting the course for achieving strategic objectives, and ultimately serving as key accountability instrument to RIS3 stakeholders and wider society.

Required data

To build the envisioned information tool and dashboard for RIS3 intervention logic design, there is a need to have a list of all priority sectors/domains selected by European regions. The current Smart Specialisation Platform tool – Eye@RIS3 - that maps the selected RIS3 priorities still categorises them according to traditional industry classifications. There is a need to explore, if more fine-tuned classification that includes also cross-sectoral and emerging industries can be devised.

The tool requires a listing of all relevant policy measures used to support research, development, innovation, entrepreneurship, higher education and skills development. Moreover, there is a need to compile concise and coherent information on evidence of possible outputs, results and longer-term outcomes of each type of support measures. The effects of specific policy intervention obviously differ across various contexts and are influenced by a diverse set of framework conditions, yet results of decades long evaluation exercises across the world can give sound indications on the type of effects that generally can be expected from various policy support measures.

Relevant data sources

The list of new cross-sectoral and emerging industries should be aligned with the **European Cluster Observatory** categorisation and other policy monitoring tools of DG Growth.

Science and Innovation Policy Evaluation Repository (SIPER) is a database consisting of science and innovation policy evaluations from across the world. SIPER is run by a team based at the Manchester Institute of Innovation Research and it gathers a comprehensive repository of evidence on effects of wide range of RDI policy support measures – http://datasets.risis.eu/metadata/siper. Various guidance documents, e.g. those commissioned by DG Regio http://ec.europa.eu/regional_policy/en/policy/evaluations/guidance/#4, can be used to construct necessary information for policy mix design.

Implementation roadmap

1. Develop an elaborated list of RIS3 priority areas/domains
2. Develop a guiding questionnaire for helping users to define specific levers within RIS3 priority areas/domains
3. Develop a full list of most frequently used policy support measures in support of research, development, innovation, entrepreneurship, higher education and skills development
4. Gather and categorise evidence base on possible effects of each support measure type.

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Title of the method: 5.2 RIS3 action plan co-design
Applicable to the RIS3 phase: 5. Policy mix – Action plan implementation

Background and rationale

Broadly speaking, co-design is a method for the creative practice, and is also known as participatory co-creation and open design process. Moreover, the method goes **beyond consultation by creating and deepening collaboration** among citizens attempting to resolve a challenge. It is crucial that the users are **willing to share their experience within the design process**. The e-democracy concept – a web-based concept for co-creation, intended ot support democratic decision making, has been discussed more and more over the last ten years for various reasons (Macintosh, 2004). Many citizens are questioning traditional forms of democracy and thus want the policy-making processes to be more innovative and "co-design-driven". Moreover, the demand for being more intensively involved appears to be on the rise. Additionally, it is vital to encourage democratic societies to share different views and opinions of active citizenship by direct involvement and engagement via co-designing (Tuzzi et al., 2007). E-participation is beneficial to e-government since it is linked to the relationship between government and citizen. (Lironi, 2016).

In line with the latest report of The World Bank (2016) this co-design / crowdsourcing method can be used to collect and merge data within RIS's entrepreneurial discovery process to focus on the policy mix. The method's primary concept facilitates the idea behind crowdsourcing and is intended to be quick, efficient and simple. As recommended by The World Bank (2016) the method encourages a culture of a public–private dialogue, expands public administration's online presence, including in social media, and facilitates the collaboration among stakeholders.

Description of the method

The method co-design boosts the involvement of different individuals to deliver a final outcome. Therefore, the method begins with an underlying concept for which the users co-operate:

- a definition of what the system does,
- a development process, and
- a definition of the expected outcome (Sherriff, 2015).

Furthermore, the users should be committed to the co-production process, since the users have different roles at different stages of the design process (Sherriff, 2015).

Key issues for the method co-design (Sherriff, 2015):

- *Participation*: co-design represents a collaboration.
- *Development*: co-design is a process of development for exchanging information and know-how continuously.
- *Ownership and power*: co-design moves power towards the process. The generation of a framework, which describes the required balance of rights and freedoms among users, is required. This will help to establish a sense of collective ownership of the challenge to overcome.
- *Outcomes*: co-design actions are creative, practical, and outcome-oriented. Defining objectives plays a key role.

Clear definitions for co-design do not exist, especially for government service delivery. Nevertheless, for instance regarding smart cities, **co-design can be viewed as** (Sherriff, 2015):

- focusing on stakeholder needs instead of what technology can do to,
- reforming services, and
- engaging stakeholders in a specific way.

Moreover, **co-design is characterized by three dimensions** (Sherriff, 2015):

- *horizontal movement*: cooperating with colleagues from parallel organisations in the same region or in another.
- *vertical movement*: working with stakeholders on different services across the chain level.
- *intensity*: fact-finding involvement by forming the results with the citizens.

The method is clearly bottom-up and follows a participatory approach. The method requires an intensive public–private collaboration, each having distinct roles in the method. This is in line with the key characteristics of research and innovation strategies for smart specialisation. Entrepreneurs, policymakers, citizens, and researchers represent the relevant stakeholders. These groups can all contribute to (re)designing research and innovation strategies in various ways via the proposed method. For instance, citizens live in the region and know what improvements are most essential. So, they can offer feedback based on their demand and needs. Additionally, regional entrepreneurs are experts to identify entrepreneurial opportunities to satisfy the regional demand and needs of the citizens. Furthermore, researchers contribute with their expertise related to innovation within the co-design framework.

Citizen contributions are powerful. In addition to creating new ideas and solving issues, for instance, turning conceptual solutions into specific designs for implementation can be also facilitated. This method of co-design is becoming increasingly popular because of several advantages delivered by web-based tools (e.g. support of sharing information, visualisation, virtual prototyping, and collaborative idea building). Web-based virtual co-design and prototyping instruments are used to establish an idea, design and develop a prototype. By using this, citizens can create new concepts together and detail these ideas on design boards online. Stakeholders can articulate and visualise their own solutions (Sherriff, 2015). Because creativity plays a crucial role throughout the processes, this method also shows great potential to facilitate the entrepreneurial discovery process.

"Citizens as Partners: OECD Handbook on Information, Consultation and Public Participation in Policy-Making" was published by the Organisation for Economic Co-operation and Development (OECD). This guide highlights government-citizens-relationships in democracy. It also inspects the relationships in policy-making on the local, national, and international levels emphasising that representative democracy is based on rules and principles which should guide the interactions among the government and the citizens. In the handbook ways are described how the interactions can be strengthened (Gramberger, 2001). In this framework, active participation plays a key role. Citizens are involved in the decision-making and policy-making process, which is an advanced two-way relationship (Lironi, 2016). Co-design facilitates these vital interactions.

A framework was created by the United Nations (UN) for e-participation to strengthen government-citizen interactions (United Nations, 2014), such as E-decision-making (Empowering citizens through co-design of policy options and co-production of service components and delivery modalities) (Lironi, 2016).

The aim of e-participation initiatives is to "improve citizens' access to information and public services and to promote participation in public decision-making which impacts the well-being of society, in general, and the individual, in particular" (United Nations, 2014; Lironi, 2016, p. 13).

How intensively stakeholders can be involved when using the online tools can be determined by **three levels of e-participation** (Macintosh, 2004):

- *E-enabling* means that people who typically would not have internet access and take advantage of the information should be supported. This level also discusses the use of

technology to reach more people and offer more accessible and clear information. E-enabling focuses on *accessibility and understandability*.

- *E-engaging* with citizens concentrates on consulting a larger audience to allow contributions and to support deliberative debates on policy problems. In particular, e-engaging refers to e-participation of citizens in *consultation by using a top-down approach*.
- *E-empowering* citizens is about supporting participation and simplifying bottom-up ideas to affect the political agenda. Stakeholders become *consumers and producers of policies* and therefore can co-design the creation of policies (Lironi, 2016).

Results showed that the co-design method represents a learning process for citizens and decision-makers, supports new and innovative ideas to shape policies, and increases the legitimacy of policy-making. Overall, crowdsourcing has the potential to improve legitimacy by generating more trust in the process of decision-making within defining the policy-mix. Thus, if the participants did not receive the desired result, they would still keep their faith in the fair system. The European Union (EU) is strengthening the notion of stakeholder engagement (Warren, 2009; Lironi, 2016).

Existing projects

Stakeholder engagement in the policy mix processes – cooperating with each other and accomplishing consensus – is spreading throughout the world. It creates vital advantages (Irvin and Stansbury, 2004). The "European Citizens Initiative" (ECI) is a tool of participatory democracy in the European Union. ECI's objective is to engage stakeholders directly in the policy mix process in the EU (EU, 2011; Lironi, 2016). The platform www.puzzledbypolicy.eu was established to invite stakeholders to take part in various policy-making stages that follow the inform-consult-empower framework. The idea of the framework is that the citizen involvement begins with wanting to know more about policies and then discussing them. When they are informed, they primarily discuss existing policies instead of creating new ones (Sánchez-Nielsen et al., 2014; Lironi, 2016).

Participatory decision-making e-tools

The concept of liquid democracy is a "model of democracy that combines representative and direct democracy and tries to even out the difficulties in both models" (Jansen, 2013; Lironi, 2016, p. 42). To know how to connect with a community, it is vital to know what the already existing instruments for participatory democracy are. Thus, a Liquid Democracy meeting was organised in November 2014 where experts and developers on liquid democracy presented their tools and theories (Reda, 2014). In addition, there were debates on challenges of participation systems, for example, accreditation, transparency, anonymity or real name policies, usability, and the potential of gamification (Lironi, 2016). In this context, "Cbased" (Cbased, 2016) develops toolkits for participatory decision-making processes. Cbased supported the implementation of the tool "Discuto" (Discuto, 2016) to open the procedure to the public (Lironi, 2016). The online platform Discuto "helps you make better decisions" (Discuto, 2016; Lironi, 2016, p. 42) and therefore includes many functions, for example, instant discussions, real-time, scalable polls, instant feedback, etc. Here, every paragraph of the report can be commented on and be voted on for two months (Cbased, 2015; Lironi, 2016).

The Discuto e-participation tool is seen as a successful project. Nevertheless, there are challenges that are still unsolved regarding the usage of digital tools for citizen involvement in decision-making while co-designing a policy-mix. The main challenge is to **boost the participation of the citizens** (Reda, 2016). Overall, e-information should go together with e-participation, which needs more effort. Intermediaries could play a vital role in facilitating the procedure of e-information to let the citizens be more informed and involved in e-consultations and other e-participation types (Lironi, 2016).

The strengths of this co-designing method for policy-mix include (Lironi, 2016):

- Encouraging participation and active citizenship.

- Offering citizens a policy agenda-setting power.
- Supporting stakeholders to learn about decision-making and political processes.
- Minimising the democratic deficit by connecting stakeholders.

Collaborative policy-mix making

The method can be used to involve stakeholders in writing political manifestos, defining policy mixes and priorities, determining the allocation of budgets, and participating the political process of decision-making. Political parties, cities, local councils, members of Parliaments, community groups, and several organisations already tested existing tools for this method such as D-CENT. Overall, creating policies via co-creation results in processes and outcomes that will be more open, more clear, and more cooperative (D-CENT, 2016).

For RIS3 it is vital to involve a diverse set of stakeholders within a co-design process for a policy-mix. So, this type of method can be used to receive feedback on policies, different agendas and programmes to make the design process easier. Additionally, the stakeholders can vote on the drafts and add comments to improve it. Co-design could support focus on new (entrepreneurial) ideas as more people are involved and engaged.

Usability and impact

Co-design can result in receiving more feedback and ideas from the public for a better RIS3 result. Furthermore, additional (entrepreneurial) information on the region is also gained. As a result, the stakeholder and citizens of the region or nation feel more involved in the RIS processes since they are able to add their opinions in the co-design process of RIS3. This method also encourages "quiet" individuals to share their feedback as every opinion is weighted equally. Additionally, this method and tool should be easy to use from everywhere, at any time. Many cities and countries have implemented existing tools such as D-Cent and have gained much more information on specific topics. Nevertheless, particular effort has to be taken to inform stakeholders of the possibilities for becoming part within the design of RIS3. Additionally, stakeholders need to be introduced to relevant S3 topics.

One of the key outcomes of co-designing is the increase of the sense of ownership of the outcome, i.e. the RIS3 action plan. For instance, this action plan will guide the region and its stakeholders. One central key motivator within co-design is that the stakeholders feel engaged within (re)designing the strategies which are keys to their future lives. They are able to provide valuable information regarding the region and work together with other stakeholders with different perspectives. Thus, the region will grow and learn together which builds a fruitful foundation for a smart, sustainable and inclusive growth in Europe.

Required data

To implement the method via a tool such as D-CENT – knowledge of Object 8, Clojure (JVM-based language) is required, because this programme is written in this language. Knowledge in PostgreSQL is also essential because this is the type of database the data is stored in. Furthermore, the tool supports authentication through Facebook, Twitter, and Stonecutter by using the OpenID Connect specification. So for the user, a Facebook account, Twitter account, or an email registration is necessary to access the co-design tool. For the email registration, a username, email, and password is needed. Additionally, feedback and ideas for the co-design phase are necessary from the users.

Relevant data sources

For more information regarding the project D-CENT please follow this link:

- http://dcentproject.eu/

For the existing application Object 8 this document provides additional information:

- http://tools.dcentproject.eu/pdfs/Collaborative-policy-making.pdf

To implement the project itself, the code and the implementation roadmap can be found via the following link:

- http://github.com/d-cent/objective8

The Object 8 tool is written in Clojure (JVM-based language). The database used is PostgreSQL.

The required data might include the RIS3 scope, objectives and other content plus the development process. Contact lists of potential participants to the co-design of the action plan might be helpful as well.

According the agreed technical specifications of the tools that will be developed, the proposed Object 8 tool appears that is not compatible to be integrated. Of course, the tool could be integrated as an external link.

Implementation roadmap

The first step is to download the code from http://github.com/d-cent/objective8 and to download these programmes:

- VirtualBox,
- Vagrant, and
- Ansible.

The full instruction is provided here: http://github.com/d-cent/objective8

Implementing co-design requires a diverse set of stakeholders and their engagement. This is key to be successful with this method. Thus, the method and the tool need to be linked and shared as much as possible across different platforms and forums so that the implementation of the co-design method guides its stakeholders to the expected outcome.

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Title of the method: 5.3 RIS3 budgeting

Applicable to the RIS3 phase: 5. Policy mix – Action plan implementation

Background and rationale

The method will provide a framework for identifying, using and combining different budgetary sources to capture the funding dimension of the RIS3 action plan and the needs for funding during the implementation period. Users will be able to access information the potential sources of funding and indicate the allocation of funds by policy measure/action line.

One of the S3 aims is to foster more effective spending of public resources, by concentrating on priority areas for knowledge-based investments, focusing on the strengths and comparative advantages of each region. Budgeting is an important tool as it assists RIS3 partnerships to identify what resources are available in shaping and implementing the smart specialisation action plan. The *Guide to Research and Innovation Strategies for Smart Specialisations (RIS 3)* (2012) refers to "the four Cs of smart specialisation". The first one is "*(Tough) Choices and Critical mass"* and refers to the need to limit the "number of priorities based on own strengths and international specialisation – avoid duplication and fragmentation – concentrate funding sources ensuring more effective budgetary management" (European Commission, 2012).

Furthermore, budgetary resources and budgeting are part of the RIS3 ex-ante conditionality. It requires EU Member States and regions to have smart specialisation in place that:

- "sees a Member State has adopted a framework outlining available budgetary resources for research and innovation; and
- a Member State has adopted a multi-annual plan for budgeting and prioritisation of investments linked to EU priorities (European Strategy Forum on Research Infrastructures – ESFRI)." (European Commission, 2014).

However, a European Commission Expert Group (2015) found that "Many of the RIS3 assessed did not provide a detailed budget as requested by the ex-ante conditionality. There seem to be an assumption that the RIS3 budget will be equal to the ERDF OP earmarked budget for R&D activities. This does not guarantee, however, that enough funds will be available to implement the RIS3, e.g. if arbitration is needed between different policies". An example of an initial RIS3 budget for the Czech Republic is provided in annex.

The road to successfully implementation of a smart specialisation action plan, necessitates good planning and coordination of stakeholders and resources. An OECD report (2013) argued that one of the main issues in implementing a successful smart specialisation action plan is that policy priorities are rarely translated into policy instruments and into public budget allocations:

> *" … the absence of a clear view on public allocations to prioritized areas, as revealed by the enquiry, prevents policy-makers to assess the relevance and effectiveness of their policies."*

A clear link between priorities, policy instruments and budget is important as clear budgeting can help guide the choice of instruments used in the action plan (Nauwelaers, et al., 2015). Knowledge about the available budget and financing sources assists in the choice of appropriate instruments, which in turn is also dependent on the specific regional policy funding context (European Commission, 2012). Budgeting should also take account of various EU funding sources and the potential synergies between different sources (European Commission, 2014).

In the process of budgeting, it is necessary to identify all available funding, especially from the private sector that can leverage public sources. It is also important in setting the priorities for the S3 action

plan, to include as many stakeholders as possible as the both the government and the industry have imperfect information on their own. Hence, cooperation becomes vital and an "inclusive and interactive bottom-up process in which participants from different environments" (European Commission, n.d.) needs to be created.

A transparent and updated budgetary planning framework can also assist in developing an effective procurement schedule for the RIS3 action plan. It can help "To guide procurers to join forces with others, in order to attain critical mass, making it interesting for firms to develop innovative solutions for a bid and in order to pool capacities (legal, procedural, knowledge of market, technologies and performance levels, administrative budgets for the procurement processes, etc.)" (European Commission, 2012).

The baseline budget can also be used as an indicator for on-going budget allocation and expenditure, e.g. are expenditures of the programme in line with the planned budget. Furthermore, this information feeds into monitoring and evaluation processes. Flanders in Belgium, for instance, used it as part of the impact scan methodology to monitor the regional innovation budget. Information on both the total amount spent on regional innovation as well as in-depth knowledge of the distribution of this money by policy objectives, intermediaries and services are needed (Nauwelaers, et al., 2015).

The Guide on Research and Innovation Strategies for Smart Specialisation (RIS3) (2012) gives guidelines on what needs to consider when budgeting a S3. For instance:

- Does the strategy identify appropriate actions covering the proposed policy mix?
- Is there sector- or priority- specific support services/schemes foreseen?
- Does the strategy identify budgetary sources, and does it present indicative budget allocations?
- Does the strategy create synergies between different policies and funding sources?
- How does it align/leverage EU/national/regional policies to support upgrading in the identified areas of current and potential future strength? (European Commission, 2012).

The OECD (2013) recommends to develop a 'Smart Specialisation-oriented' public budget calculation that provides a picture of budgets allocated to each prioritised area by aggregating:

- Budgets allocated to dedicated bodies and programmes (institutes, centres, R&D programmes, clusters, etc.);
- Budgets allocated through preferential treatment in generic programmes;
- Ex-post funding received by prioritised areas from generic programmes.

At regional level, these types of budgets should include, besides budgets from regional origin, also national funding sources available to the prioritised areas, as well as funding of EU origin. (OECD, 2013) The publication Regional Policy for smart growth in Europe 2020 (European Union, 2011) has a chapter on "financial engineering support" and discusses the different types of funding, e.g. non-repayable grants, loans, venture capital, guarantees and other forms of financial engineering.

In short, the budgeting methods adopted need to provide:

- A multi-annual view on financial resources to be mobilised
- A means of distinguishing between specific/vertical measures entirely or largely targeting S3 priorities and 'generic' or horizontal' measures that may provide funding to contribute to S3 measures
- A disaggregation by source of funding (national and/or regional public funds, national and/or regional private funds (businesses, charitable foundations, etc.),
- Potentially identify synergies between monetary, in-kind (e.g. organisations that will provide staff to support implementation) and legal/regulatory instruments.

Description of the method

The method will provide a framework for preparing and updating RIS3 budgets based on the sources of funding and committed versus actual expenditure. The method will support RIS3 partnerships and managers in handling the funding dimension of the RIS3 action plan and on-going financial planning during the implementation period. The sources of funding and allocation of funds by type of measure, beneficiary and type of financial instruments will be captured. There are a wide range of budgeting methods and procedures which very much depends on national standard and practices (see OECD, 2014). Hence, the method and related tools will provide a harmonised tool that enables comparison of RIS3 budgets and policy mixes at European level. The tool will not to provide a financial or budgetary planning tool adapted to specific national budgeting rules or accounting procedures.

The tables on the following pages provides a sketch of example of 'nested tables' that would be available via the tool and would generate an online overview of budgetary planning for regions. The tables will be downloadable in Excel, CSV or PDF format. The set of tables will be built up from the 'policy measure' (programme, initiative, etc.) level by RSI3 managers entering data into tables and coding the information on planned, committed and spent budgets by various categorisations. **The categories defined by the Commission Implementing Regulation (EU) No 215/2014 of 7 March 2014** (http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R0215), namely:

- Thematic objective
- Intervention code
- Forms of finance.

And by **funding source (private, national/regional public funds, ESIF, Horizon 2020, etc.).** In certain cases, it may also be relevant to capture qualitative information on related non-financial support such as legal/regulatory changes underpinning financial interventions. This could be captured through a comment function allowing users to input notes or additional information.

In the case where funding sources are competitive or not yet confirmed, it is useful to provide at least a qualitative positioning analysis with respect to additional funding sources for the main S3 measures, initiatives or key organisations (clusters). An example from the Walloon (Belgium) S3 strategy is provided below where the Walloon competitiveness clusters are aligned with EU level platforms.

Annexe 1 : Pôles de compétitivité : positionnement vis-à-vis des priorités européennes

	European Technology Platforms	European Innovation Partnerships	PPP	KIC	Réseaux UE
Biowin		Active and healthy ageing	IMI		European Diagnostic Cluster Alliance European Council of Bioregions European Biotechnology Network
Mecatech	Manufuture ESTEP ARTEMIS	Raw materials	**Factories of the Future** **SPIRE** Cleansky Energy-efficient buildings Clean vehicles	Raw materials	Vanguard Initiative Pilot smart specialisation platform for advanced manufacturing (3D printing)
Wagralim	Food 4 Life			Food for future	European Food Alliance World Food innovation
Greenwin	SusChem WssTP	Raw materials	**BBI** SPIRE Energy-efficient buildings Factories of the Future	Raw materials	ECRN Projet SCOT (Regions of Knowledge) Réseau "BIG-C"
Skywin	ACARE		Cleansky	Urban mobility	EACP Nereus
Logistics in Wallonia	ERTRAC European Technology Platform on Logistics ALICE	Smart cities	Shift2Rail	Urban mobility	Euregiolog[3] Ecologistics

The OnlineS3 budgeting tool could include an additional application to enable regions to map key regional/national organisations/clusters with respect to European partnerships or initiatives.

Overall RIS3 financial plan: funding sources and form of finance by RIS3 priority

RIS3 priority	Funding source	Form of finance	2014	2015	2016	2017	2018	2019	2020	2021
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)

Additional lines added as required

Overall RIS financial plan : ESI Funding only - by intervention field and form of funding

RIS3 priority	Thematic objective	Intervention field	Form of finance	2014	2015	2016	2017	2018	2019	2020	2021
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Priority description (from sub-table)	Data from sub-table	Data from sub-table	Data from sub-table	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)

Additional lines added as required

Overall RIS financial plan: source of funding

Funding source	2014	2015	2016	2017	2018	2019	2020	2021
Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)

Additional lines added as required

RIS financial plan – priority level (one table per priority) : funding source and form of finance

Measure	Funding source	Intervention field	Form of finance	2014	2015	2016	2017	2018	2019	2020	2021
Text field	Pull down list multiple options*	Pull down list multiple options*	Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Text field	Pull down list multiple options*	Pull down list multiple options*	Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Text field	Pull down list multiple options*	Pull down list multiple options*	Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)
Text field	Pull down list multiple options*	Pull down list multiple options*	Pull down list multiple options*	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)	Funding planned/ committed/ spent (€)

Additional lines added as required

* see lists of proposed categories in annex

Usability and impact

The quasi-absence of detailed budget plans in the initial RIS3 strategies has led to a further round of RIS3 action plans during which Member States and regions are requested to provide, amongst other information, more detailed budgeting plans. This tool will support the process of improving budgeting, planning of financial resources, identification of synergies between sources of funds, the extent to which RIS3 are leveraging private finance, etc. The tool will create a complementary and more detailed dataset to the data collected for ESI Fund purposes by managing authorities. It should also provide a means for strategic monitoring of RIS3 as they are implemented as actual versus planned funding/expenditure can be compared over time.

The tool will fill a clear gap for users (RIS3 managers and stakeholders) in the current 'toolkit' available and should lead to a more harmonised, and therefore, comparable approach to budgeting RIS3. This will be of strategic value at both national and EU levels for future evaluation and reporting purposes.

Required data

RIS3 managers should be able to access information on the funding spent on relevant S3 and innovation policy initiatives and have a thorough knowledge of the distribution of this money by policy priorities, intermediaries and services (Nauwelaers et al., 2015). When designing monitoring and evaluation activities for smart specialisation, both for the priority-setting and evaluation of programmes, governments may want to develop a pilot exercise on "implementing 'Smart specialisation-oriented' public budget pictures of budgets allocated to each prioritised areas by aggregating: i) Budgets allocated to dedicated bodies and programmes (e.g. institutes, centres, R&D programmes, clusters); ii) budgets allocated through preferential treatment in generic programmes; iii) ex post money received by prioritised areas in generic programmes" (OECD, 2013).

Relevant data sources

The ESI Fund managing authorities have a legal obligation to collect and categorise data and this data is compiled by DG REGIO and made available for research and analysis purposes:

- http://ec.europa.eu/regional_policy/en/policy/evaluations/data-for-research/

DG JRC has developed an ESIF-viewer, visualising planned investments using European Structural and Investment Funds:

- http://s3platform.jrc.ec.europa.eu/esif-viewer

However, the tool will essentially be fed by data uploaded directly by RIS3 managers or monitoring and evaluation teams. Hence, there is a need to foresee an online login function so that data entered for a specific region or Member State is protected from unauthorised changes.

Implementation roadmap

The implementation of the budget tool will require, at least, the following steps:

1. Agreement on the categorisations to be used when developing the budget tools, e.g. should the ESF secondary intervention codes be included, should there be a possibility to code budgets by industrial (NACE) or scientific/technological classifications, etc.
2. Development of the required set of nested tables through a co-design process with managing authorities or relevant public agencies (e.g. Scottish Enterprise, etc. in Scotland) in the pilot regions
3. Consultation with DG REGIO statistical unit to ensure complementarity and alignment with existing ESI Fund data sets
4. Development of an online tool with a login function allowing identified users to upload data on RIS3 budgets for their region/country.

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Categories for budget tables

Forms of funding (indicative list, to be further developed):

- Private (business) contribution
- National public funds
- Regional public funds
- Charitable or other national/regional sources
- ERDF: European Regional Development Fund
- ESF: European Social Fund
- EAFRD: European Agricultural Fund for Rural Development
- EMFF: European Maritime and Fisheries Fund
- European Fund for Strategic Investments (EFSI)
- Research Framework Programme (currently Horizon 2020) – potentially broken down by sub-programme
- European Institute of Innovation and Technology (EIT) - Knowledge and Innovation Communities (KIC).
- European Innovation Partnerships
- Connecting Europe Facility (CEF)
- Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME)
- LIFE
- Creative Europe
- Employment and Social Innovation (EaSI) programme
- Erasmus+
- Third EU Health programme

THEMATIC OBJECTIVE (ERDF and the Cohesion Fund)

- 01 Strengthening research, technological development and innovation
- 02 Enhancing access to, and use and quality of, information and communication technologies
- 03 Enhancing the competitiveness of small and medium-sized enterprises
- 04 Supporting the shift towards a low-carbon economy in all sectors

- 05 Promoting climate change adaptation, risk prevention and management
- 06 Preserving and protecting the environment and promoting resource efficiency
- 07 Promoting sustainable transport and removing bottlenecks in key network infrastructures
- 08 Promoting sustainable and quality employment and supporting labour mobility
- 09 Promoting social inclusion and combating poverty and any discrimination
- 10 Investing in education, training and vocational training for skills and lifelong learning
- 11 Enhancing the institutional capacity of public authorities and stakeholders and an efficient public administration
- 12 Not applicable (Technical assistance only)
- 13 Multi-thematic objective

INTERVENTION FIELD – (full list in implementing regulation) – the main fields likely to be relevant for S3 strategies include but all fields will be available in tool:

- **Productive investment:**
- 001 Generic productive investment in small and medium – sized enterprises ('SMEs')
- 002 Research and innovation processes in large enterprises
- 003 Productive investment in large enterprises linked to the low-carbon economy
- 004 Productive investment linked to the cooperation between large enterprises and SMEs for developing information and communication technology ('ICT') products and services, e-commerce and enhancing demand for ICT
- *Sustainable transport*
- 043 Clean urban transport infrastructure and promotion (including equipment and rolling stock)
- 044 Intelligent transport systems (including the introduction of demand management, tolling systems, IT monitoring, control and information systems)
- Information and communication technology (ICT) infrastructure
- 045 ICT: Backbone/backhaul network
- 046 ICT: High-speed broadband network (access/local loop; >/= 30 Mbps)
- 047 ICT: Very high-speed broadband network (access/local loop; >/= 100 Mbps)
- 048 ICT: Other types of ICT infrastructure/large-scale computer resources/equipment (including e-infrastructure, data centres and sensors; also where embedded in other infrastructure such as research facilities, environmental and social infrastructure)
- *Research and development and innovation*
- 056 Investment in infrastructure, capacities and equipment in SMEs directly linked to research and innovation activities
- 057 Investment in infrastructure, capacities and equipment in large companies directly linked to research and innovation activities
- 058 Research and innovation infrastructure (public)
- 059 Research and innovation infrastructure (private, including science parks)
- 060 Research and innovation activities in public research centres and centres of competence including networking
- 061 Research and innovation activities in private research centres including networking
- 062 Technology transfer and university-enterprise cooperation primarily benefiting SMEs
- 063 Cluster support and business networks primarily benefiting SMEs
- 064 Research and innovation processes in SMEs (including voucher schemes, process, design, service and social innovation)
- 065 Research and innovation infrastructure, processes, technology transfer and cooperation in enterprises focusing on the low carbon economy and on resilience to climate change
- *Business development*
- 066 Advanced support services for SMEs and groups of SMEs (including management, marketing and design services)
- 067 SME business development, support to entrepreneurship and incubation (including support to spin offs and spin outs)

- 068 Energy efficiency and demonstration projects in SMEs and supporting measures
- 069 Support to environmentally-friendly production processes and resource efficiency in SMEs
- 070 Promotion of energy efficiency in large enterprises
- 071 Development and promotion of enterprises specialised in providing services contributing to the low carbon economy and to resilience to climate change (including support to such services)
- 072 Business infrastructure for SMEs (including industrial parks and sites)
- 073 Support to social enterprises (SMEs)
- 074 Development and promotion of commercial tourism assets in SMEs
- 075 Development and promotion of commercial tourism services in or for SMEs
- 076 Development and promotion of cultural and creative assets in SMEs
- 077 Development and promotion of cultural and creative services in or for SMEs
- *Information and communication technology (ICT) — demand stimulation, applications and services*
- 078 e-Government services and applications (including e-Procurement, ICT measures supporting the reform of public administration, cyber-security, trust and privacy measures, e-Justice and e-Democracy)
- 079 Access to public sector information (including open data e-Culture, digital libraries, e-Content and e-Tourism)
- 080 e-Inclusion, e-Accessibility, e-Learning and e-Education services and applications, digital literacy
- 081 ICT solutions addressing the healthy active ageing challenge and e-Health services and applications (including e-Care and ambient assisted living)
- 082 ICT Services and applications for SMEs (including e-Commerce, e-Business and networked business processes), living labs, web entrepreneurs and ICT start-ups)

Form of finance

- 01 Non-repayable grant
- 02 Repayable grant
- 03 Support through financial instruments: venture and equity capital or equivalent
- 04 Support through financial instruments: loan or equivalent
- 05 Support through financial instruments: guarantee or equivalent
- 06 Support through financial instruments: interest rate subsidy, guarantee fee subsidy, technical support or equivalent
- 07 Prize

Example of a RIS3 financial plan – ESI Funds only from Czech Republic RIS3 (December 2014)

Indicative allocation of operational programme resources to RIS3 key areas of change (EUR)

Key area/strategic objectives	Operational programme/ specific objective		ESIF contribution	National co-financing (public + private)	Total
Key area of change A: Higher innovation performance of companies	OP EIC	SO 1.1	974,888,932	974,842,633	1,949,731,565
		SO 1.2	339,889,931	339,873,790	679,763,721
		SO 2.1	609,428,042	293,096,703	902,524,745
		SO 2.2	56,540,420	27,192,400	83,732,820
		SO 2.4	8,459,483	4,068,481	12,527,964
		TOTAL	1,989,206,808	1,639,074,007	3,628,280,815
Key area of changes B: Improving the quality of research	OP PGP	PA 1	62,492,932	62,492,932	124,985,864
	OP RDE	PA2 SO5	55,434,927	9,782,634	65,217,561
	OP RDE	PA1 SO1	1,006,013,636	177,531,818	1,183,545,454
Key area of change C: Increasing the economic benefits of public research	OP RDE	PA1 SO2			
	OP RDE	PA2 SO5	55,434,927	9,782,634	65,217,561
	OP EIC	SO 1.2	37,765,548	37,763,754	75,529,302
Key area of change D: Better supply of HR, in terms of both quality and quantity, for innovative enterprise, research and development	OP RDE	PA2 SO1	599,600,013	105,811,767	705,411,780
		PA2 SO4			
		PA2 SO5	55,434,927	9,782,634	65,217,561
		PA3 SO2	677,538,007	119,565,530	797,103,538
		PA3 SO3			
		PA3 SO5			
		TOTAL	1,332,572,947	235,159,931	1,567,732,879
Key area of changes E: Development of eGovernment and eBusiness to improve competitiveness (development of ICT and digital agenda)	OP EIC	SO 4.1	521,380,364	471,203,877	992,584,241
		SO 4.2	222,277,225	200,885,759	423,162,984
		TOTAL	743,657,589	672,089,636	1,415,747,225
	IROP	SO 3.2			
	OP Employment	SO 4.1.1	52,713,438	10,898,366	63,611,804
Key area of change F: Improvement and better utilisation of social capital and creativity in	OP Employme	SO 3.1.1	42,170,750	3,171,511	45,342,261

Title of the method: 5.4 State aid law compliance for RIS3 implementation
Applicable to the RIS3 phase: 5. Policy Mix

Background and rationale

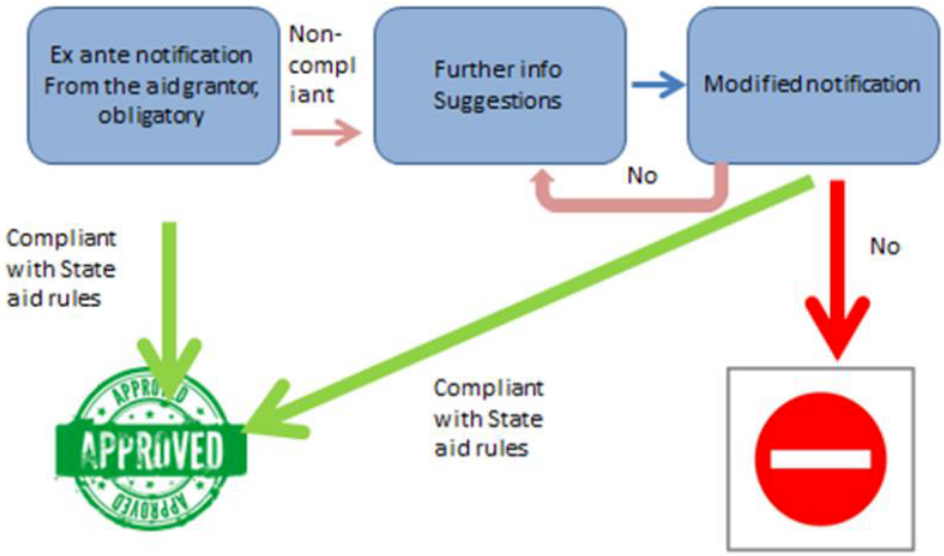
State aid law is part of EU competition law and aims at constraining the funding possibilities of public authorities to sustain competition within the internal market, i.e. the 28 Member States. As a rule, State aid is prohibited as it distorts normal market conditions. Nevertheless, the European Commission (EC) can qualify certain public interventions as compatible aid, in case they contribute to the common interest like environmental protection, innovation or investments in underdeveloped regions. In case of S3 implementation, the selection of the appropriate State aid rule is not a difficult task since the main aims of S3 largely overlap with the objectives of compliance with State aid rules (e.g. fostering growth, innovation, SMEs). Similarities can be found between the approach of the EU State aid policy's common assessment principles and S3 principles. Thus, several objectives of a RIS3 action plan may be aligned to one or more State aid rules, and beneficiaries contributing to the implementation of S3 may be able to receive State aid[34].

Innovation policies can be implemented by means of direct grants or financial engineering measures. Tax incentives can also play a role in the development of certain economic activities and fall under State aid of the European Commission. The understanding and clarity of State aid rules however still constitute a bottleneck for RIS3 implementation in many regions. It is necessary to assess the potential of implementation and the compatibility of the RIS3 action plan with respect to available funding from the OPs and other programmes to achieve sustainable RIS3 implementation.

Description of the method

The objective of this method is to provide management authorities and RIS3 partners with a better understanding of State aid regulations (and definitions) that affect innovation and that are relevant for RIS3 implementation (e.g. support to SMEs, clusters and research infrastructures). The method helps the user/policy maker to identify if the policy instruments included in the RIS3 policy mix/action plan are eligible for State aid (see Figure 1).

Figure 1 Logic framework of State aid compliance



Source: http://s3platform.jrc.ec.europa.eu/state-aid

[34] See: http://s3platform.jrc.ec.europa.eu/state-aid

In the framework for State aid for R&D and innovation (European Commission, 2014), the EC identified a series of RDI measures for which State aid may, under specific conditions, be compatible with the internal market:

- R&D project aid: fundamental research, industrial research, experimental development, feasibility studies (Article 25 General Block Exemption Regulation 2014-2020 (GBER))[35]
- Investment aid for the construction and upgrade of research infrastructure (Art. 26 GBER)
- Investment aid, operating aid for innovation clusters (Art. 27 GBER)
- Innovation aid to SMEs: aid for industrial property rights costs, aid for the secondment of highly qualified personnel, aid for innovation advisory and support services (Art. 28 GBER)
- Aid for process and organisational innovation: implementation of a new or significantly improved production or delivery method (Art. 29 GBER)
- SME access to finance: aid for 'innovative' start-ups: either innovativeness confirmed by external expert or R&D costs representing minimum 10% of total operating costs (Art. 22 (5); Art. 2 No. 80 GBER).

State aid received must remain under a series of notification thresholds to be eligible for GBER (Art. 4 GBER 2014. In the case of RDI aid, the notification thresholds are listed in Table 1 below.

Table 1 Article 4 GBER 2014 notification thresholds for R&D&I aid

	Art. 4 GBER 2014
R&D projects	
Fundamental research	EUR 40 million
Industrial research	EUR 20 million
Experimental development	EUR 15 million
Specific provisions	Double thresholds for EUREKA and Article 185 and 187 Joint Undertakings 50% increase for repayable advances
Feasibility studies	EUR 7.5 million
Research infrastructure	EUR 20 million
Innovation clusters	EUR 7.5 million per cluster
Process and organisational innovation	EUR 7.5 million per undertaking, per project
SME innovation aid	EUR 5 million per undertaking, per project

Source: Laiu et al., 2014

In the case of aid for R&D projects, eligible costs include expenditure for land, buildings, instruments and equipment, only to the extent and for the period used for the project. For industrial research projects, laboratory-scale prototypes and small scale pilot lines are also eligible; and there is no ex-post deduction of commercial revenues generated by prototypes and pilots from eligible costs. Moreover, different aid intensities exist varying by company size. In addition, there exist specific compatibility conditions for investment aid for the construction and upgrade of research infrastructure and innovation clusters.

It is a key part of Cohesion policy for 2014-2020 to increase administrative capacity in MS in the field of State aid. Under the (enlarged and simplified) 2014 GBER framework a large proportion of aid is under the control and responsibility of the Member States (MS); and a lesser share is under the control of the EC with stricter conditions. MS have flexibility on how to set up projects/schemes. For achieving State aid compliance, the Managing Authorities (Simon and Przeor, 2016):

- Should first discuss with their State aid contact points in national administrations
- Technical Assistance budget may be used for obtaining expert advice

[35] See: http://ec.europa.eu/competition/state_aid/legislation/block.html

- For advice on individual projects, MS may contact DG Competition of the European Commission for pre-notification talks.

In the case that individual aid goes above the notification thresholds as defined in the RDI framework, an assessment criteria and process is defined focused on evaluation by Member States (Table 2).

Table 2 Assessment principles and approach of large individual aid above the notification thresholds of the R&D&I framework

Assessment principle	Assessment Approach under the RDI Framework (notified projects)
Contribution to increased RDI and need for state intervention (market failure)	Demonstration of general/specific market failure by MS for all notified cases (e.g. through sectoral comparison) Presumption of absence of market failure where there are similar projects in the market. Presumption of presence of market failure for EU funded projects
Appropriateness	To be demonstrated; presumed for EU-funded project
Incentive effect	Aid application before start of works For large individual aids, MS to support counterfactual analysis of incentive effect with company –and industry-specific elements
Proportionality	Where no alternative project exists: aid must not exceed the minimum necessary to make the project sufficiently profitable Where a counterfactual project exists: aid must not exceed the net extra costs established by comparing the expected net present values of both alternative investments Where a counterfactual exists, but is too remote for aided project: hurdle-rate approach may apply
Negative effects	Analysis of distorting dynamic incentives, creation of market power and maintaining inefficient market structures

Source: Laiu et al., 2014

Usability and impact

State aid is perceived as a problem because is often an unknown territory. The EC has highlighted the need to act in State aid, for several reasons[36]:

1. The application of State aid rules has been identified as a potentially risky area in management of the European Structural and Investment Funds (ESIF);
2. Most parts of the State aid Modernisation Package entered in force on 1 July 2014, at the beginning of the 2014-2020 programming period, provided Member States with a clear of set rules but also increased the level of uncertainty on how to apply them;
3. The 2014-2020 period marks a clear shift of cohesion policy resulting in a higher number of projects where State aid is potentially involved.

Several EC guidelines and documents have urged for the need to communicate complex procedures simply. The risk of clawback of state funds must be minimal to ensure confidence among stakeholders on the use of State aid. When aligned to one or more State aid rules, beneficiaries contributing to the implementation of S3 may be able to receive State aid and hence contribute to more efficient RIS3 implementation, particularly in regions with limited funds for policy support.

[36] See: http://ec.europa.eu/regional_policy/en/policy/how/improving-investment/state-aid/

Required data

The key relevant data sources for design of RDI State aid logic framework are enlisted below:

- European Council Regulation 2015/1589 of 13 July 2015 *laying down detailed rules for the application of Article 108 of the Treaty on the Functioning of the European Union*. Available at: http://eur-lex.europa.eu/legal-content/DE/TXT/?uri=uriserv:OJ.L_.2015.248.01.0009.01.ENG - official legal text elaborating the general provisions of State aid
- European Commission Regulation No 651/2014 of 17 June 2014 *declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty*. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2014.187.01.0001.01.ENG - regulation describing the exemptions to the State aid rules, known also as General Block Exemption Regulation – GBER
- European Commission Communication C(2014) 3282, 21.5.2014 *Framework for state aid for research and development and innovation*. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014XC0627(01) - official EU document elaborating on the interpretations of state aid application to RDI.
- European Commission (2015) *Analytical Grids on the application of State aid rules to the financing of infrastructure projects.* Staff working document, Grid No 4, September 2015. Available at: http://ec.europa.eu/competition/state_aid/studies_reports/state_aid_grids_2015_en.pdf - the document reflects the current rules and decision practices in application of State aid rules to construction and upgrade of research infrastructure and innovation clusters. The content does not prejudge possible developments in the State aid enforcement practice and the application of public procurement rules.
- European Commission (2012) *Guidance Note to the COCOF on Verification of Compliance with State Aid Rules in Infrastructure Cases*. Working document COCOF_12-0059-01, 21.11.2012. Available at: http://ec.europa.eu/regional_policy/en/information/publications/cocof-guidance-documents/2012/guidance-note-to-the-cocof-verification-of-compliance-with-state-aids-rules-in-infrastructure-cases - The purpose of this note is to give guidance on the treatment of infrastructure projects under Cohesion policy rules.
- European Commission (2015) *General Block Exemption Regulation (GBER): Frequently Asked Questions.* Available at: http://ec.europa.eu/competition/state_aid/legislation/block.html - a guide to GBER regulation meant to familiarise authorities and beneficiaries with the GBER and help them to apply the rules to their specific situation.

Relevant data sources

The most relevant existing tool is the **eStateAid-WIKI** of DG Competition of the European Commission. The '**eStateAid-WIKI**' is an IT-tool to facilitate informal exchanges on general State aid matters between the European Commission's services and the Member States and EFTA countries (including the ESA). The *e*State aid WIKI does not encompass the exchange of information regarding specific cases, i.e. information about specific companies or individuals, for which other formal channels are in place.

Access to the *e*State aid WIKI is open to a limited number of users only, as controlled by DG COMP of the EC. Submitting a question is limited to a few authorities per Member State, while 'read access' is provided more widely. The Wiki represents a useful tool for increasing transparency on the interpretation of State aid rules.

The **State aid Scoreboard**[37] of DG COMP comprises aid expenditure made by Member States which falls under the scope of Article 107(1) of the Treaty on the Functioning of the European Union (TFEU). The data is based on the annual reporting by Member States pursuant to Article 6(1) of Commission Regulation (EC) 794/2004. Expenditure refers to all existing aid measures to manufacturing industries, services, agriculture and fisheries, for which the Commission adopted a formal decision or received an information fiche from the Member States in relation to measures qualifying for exemption under the General Block Exemption Regulation.

As part of the State aid control, DG COMP allows to submit a **complaint form online** with regards compliance to EU rules and equal application of exemptions across the EU, here: http://ec.europa.eu/competition/forms/sa_complaint_en.html.

Implementation roadmap

The proposed implementation roadmap is the following:

1. **Data collection and analysis**: this step includes the collection and analysis of all relevant data and cases related to the RDI State aid framework. This includes all the data listed above in the "Required data" section.
2. **Design of RDI State aid compliance logic framework**: based on all State aid rules and regulations, and with the help and assistance of a competition lawyer and DG COMP and DG REGIO experts, a logic framework on the use of State aid in support of smart specialisation will be designed. This logical framework should consider all details included in the regulations and outlined in the section "Description of the method" above.
3. **Implementation of Online State aid quiz**: once the logic framework is built, an online tool will be designed for regional policy makers and RIS3 Managing Authorities. The tool will guide the users through the main characteristics of State aid Law for RDI. It will also provide a question and answer quiz (multiple choice, closed questions) based on the logic framework. The output of the quiz will be a State aid diagnosis that identifies, if any of the policy instruments included in the RIS3 policy mix/action plan is eligible for State aid. It will also give information on 'next steps' and 'what to do next' to benefit from State aid, including relevant contact points.

References

European Commission (2012), *State aid – Italy. Measures to encourage risk capital investments in newly created enterprises*, Available at: http://ec.europa.eu/competition/state_aid/cases/244253/244253_1373480_139_2.pdf

European Commission (2014), *Communication from the Commission, Framework for State aid for research and development and innovation*. Available at: http://ec.europa.eu/competition/state_aid/modernisation/rdi_framework_en.pdf

Laiu R., Grozea C., Von Wendland B. (2014), *The General Block Exemption Regulation 2014-2020 (GBER)*, JASPERS Networking Platform State aid seminar, 8 July 2014. Presentation available at: http://www.jaspersnetwork.org/download/attachments/15433806/Jaspers%20State%20Aid%20seminar%20-%20GBER.pdf?version=1&modificationDate=1405083969000&api=v2

Simon Y., Przeor M. (2016), *State aid rules for RDI. Selection of questions received from Member States*, European Commission. Presentation available at: http://ec.europa.eu/regional_policy/sources/conferences/state-aid/rdi/ppt03-1045-1215_issues_identified_simon_przeor_rdi_27012016.pdf

[37] See: http://ec.europa.eu/competition/state_aid/scoreboard/index_en.html

Title of the method: **5.5 RIS3 calls consultation**

Applicable to the RIS3 phase: **5. Policy Mix – Action plan implementation**

Background and rationale

The aim of this method is to allow stakeholder input during the 'Calls for Projects' process. This would allow stakeholders to propose specific selection criteria and feedback during the overall process. This method could be considered to be part of a wider open consultation framework, adopted by the EU that incorporates stakeholders' active interaction with the regional or national authorities. As a result, such a consultative process could increase the effectiveness of the resulting RIS3 actions, by making them meet more responsively the regional policy needs and by strengthening stakeholders' participation in the submission of projects for support. This method aims to facilitate the RIS3 Action Plan implementation, in terms of preparing and assessing Calls for Projects.

Description of the method

In general, the term 'stakeholder consultation' refers to the interaction with stakeholders during processes of evaluation or preparation of policy initiatives, as well as implementation of existing interventions. In this case, we choose to focus on stakeholders' participation throughout the Call for Projects process.

This method offers stakeholders the ability to interact with the Call for Projects, during the preparation stage, proposing evaluation criteria that could be included. Its additional value rises especially in the cases of projects related to highly specialized areas that might require increased scientific or technical knowledge, in order to prepare the selection criteria for the projects. For example, if the Call for Projects addresses a very specific topic such as: "The effect of climate change on Arctic permafrost and its socio-economic impact, with a focus on coastal areas" (http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/bg-11-2017.html), then it would be much easier for regional authorities, which might not have the appropriate knowledge base for this topic, to interact with certain specialized stakeholders for preparing the selection criteria for the projects.

Throughout a consultation strategy design process, there are 4 key stages including: 1) the objective setting; 2) the stakeholders' definition; 3) the selection of the methods and the tools; and 4) the consultation data management system (EC, 2015). Given the fact that the first stage referring to the objectives' setting has been already set in the phase of Call preparation, during a previous Phase in the RIS3 strategic planning process, the other three stages should be implemented within this method.

Focusing on stage 3, the most appropriate consultation methods and tools depend on the objectives of the consultation, the identified stakeholders, the nature of the initiative as well as required time and resources. There is a large number of methods that could be used, corresponding to a variety of stakeholder consultation tools. These might include: open public online consultation, open public online consultation – consultation website template, surveys, Eurobarometer surveys, stakeholder conferences / public hearings / events, stakeholder meetings/workshops/seminars, focus groups, interviews, Commission expert groups/similar entities, SME panels, consultations of local/regional authorities (networks of the Committee of the Regions), questionnaires, online discussion fora/interactive online tools.

The purpose of the stakeholder consultation process covers three main domains: i) informing; ii) seeking views; and iii) participation and partnership. The selection of the appropriate consultation tool should be based first on the type of Call, and second on the extent to which regional authorities would like stakeholders' participation to be embedded within the process of Call preparation. The selected method could be implemented as an online tool to manage and assess RIS3 project proposals. Through this tool those managing the Calls for projects and the stakeholders participating in the process would be able to communicate and interact with each other.

Usability and impact

By implementing the Calls-for-Projects consultation method, it will be possible for regions and stakeholders to better communicate with each other regarding what they expect from the RIS3 actions. Promoting a constructive dialogue between them, the Call-for-Projects process could be properly designed in order to properly specify the criteria for project selection, so that they are best fitted to both sides: those that call for projects and those that take part in them. This would positively impact on the effectiveness and ease of implementing RIS3, by facilitating regions to call for projects that best fit their priority setting that has resulted from shared vision and strategy formulation under the RIS3 framework.

Required data

For implementing this method, information regarding the priority setting from Phase 4, as well as the shared vision and the strategy formulation, coming from Phase 3, is required. Moreover, information regarding the calls for projects is also needed, in the form of draft texts, so that participating stakeholders can have a solid basis upon which they can share their proposals and thoughts.

Relevant data sources

All data will be produced by the participants during the consultation process. Additional data that would be useful would include similar actions implemented in other EU regions, and assessments of actions which might inform stakeholders about the impact and challenges of similar actions in other regions. The following section provides a practical example for implementing the Calls consultation method in the field, using stakeholder meeting as the main implementation tool.

A practical example from the Region X

A technical meeting for the finalisation of the 1st call of proposals on innovation, research and development for enterprises, OP of the Region X, 2014-2020, took place in the summer of 2016. In the technical meeting more than 50 representatives from companies, university and research labs, and the public administration were invited. It was organised by the Special Managing Service of the Regional Operational Programme of Region X and concerned the discussion and feedback on the forthcoming call of the ROP «Investment Plans for Research, Innovation and Business Development», Investment Priority 1b.1.1.

Following a welcome by the chair of the Regional Research and Innovation Council and reference to the RIS3 by the Special Managing Service, the technical meeting took place in three sessions:

a) Presentation of the main features of the forthcoming call, which was targeted at the chemical and polymer materials industries, and the criteria for the assessment and selection of investment projects.
b) Comments by representatives of the DG Regio G5.
c) Comments and suggestions on the call by participants in the meeting.

In the first session, a presentation of the forthcoming call was made. The Call was 60 pages of text describing:

1. The legislative - regulatory framework for implementation of action
2. The identity of action
3. Bodies implementation of action
4. Eligible activities
5. Eligible expenditure - budget operations
    a. Eligible expenditure
    b. Budget projects - implementation period
6. Financing scheme
7. Procedure and receiving funding request
8. Documents and information for the assessment of funding applications

9. Criteria & process assessment - approval of operations
    a. Bodies assessment funding applications
    b. Evaluation process - evaluation criteria
    c. Appeals process
    d. Approval of operations
10. 11 procedure implementation - monitoring of operations
    a. Settlement costs of implementation
    b. Monitoring acts; checks - certificates
    c. Payment of aid
11. Procedure changes
12. Completion of operations
13. Beneficiaries obligations and review compliance
    a. Test compliance obligations of beneficiaries
    b. Sanctions.

During the second session of the meeting, the comments by representatives of DG Regio focused on the need (1) to make an explicit reference to the RIS3 Action Plan and the RIS3 action to be implemented through this call, (2) to make clear the connection of the call and the EDP workshop on Chemicals and Polymers that was held earlier in the Region X, (3) to specify segments of the chemical, rubber and plastics industries should have priority, (4) to define the precise meaning of "applied research and development", "experimental development" and "innovation" given the different levels of co-funding in these categories, (5) to assess the contribution of proposals to output indicators and regional innovation performance indicators, (6) limit the funding on building and premises below the foreseen 35%, and (7) use more output and result indicators (four and one only) to assess the impact of the call.

In the third session, the discussion with the participants, mainly those coming from the industry, was detailed and covered most of the meeting. It focused on the following subjects:

1. Industries to be supported: The use of NACE codes (20-Manufacture of chemicals and chemical products, and 22-Manufacture of rubber products and plastics) to define enterprises eligible for support was received very well, especially for its clarity. Additionally, it was asked (1) including industries that produce polymer products falling in other than 20 and 22 groups (e.g. 13.9 Manufacture of other textiles), (2) defining whether the group codes refer to industrial permissions or categories of financial activity, and (3) defining the time limit that a company may register additional activity codes (e.g. till the opening of the call / file submission/ 31-12-2014/ other).

On the contrary, the reference to the value chain (justify the contribution of proposals to the value chain of chemicals and polymer materials) was seen as unclear and imprecise. While in Annex 4, detailed information is provided on 3- and 4-digit eligible manufacturing activities, the use of the value chain does not clarify whether a proposed investment project would be eligible. Moreover, it was observed that references to value chains makes the use of NACE groups unnecessary, since a value chain may comprise many industry groups, from agriculture, to utilities, and retail.

2. Conditions and intensity of support: The conditions for support, from the state-aid regime point of view were discussed, in particular those concerning non-eligible enterprises, faulting enterprises, bankrupt enterprises, obligation of location premises not headquarters in the Region X, etc.; those concerning the spending period; and the minimum funding support. Also the different rates of funding were discussed per type of research and size of company.

The demarcation lines between "industrial / applied research", "experimental development" and "innovation" were seen as unclear, especially the justification of new vs. existing knowledge and skills for product development / improvement (innovation). There is a need for very experienced assessors to judge the industrial limits between applied research and experimental development.

The purpose of including feasibility studies in the investment plan was clarified, as studies concerning the valorization / exploitation of the R&D than feasibility studies for the proposed research and innovation. In addition, the meaning of open science criteria was explained, as using them may increase the level of funding.

3. Eligible categories of funding and ceiling per category: The table of funding categories and max funding per category was extensively discussed. It was admitted that (1) a minimum ceiling to personnel spending should be defined, e.g. 25% of total cost, which guaranties that the produced research and skills will remain in the beneficiary enterprise; (2) spending for buildings and premises should concern only internal refurbishment related to research and pilot units and co-funding rate should be lower; and (3) spending for subcontracting and purchase of technology should not lead to "buy" rather than "produce" research and innovation.

4. Assessment process and criteria: The four stages of assessment were presented. The inclusion in the assessment criteria of (a) orientations from the EDP workshop realised earlier in the Region, and (b) criteria related to innovativeness of proposed investments, contribution to regional innovation performance, and generation of knowledge-intensive employment was discussed.

Assessment criteria related to employment creation are included in Stage B; and might also be part of Stage C, as generation of knowledge-intensive employment. Criteria related to targeting new market opportunities are included in Stage C; might also be related to EDP workshop conclusions. For successful projects, the assessment should be extended at the implementation period, which would enable corrective actions before the end of the project and the period of eligible expenses.

5. Required documents for the assessment of funding applications: Fourteen justification documents were requested to be submitted, together with the application form. Clarifications related to these documents was an important part of the meeting,. It was asked that these documents would be simplifed and reduced as much as possible at the submission stage. A more complete justification should then be required at a later stage from those enterprises positively assessed for funding.

Overall, the technical meeting was a fruitful and informative meeting. The need for a second round of EDP, focusing on the calls for investment and support, was fully justified. The Special Managing Service of the ROP invited the participating companies and research labs to send additional material and comments before the finalisation of the call to be expected by September 2016.

Implementation roadmap

Step 1: Selection of stakeholders to be invited

Starting from the stakeholders' mapping, this part targets to identify the basic categories of stakeholders, based on their level of interest and influence on the specific Call. According to the Better Regulation "Toolbox", there are six steps/questions for stakeholder identification:

1. Who is directly impacted?
2. Who is indirectly impacted?
3. Who is potentially impacted?
4. Whose help is needed to make it work?
5. Who thinks they know about the subject?
6. Who will show an interest in the subject?

Step 2: Selection of consultation mode

Method: Regarding the consultation method, a choice should be made on whether it is going to be open to the public or targeted. Although open public consultations can foster transparency and accountability, and ensure the broadest public validation and support for an initiative, targeted consultation might better fit the concept of calls for projects, as it allows more focused interactions

or dialogue and may tap expertise more efficiently, in particular when dealing with a very specific or technical subject.

Tool: the choice of the appropriate consultation tools should take into consideration some basic principles, including: proportionality, the degree of interactivity needed, accessibility and time restrictions. In practice, a hybrid tool including physical presence and online platforms could be a very good solution for implementing this method.

Step 3: Definition of call assessment criteria under the RIS3 framework

An assessment grid for evaluating the consistency between the proposed Call of projects and the RIS3 framework is presents in the following table. It is important to align the assessment process of submitted projects under the RIS3 framework, as projects tending to illustrate a higher level of RIS3-orientation will be more easily implemented within the RIS3 framework, showing at the same time higher levels of efficiency.

Table 12 Assessment grid of consistency between RIS3 and a Call of action

RIS3 Steps and sections	**Assessment of features of the proposed call / action**
Phase 1 Governance	□ Does the action has been designed in collaboration to stakeholder or other form of broad participation? □ Are outcomes of the action to be disseminated to larger audience? □ Do the public outcomes of the action follow an open science / open innovation approach?
Phase 2 Analysis of context	□ Does the action take into account the results of RIS3 SWOT analysis and the innovation potential of the region? □ Does the action contribute to extroversion of productive activities or their positioning in trans-regional and international value chains? □ Which is the degree of alignment of the action results of the EDP process (full align, partly aligned, EDP has not been realised or the action does not relate to EDP results)?
Phase 3 Shared vision/ Strategy formulation	□ Does the action contribute to research and innovation activities? □ Are social, organisational, service and market innovation considered beside technological and science based innovation? □ Does the action contribute to private sector research and innovation? □ Are the societal inclusive, environmental and sustainable economic development challenges addressed? □ Are challenges of modernisation / diversification of productive activities addressed by the action?
Phase 4 Priority setting	□ Is the action in alignment with context analysis and harvesting of entrepreneurial discoveries and DAE? □ Is the concentration of resources sufficient to achieve the objectives of the action?
Phase 5 Policy mix/ Action plan implementation	□ Do eligible activities fall within the priority sectors and activities of RIS3? □ Are there private organisations or a mix of public and private organisations supported by the action? □ Is the action a follow-up of pilot project or small scale implementation?

Phase 6 Monitoring and Evaluation	☐ Does the action define output and result indicators? ☐ Are indicators linked to priorities with clearly identified baselines and targets? ☐ Are the outcomes of the action sustainable in the long run?

Step 5: Analysis of stakeholders' views and reporting to the Call authority

The analysis of the stakeholders' views should include a series of statistical data, coming from the stakeholders' input. These data should give an overall picture regarding the attitude of the stakeholders towards the selection criteria of the call. Moreover, additional input including new selection criteria should be seriously taken into account, especially in cases where the call refers to projects requiring a high level of scientific background knowledge.

References

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Title of the method: **5.6 RIS3 innovation maps**
Applicable to the RIS3 phase: **5. Policy Mix – Action plan implementation**

Background and rationale

Thus far, little effort has been made to analyse data from the private sector's R&D and innovation grant applications, both at national and regional levels. This data provides bottom-up information about new emerging businesses and technology trends as perceived by the private sector. Many R&D and innovation grants require matching funds from the private sector, and hence this information is more credible regarding business interests and trends than official declarations.

In the context of the smart specialisation process and entrepreneurial discovery, Innovation Maps (IMs) have been used to help tease out information about technological trends by the private sector. They are considered as new ways to collect and analyse data from R&D and innovation grant applications to identify emerging areas of business and technological strengths.

Innovation Maps were used as an essential part of the Entrepreneurial Discovery Process (EDP) in Poland, particularly within the pilot project on the EDP and business needs analysis conducted by the World Bank (2015). They were used to identify key priorities for business innovation spending.

Description of the method

In general terms, an Innovation Map is a method that enables acquiring a better understanding of the process of innovation, assisting in the development of new tools to measure innovation-related phenomena and to articulate innovation plans (Mahdjoubi, 1997).

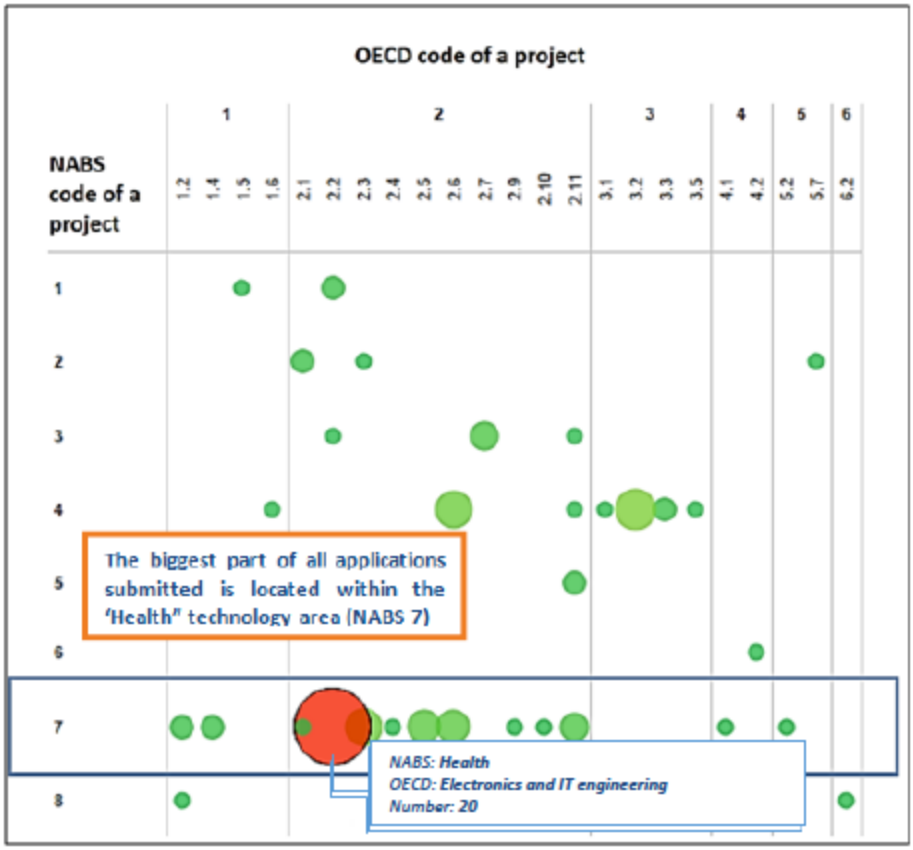
The method is one that has not been widely used in EU regions/countries. In the context of the RIS3 development process, Innovation Maps have been used in Poland to help understand technological trends within the private sector using data on grant applications.

The World Bank (2015) methodology for developing an IM based on grant applications data is the following:

1. Data collection. Data on grant applications should be collected. If several Ministries, agencies or stakeholders are involved in the funding of innovation and R&D support programmes, then there is a need for joint collection of this data into a single database.
2. Data cleaning. Classification of support applications based on existing classifications (e.g. Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets -NABS 2007) (1). Extraction of data from the applications into: applicant type (company vs. academia/research); application status (approved vs. declined); geographic division (regions); other.
3. Data analysis. The objective is to create maps built along a business/technology matrix, combining the business area of a grant application (this is likely to vary per region or country), with a technological classification (e.g. NABS 2007), to identify business and technology trends and new areas of competitive strengths based on revealed preferences of the private sector.
4. Visualisation. Heatmaps and charts are produced to show the concentration of the number of applications into regions, business areas and technology areas, as well as various other classifications.

The following Figure presents an Innovation Map for the Dolnoslaskie region (PL) based on "fast track" applications to the Polish National Centre for Research and Development (NCBR).

Figure 1 Innovation map for Dolnoslaskie region (PL)



Source: World Bank (2015) based on data from NCBR

5. Policy intelligence. When grant application data is collected over several years, the innovation maps' results can be compared to other exercises such as technological foresight results. They can also be benchmarked against smart specialisation priorities and analysed within specific groups to evaluate fitness of prioritised specialisation areas, etc.

Usability and impact

IMs can help uncover critical bottom-up information embedded in firms' R&D and innovation applications for public support. Among the identified possible benefits, IMs (World Bank, 2015):

- Act as complements to top-down approaches such as foresight programmes, macro and sectoral data and innovation surveys
- Help verify/modify/create smart specialisation priority areas based on the private sector's real demand and thus help better prioritise public support for innovation and enhance its efficiency
- Help monitor business and technology needs trends in real time (assuming the existence of an online, standardised and automated system of submission of grant applications)
- Provide credible and granular information on innovation activities
- Once a grant database is set-up, it would be possible to monitor changes in real time, as applications would have all the data to produce updates simultaneously (long-term)
- When implemented at a national level, they can help identify regional strengths and concentrations of innovation activities.

Required data

The collection of grant data from grant applications submitted to public innovation support institutions is a prerequisite for producing an Innovation Map. This requires the existence of a database of grant applications, and preferably an online, standardised and automated system for submitting grant applications that allows data mining, to automate the retrieval and analysis of this data. This is however not a normal practice in the EU.

An example of an automated grant application system at EU level is the Horizon2020 Participant portal[38]. The portal is the single entry point for the submission of EU-funded grant applications. Linked to the portal, the European Commission manages the Community Research and Development Information Service (CORDIS), which includes a Projects and Results service[39]. This service is a one-stop shop for information on EU-funded research projects and project results. It includes information in the lifecycle of each project: the grant details, funding and participants, the project's own Report Summaries, the latest multilingual Results in Brief and links to specific publications and other documents. Programme data from FP5 to FP7 are included in CORDIS. It also includes data on grant holders from the private sector. However, this refers to research projects and not necessarily innovation projects.

For the countries that collect innovation project data already (e.g. Finland, UK –see below), this would require adjusting/adapting the existing grant application systems to a standardised classification system of business areas and technology areas (e.g. NABS and OECD classification as was the case of the Poland in the World Bank study). A standardised approach to data would help create innovation maps at regional, national and EU levels based on information from all relevant public support instruments, including specifically flagship matching grant programmes.

If the implementation were to be enacted at the EU level, it would require the collection of grant data for all regions and from all funders and donors at EU level. Data could be collected or mined using automated systems following the submission of grant applications. Compliance to the fundamental requirements of the open data paradigm would be also necessary.

Relevant data sources

The main source of data for the implementation of this method is grant application data. Tools for tracking data on projects and initiatives that are publicly funded are not widely used in the EU. Good practices in this regard include the open data storehouse of Tekes in Finland, which allows to search for projects and beneficiaries that have been funded through Tekes programmes[40]. The Tekes database allows searches by organisation type (private sector companies; research organisations and others); by project status; Tekes programme and research type. The database allows searches by economic sector. Technology areas are not defined in the database, although some of them are described in the project's abstract. The geographical area/locality of the grant holders are also identifiable.

Probably the most developed grant dataset in the EU is the Gateway to Research database[41] of the UK. The dataset provides information about publications, people, organisations and outcomes related to research projects. It includes information about the project such as abstract, duration, the amount awarded, the researchers involved and a list of publications produced. The data is collected from a range of systems used by the funding organisations to collect information from researchers, including the Joint Electronic Submissions system (Je-S) and ResearchFish. Gateway to Research (GtR) publishes information from a variety of source systems. The information is not transferred to GtR on a real-time basis and the information is processed against a set of business rules to determine suitability for

[38] See: http://ec.europa.eu/research/participants/portal/desktop/en/home.html

39 See: http://cordis.europa.eu/guidance/about-projects_en.html

[40] See: https://extranet.tekes.fi/ibi_apps/WFServlet?IBIF_ex=o_projekti_htm1&IBIAPP_app=openraho&YKIELI=E

[41] See: http://gtr.rcuk.ac.uk/

publication. The dataset is currently static, or a simple snapshot of other databases and is not being updated regularly. However, the infrastructure is being built to refresh all the data in the website on a regular basis. This will enable consistency for future data access and further analysis. The database does not distinguish technology areas or economic areas. However, abstracts for projects are provided, as well as organisations descriptions. Private sector companies are also distinguished.

Ongoing studies on open data on the use of EU Structural Funds have shown that most data currently published by the EU national and regional authorities are not compatible yet with some of the fundamental requirements of the open data paradigm[42]. Data is rarely complete, accessible, timely, machine-processable and non-proprietary. Open data on public support would allow for tracking of project themes and topics, and assessment of how they match with S3. This kind of data could be highly valuable in tracking progress towards objectives and vision, but also in informing the RIS3 update.

In terms of tools for the visualisation of Innovation maps, the following could be mentioned as options:

- InstantAtlas (http://www.instantatlas.com) is a data visualisation tool that provides interactive graphs and maps based on statistical data. It is widely used by government organisations at regional and local level in the UK, including the Greater London Authority, the Bristol City Council, the Brighton and Hove Local Information Service (data sharing and needs assessment) and the Devon County Council[43]. It has been also used by the Bavarian State Office for Health and Food Safety to provide regional data about the health situation of the population of Bavaria using interactive maps on, for instance, the geographic patterns of mortality, illnesses, risk factors and care indicators[44].
- Raw (http://raw.densitydesign.org) is a web application for vector graphics (similar graphics as the ones produced by the World Bank for the Polish EDP study). The app is developed and maintained at the DensityDesignLab of the Polictecnico di Milano. It focuses on the visual representation of complex, social, organisation and urban phenomena, and aims to exploit the potential of information visualisation and information design in order to provide innovative and engaging visual tools that enable stakeholders to build solid arguments.

Implementation roadmap

Two implementation Roadmaps could be foreseen: one for regions/countries that already have open access data on innovation grants (1); and a second for those that do not (2). Prior to the implementation Roadmap it could be foreseen to first map among EU regions/countries, those which already collect data on innovation grants systematically (1) and those that do so following the principles of open data (2) (Step 0). Two of the most known open access datasets on innovation grants are presented in the relevant data sources section above.

A proposed Roadmap is presented below. Regions/countries that are under case 1 (no collection of grant data) will need to go through all steps of the Implementation Roadmap, while others could be expected to start in point 2:

1. Collection of grant data of innovation programmes, including publishing the results systematically.
2. Definition of a method of classification, by business areas and technology areas. The use of standard classifications is encouraged to allow for cross-regional and cross-country comparisons. Consensus/agreement of a classification method at EU would be ideal and allow for cross-country EU-wide comparisons.

[42] See: http://luigireggi.eu/en/

[43] See: http://www.instantatlas.com/Greater_London_Story.xhtml

[44] See: http://www.instantatlas.com/health-atlas-of-bavaria.html

3. Data cleaning and data classification. Each region/country would need to classify the grant data by technology area and business area.
4. Innovation Maps visualisation tool. An innovation map visualisation tool is needed. It could be newly developed, or an existing tool could be adopted. Several interactive visualisation tools already exist (e.g. InstantAtlas, Raw, etc. –see above)
5. Data analysis and policy intelligence. Each region/country can make use of the data results to inform their smart specialisation process based on up-to-date bottom-up private sector data.
6. Data openness. All data should be posted online for wide public distribution (e.g. posted on the respective websites or other dissemination/communication websites), including for the private sector's use to help them guide their developmental visions.

In the long-term, further issues could be considered:

- Innovation grant data could be made more granular by collecting more detailed information on the type of projects funded and technologies developed, as well as on the applicant.
- Create and implement an online grant application submission tool which allows presenting data in real time. This tool could request and indicate the key technology that the private sector wants to invest in and the key business area of declared investment.
- Develop synchronised databases for grant applications across regions/countries from different support institutions.

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Title of the method: **5.7 RIS3 open data tool**

Applicable to the RIS3 phase: **5. Policy mix – Action plan implementation**

Background and rationale

This method aims to develop a tool to facilitate the use of open data related to projects. This would be in the form of a data repository that enables the tracking of projects and initiatives implemented in each region.

Open data tools are currently not widely used in non-publicly funded projects. However, their use would facilitate tracking project themes and topics to find how well they match with S3. This data could be valuable in tracking progress towards objectives and informing the RIS3 update.

Description of the method

The method entails the setting up an Open Data Platform accessible through as a web service or through a website such that it enables up-to-date data from on regional projects and their results. The ODP will have full accessibility through published APIs (application programming interface), which will provide functions to access the Open Data Platform, and will allow the inclusion of both structured and unstructured data such as data that may be available through individual project websites and progress reports as well as results through RIS3 innovation maps (see the description of method 5.6).

Usability and impact

This tool will be usable by regions to track the progress towards their objectives and vision. This will impact the data analysis of method 5.6 RIS3 innovation maps and the data that is presented in them, as the open data tool will act as one of its data sources. This will provide data on the number of projects implemented and their linkage to their corresponding S3. This will aid in measuring progress against the vision of the S3. It may also act as a useful tool for those taking part in the project as a means of tracking how well they have progressed.

Required data

Various types of data will be needed about RIS3 projects to create a generic model that can be used to represent each project, while not being so general that it loses its specificity to each project. Further information will be needed about the linkage between each project and the corresponding S3 priority to be supported by the objectives of the project.

Relevant data sources

- Regional S3 Project Websites
- Regional S3 Project Progress Review Report
- Regional Innovation Maps

Implementation roadmap

The first step of implementing this method is to establish a uniform object data model as a class to represent the relevant project data. This would set out the ontology and metadata structure to enable the semantic indexing and retrieval of all types of data objects that could be sourced from a variety of sources such as individual project websites, project progress reviews and RIS3 innovation maps.

The metadata descriptors will provide data on all aspects of the project such as the Call, the Title, Contract Reference Number, Precursor Projects, Objectives, budget, matched funding, sponsors etc.

Initial analysis of the exact form of the data types to be supported and access routes/modes required will determine the detail structure of the data repository and user access interfaces that would prove appropriate for the ODP.

The stakeholders to interact with the database. This could be via a website or via a web service.

Title of the method: 6.1 RIS3 monitoring
Applicable to the RIS3 phase: 6. Monitoring and evaluation

Background and rationale

This method defines the overall process / roadmap for RIS3 monitoring, which usually encompasses all sorts of activities that have to do with the collection and processing of information about the achievement of expected results and the degree of implementation of policy measures.

A recent definition of monitoring is presented by Gianelle and Kleibrink (2015), stating that monitoring usually encompasses all sorts of activities that have to do with the collection and processing of information regarding the achievement of expected results and the degree of implementation of policy measures. Given the above, the investigation and design of both monitoring and evaluation processes taking place throughout the implementation of RIS3 projects is a crucial step. M&E must be properly organised and designed in detail for the implemented activities to achieve the highest possible socio-economic impacts.

Monitoring is an integral part of RIS3, and to receive Structural Funds assistance, all regions are required to develop tailored monitoring. The mapping exercised showed that detailed RIS3 M&E frameworks are currently in development in many regions, and that there is a great interest in inter-regional experience exchanges on this aspect of smart specialisation design.

Description of the method

Three main purposes referring to the utility of RIS3 monitoring mechanism should be highlighted here (Kleibrink et al., 2016). First, learning-and-acting is one of the core purposes of monitoring process, indicating the need for policy makers to be well informed of the reality conditions and the risks of failing, as well as the development of a learning system for participants. Second, trust-building amongst stakeholders and citizens, is another important dimension of monitoring processes. This characteristic should be accompanied by motivation, commitment and aversion to report failure. Last but not least, accountability is considered to be an integral part of this mechanism, built on clear rules for counting/measuring and bottom layer auditing.

In general, monitoring can be effectively interpreted in combination with the general RIS3 context, due to its strong connection with the RIS3 strategy structure. This means that depending on the diversified characteristics of the various RIS3 strategies that are implemented in EU countries, monitoring can take different forms. Furthermore, given the fact that monitoring can be regarded as an information gathering mechanism, one of its main utilities is to constitute a base upon which a periodic refinement and refocusing could be made.

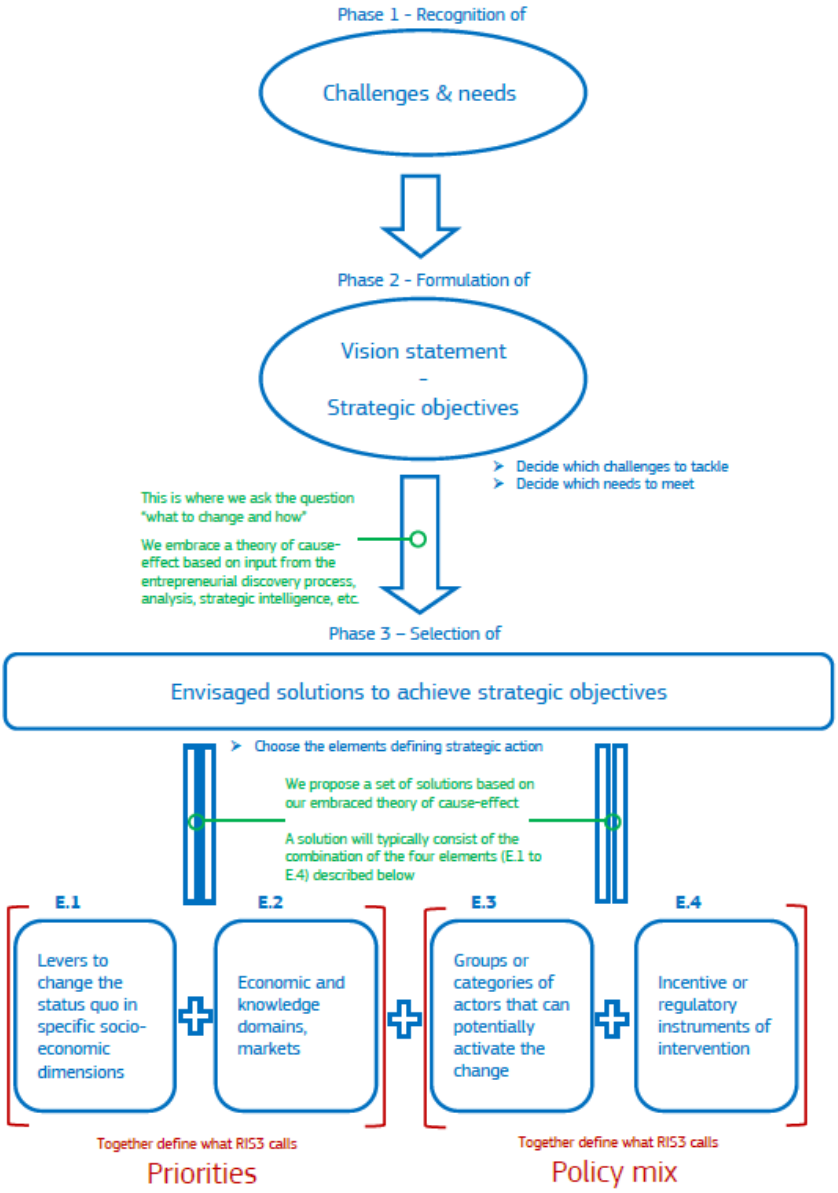
Under this perspective, in order to design the monitoring system for a RIS3 strategy, it is important to understand in detail the mechanism lying behind it. Following the work of Gianelle and Kleibrink (2015), we can acknowledge the existence of three main discrete stages that constitute the main pillar of a RIS3 intervention logic: (i) recognition of challenges and needs; (ii) formulation of vision statement and strategic objectives; and (iii) selection of envisaged solutions to achieve these strategic objectives. The interconnections between these stages are shown clearly in Figure 1.

The complexity arising from the implementation of RIS3 strategic interventions within a country becomes clear when looking at Figure 1 below. Focusing on the schematic representation of the RIS3 implementation process, it is important to highlight that moving from phase 2 to phase 3 constitutes a crucial step, as it denotes the transition from the general to the more specific part of the planning procedure. During phase 3, the selection of the "means" (levers – E.1) that will be used to achieve the desirable "ends" (goals) referring to specific socio-economic areas (E.2) will ultimately define the set of priorities that will be determined.

Having chosen a specific set of priorities it is then possible to define explicit variables and indicators, which could be used to measure the expected change made by the selected levers on the targeted socio-economic areas of intervention. More specifically, according to Gianelle and Kleibrink (2015) expected change is defined by: (i) a variable of socio-economic nature; (ii) a set of baseline and target values; and (iii) a timeframe for variable

observation. The identification process of the expected change measures therefore sets the foundation of the M&E systems. As a result, it becomes evident that the design for a well-organised and effective M&E mechanism is considered to be an integral part of the whole strategic RIS3 planning process.

Figure 1 The RIS3 structure



Source: Gianelle and Kleibrink (2015, p.6)

Usability and impact

The monitoring and evaluation (M&E) system is considered to be an important part of the overall governance system, alongside budget, human resources and auditing systems (Kusek & Rist, 2004). Its main contribution is to provide an analytical feedback system regarding the outcomes, impacts and effects of the implemented policies and programs.

According to the World Bank (2016) there are two key mechanisms through which monitoring and evaluation (M&E) can affect the effectiveness of the implemented projects. First, M&E provides crucial evidence with respect to the degree to whicih each project achieves its goals, and its results comparative to the target values. Secondly,

there is evidence throughout literature (Legovini, Di Maro and Piza, 2015) that M&E can affect the overall quality of project supervision and implementation, resulting in higher quality outputs.

Monitoring and evaluation are considered to be intrinsically interdependent, as the results derived from monitoring exercises include all the information needed to perform an evaluation analysis (Kleibrink et al., 2016). Monitoring by itself constitutes an early warning system, in cases of ineffective or even bad implementation of policy measures or actions. Thus, it is crucial to develop a design process that could provide the policy-makers with the ability to effectively choose indicators for monitoring. The more proper indicators are chosen, the better the results of their transformation into interventions to the already implemented policies and projects will be.

EU regional cohesion policy shift towards the smart specialisation framework requires a similar change in the way the monitoring process is implemented. According to Farole et al. (2011), under this new policy context, in order to improve the delivery and effectiveness of the intervention, better and leaner monitoring procedures should be included.

Required data

Policy makers define the data needs, as they decide which indicators and databases will be used for the monitoring of the implemented policies. However, potential data sources for this method that could be used include Eurostat database, as well as regional and national reports. The frequency of the monitoring process should not be ignored when choosing the appropriate databases, as data availability, especially at a regional level, is in many cases restricted.

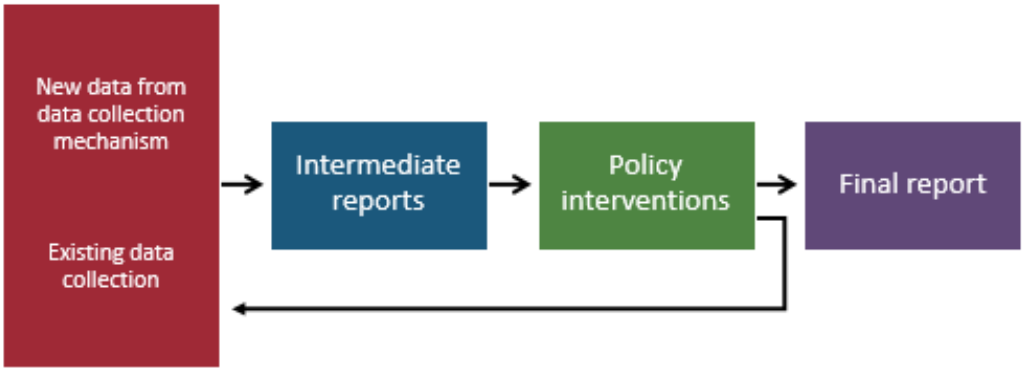
Relevant data sources

The data sources for the implementation process are not yet available, as the process by itself requires data collection throughout the period when the action programmes are being implemented.

Implementation roadmap

Regarding the structure of the application that could support this methodology, there are some key features that should be applied throughout it. As it is shown in Figure 3, the collection of new or already existing data during the data selection process will be used as input for the development of intermediate reports throughout the implementation process. Therefore, the results arising from these intermediate reports will lead to corrective policy measures, increasing the effectiveness of the implemented actions.

Figure 2 Steps of implementation of the monitoring process



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Title of the method: 6.2 Definition of RIS3 output and result indicators
Applicable to the RIS3 phase: 6. Monitoring and evaluation

Background and rationale

Output and result indicators constitute an essential part of a more general RIS3 step, focusing on monitoring and evaluation. Output and result indicators are the main instruments of monitoring and evaluation processes, and try to capture the effectiveness of the implemented programs' performance. The definitions for each one of these two kinds of indicators are given below. According to the European Commission (2015, p.7):

- *Output indicators* relate to operations supported. An output is considered what is directly produced/supplied through the implementation of an ESF operation, measured in physical or monetary units. Outputs are measured at the level of supported people, supported entities, provided goods or services delivered. They are set at the level of investment priorities or specific objective.

- *Result indicators* capture the expected effects on participants or entities brought about by an operation. Result indicators shall correspond to the specific objectives set out for each investment priority selected. Result indicators go beyond output indicators in so far as they capture a change in the situation, in most cases related to supported entities or participants.

Given the fact that output and result indicators are the main tool for performing monitoring and evaluation activities, it is important to better understand the main concept of these two processes, for effectively choosing the appropriate indices in each case. At the same time, the fact that RIS3 strategic planning has turned out to be a fundamental ingredient of policy making process within EU, indicates the need to adjust M&E mechanisms and thus, the specification of output and result indicators under this framework.

A list of the regions that have applied this method in RIS3 strategies includes: Northern Ireland, Central Portugal, Mazowieckie (PL), Zuid-Holland and Noord-Holland (NL) and many others. The mapping exercised indicated that the definition of output and outcome indicators has been applied in 90% of regions, while more structural change and context indicators have been set by some 70% of regions.

Description of the method

According to the European Commission (2014) it is important to have a common set of guidelines that will enable the project managers to effectively implement the chosen programs under the RIS3 framework. Based on this fact, the identification process of output and result indicators should follow a specific set of criteria, that will maintain the quality of the monitoring and evaluation processes.

More specifically, these indicators should be: i) responsive to policy; ii) normative; iii) robust; and iv) they should be available to be collected or calculated over time. For each of them a baseline value should also be required, in order to make comparisons and evaluations of the implemented policies. It is essential to note that before identifying the output and result indicators, a set of targets and priorities shall be established, under the RIS3 framework. The selection of the appropriate indicators will then be based upon these more general targets.

As it is stated, the result indicators are the expression of the objective of an investment priority (European Commission, 2014). At the same time, output indicators should be program specific and should be derived from the intervention logic of the program. This is a crucial difference between these two kinds of indicators, as it implies that for the case of output indicators, there is no need for setting baseline values. This means that the baseline in these cases is zero (Kokkinoplitis et al., 2015).

Finally, in order to further promote the use of high quality indicators, that could additionally provide the possibility of performing regional comparisons, a set of common indicators has been proposed by the European Commission. These indicators have standard definitions and units of measurement across different countries, when being used

for measurement throughout Operational Programs. Thus, it is also possible to aggregate the results to higher spatial levels of analysis, such as national and EU.

Usability and impact

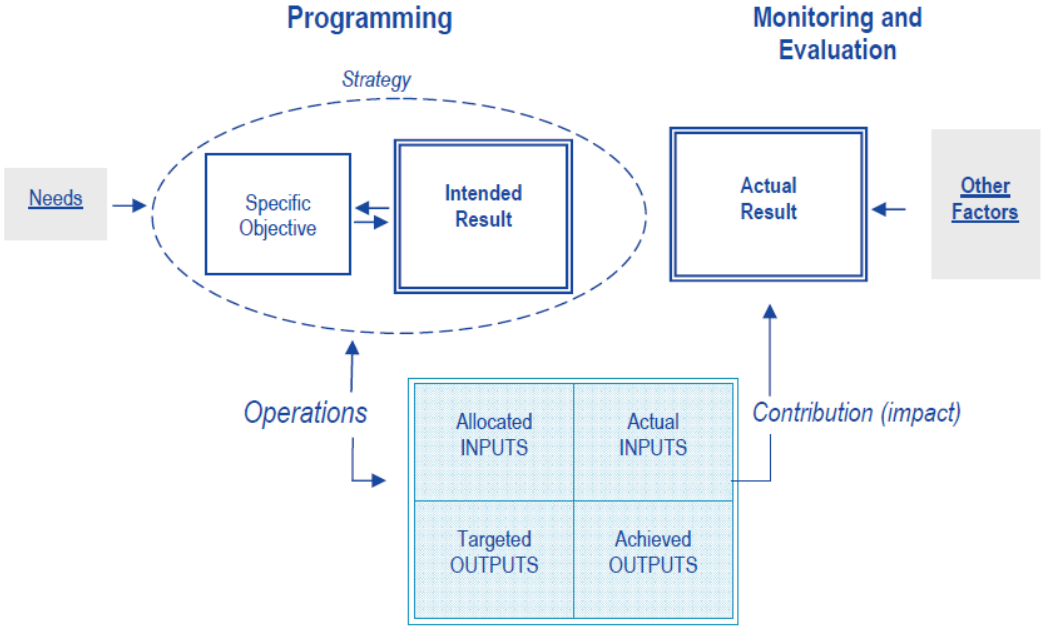
EU regions are using different types of indicators to capture the impact of RIS3. The use of a common system of indicators will provide meaning to the data and enable benchmarking of the performance and efficiency of policy measures.

The choice of output and result indicators is implemented based on a set of already defined objectives and priorities, interconnected with the general concept of well-being and progress of people. After having identified the desirable results and targets for each program, the specification of proper variables that would enable a valid measurement of the program's effectiveness is an essential procedure.

In general, it is important to define highly appropriate output and result indicators, in order to be able to specify and analyse any possible problems that might arise during the implementation process of the programs. All the available information deriving from these indicators, then will be used for understanding the problems and finding solutions to adjust the implemented policies, in order to meet the desirable target values (European Commission, 2014). It is important to note that output indicators are derived as direct effects of the programs, contributing to the further composition of the result indicators, that try to measure the effectiveness of the implemented policies, in terms of wider objectives.

Under this concept and based on previous research (Ekins & Medhurst, 2006; European Commission, 1999), Figure 1 illustrates a diagram produced by the European Commission (2014, p.5), which tries to depict more specifically the use of output and result indicators. As it is shown in this diagram, the achieved outputs are used as an input for measuring each program's contribution/impact to the overall actual result of the implemented policy. The achieved outputs are measured via output indicators, whilst the actual result is defined by the synthesis of the result indicators. One of the most crucial parts of this process is the definition of the baseline and target values for each one of these variables.

Figure 1 Diagram illustrating the main idea for an effective use of output and result indicators



Source: European Commission (2014)

Also important, is the fact that other additional factors exist and act during the implementation of the programs, affecting their final actual results. Thus, it is essential that throughout the evaluation process, a distinction between these additional factors and the contribution of policy interventions be made. This can be represented schematically as follows (European Commission, 2014):

Change in result indicator = contribution of intervention
+
contribution of other factors

According to Nauwelaers and Wintjes (2008) the evaluation process should also play a key role to understand the ways in which complex innovation policy systems operate. Although, evaluation systems were traditionally considered to have an ex post character, there is evidence that they can also be used for improving the design of innovation policies in real time (Magro & Wilson, 2013). Thus, the development and use of proper output and result indicators could work as a propulsive force towards the further development of these policies.

Required data

Data for calculating these indicators are available from EUROSTAT, at a national or regional level, for specific time periods. Another indicative example of defining the appropriate indicators for monitoring and evaluating the results of the implemented policies is also presented in the case of the Horizon 2020 strategy by the European Commission (2015).

Relevant data sources

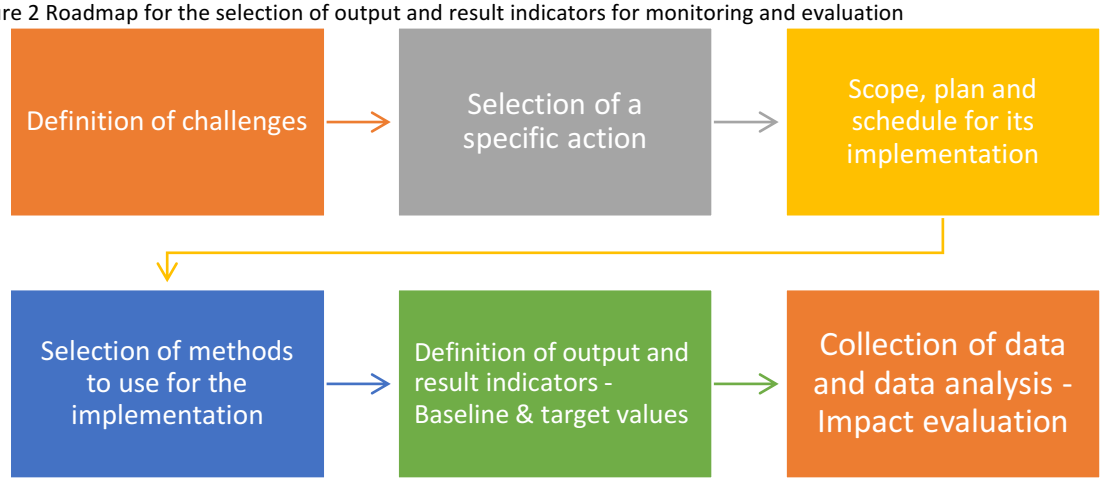
A valuable source of information regarding the potential variables that can be used as output and result indicators is the List of Common indicators published by the European Commission in 2014. This list provides a comprehensive set of indicators that can be used for monitoring and evaluation, as long as their definitions.

According to the European Commission (2014), the 46 proposed common indicators are grouped based on 10 wide areas of interest: (1) productive investment; (2) ICT; (3) Transport; (4) Environment; (5) Research Innovation; (6) Energy and Climate change; (7) Social infrastructure; (8) Urban Development specific indicators; (9) ETC specific indicators; and (10) Labour market and training.

Implementation roadmap

An analytical roadmap regarding the steps that should be followed before and after the selection of output and result indicators is given below (Figure 2). As it can be seen, the selection of challenges and the specific actions that will be used for their implementation constitute essential prior steps to the definition of indicators.

Figure 2 Roadmap for the selection of output and result indicators for monitoring and evaluation



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Title of the method: **6.3 Balanced scorecard**
Applicable to the RIS3 phase: **6. Monitoring and evaluation**

Background and rationale

The Balanced Scorecard (BSC) is a planning and management system that is widely used in a variety of areas in the private and public sector, with the aim of ensuring that the activities of an organisation are in line with its vision and strategy, improving internal and external communications, and monitoring organization performance against strategic goals. The idea behind the original balanced scorecard was that it provided a performance measurement framework that added "strategic non-financial performance measures to traditional financial metrics to give managers and executives a more 'balanced' view of organisational performance" (Balanced Scorecard Institute, n.d.- a).

However, the BSC has developed over the years and the so called "new" balanced scorecard aims to transform an organization's strategic plan from a passive tool into an active tool for an organization on a daily basis. In other words, the balanced scorecard will help planners to identify what should be done and how it should be measured:

The BSC enables organizations to clarify their vision and strategy, and translate them into action. At the same time it provides feedback regarding both the internal business processes and external outcomes in order to continuously improve strategic performance and results. (Balanced Scorecard Institute, n.d.- a)

The value of the BSC is that it transforms a strategy into a continuous process owned by every employee, not just top managers, and enables organizations to communicate high-level goals down through all levels such that employees not only know what to do, but also why they are doing it (Kaplan & Norton, 2004).

According to Kaplan & Norton (2004), what makes the balanced scorecard (BSC) special is that it:

1. Is a top-down reflection an organisations mission and strategy
2. Is forward looking
3. Integrates internal and external measures
4. Helps organisations to focus.

This method would be useful to RIS3, as it would allow the effects of specific strategies to be traced, determine how they are helpful or where they are lacking by implementing measurements to strategy objectives, based on the views of the stakeholders involved and customers affected, and improve on them in the future, in order to achieve a broader improvement in performance taking into account a wider framework that does not include financial performance.

However, it should be noted that there is a difference in approach between a private versus public balance scorecard (see "Description of the method"). Furthermore, there is also the **Public Sector Scorecard (PSS),** which has been developed from the due to the argument that the BSC still fails to measure important outcomes in the public and third sector organisations.

The mapping exercise showed that around 23% of selected regions have employed some elements of balanced scorecard in RIS3 monitoring and evaluation process. Among the most elaborate approaches would be Lower Austria, where the tailored balanced scorecard methodology ARISE was employed.

Description of the method

In a broader view, Rohm (2002), currently President & CEO of the Balanced Scorecard Institute, describes the BSC as:

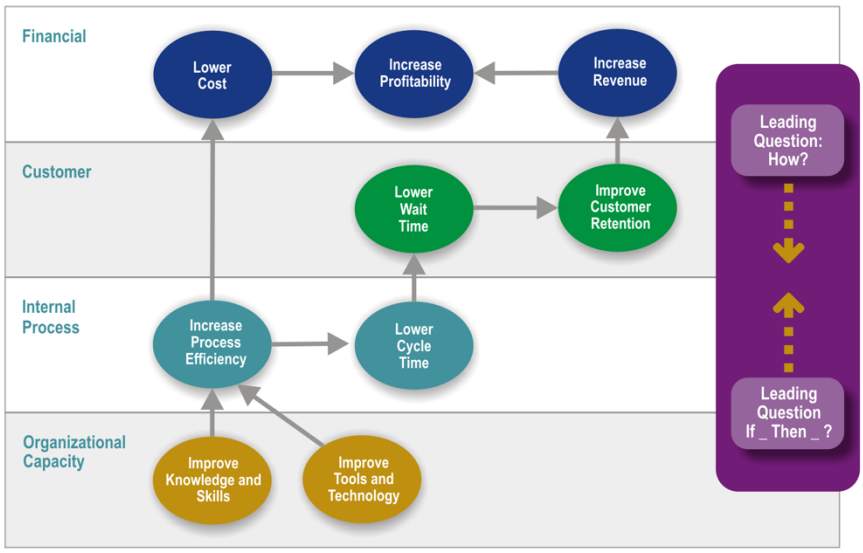
- A strategic performance management system for the whole organization
- A communications tool to make strategy clear to everyone
- A way to balance financial and nonfinancial views of organization performance
- A journey
- A system for increasing accountability
- A commitment to change
- A way of aligning organization vision with human and capital resources, and with day-to-day operations.

As a method the Balanced Scorecard (BSC) proposes to take a view on (private) organizations from four perspectives, and to develop metrics, collect data and analyze it relative to the following perspectives:

- The Learning & Growth Perspective
- The Business Process Perspective
- The Customer Perspective
- The Financial Perspective.

This is presented in a four box model (see graphic "Private Sector View" in Figure "Private versus Public Sector Scorecard"). As mentioned under "Background and rationale" BSC has developed throughout the years and the four box model now includes also a Strategy Map (see Figure), which is at the heart of modern Balanced Scorecard (The Advanced Performance Institute (API), n.d.). A Strategy Map are communication tools to show how is created for an organization. Strategy maps show a logical, step-by-step connection between strategic objectives (shown as ovals on the map) in the form of a cause-and-effect chain (Balanced Scorecard Institute, n.d.- a).

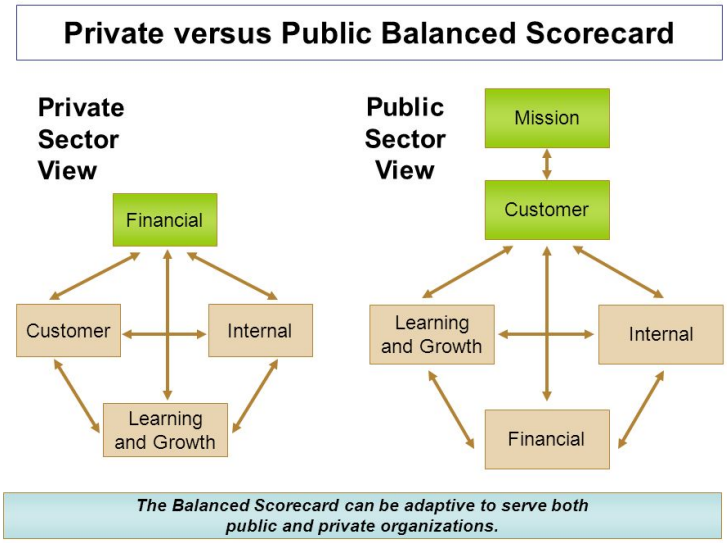
Figure 1 Strategy Map (Balanced Scorecard Institute, n.d.- a)



With respect to the values of the four perspectives in the BSC, the financial perspective ranks higher despite supplementing these with metrics from three additional perspectives (Kaplan R. S., 2010) as "[t]imely and accurate funding data will always be a priority" (Balanced Scorecard Institute, n.d.- a). However, this creates an issue for public and non-profit organisations as the BSC values financial metric data higher in organisation where success cannot be measured in financial terms. Although Kaplan does recognize that the BSC has its short comings when applied to public sector organizations (PSOs) – "The financial perspective provides a clear long-run objective for profit seeking corporations; however, it serves as a constraint, not an objective, for PSOs." (Kaplan R. S., 1999). He recognizes that

the success of PSOs should be measured according to how effectively and efficiently they meet the needs of their constituencies. Hence, the BSC has to be adapted accordingly (see picture below).

Figure 2 Private vs Public Balanced Scorecard



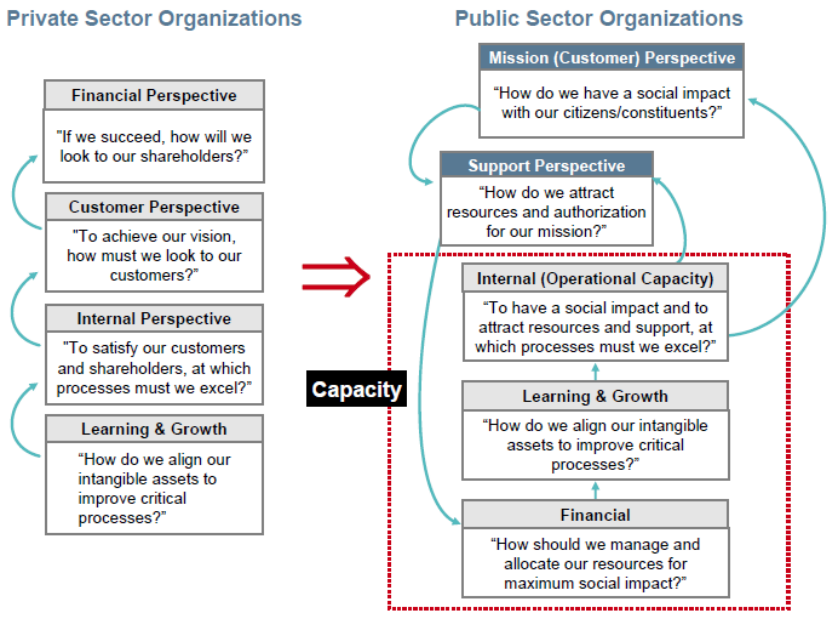
Source: (Strategy Map: Capture a Cause Effect Relationship from the Bottom Up, 2016)

The use of the BSC in the public sector stresses the role of 'Mission-Support-Capacity Framework' (Kaplan R. S., 2006) based on:

- Mission: Social Value Created
- Support: Adequate Resources Provided
- Capacity: Ability to Execute

As we can see in the graph below capacity encompasses three perspectives: Internal, Learning & Growth and Financial. Note that the Financial Perspective is at the bottom of the value chain.

Figure 3 Capacities and perspectives



Source: (Kaplan R. S., Using the Balanced Scorecard in the Public Sector, 2006)

Despite the claim by Kaplan and Norton that the BSC can be adapted to the public sector by putting the customer at the top of the hierarchy (see right graph in picture), there is evidence from the public sector that the BSC still fails to measure important outcomes (Moullin, 2013). One of the main issues with the BSC is that its language, architecture and methodology is directed towards the private sector (Moullin, 2013). Hence, the most important perspective, as mentioned above, of the BSC is still the financial perspective (see left graph "Private Sector View"). Moullin criticizes that the BSC, arguing that it has a "tendency to prize financial outcomes above all others" (Robinson, 2015), which is not ideal when the measurement of an outcome is not based on the bottom line. The issue is that the BSC has "little emphasis on service user involvement, risk management, or the need to work across organisational boundaries" (Moullin, 2013). According to Moullin (2013), most public and third sector organisations face two typical issues:

1. How to improve outcomes for service users and other key stakeholders without increasing overall cost?
2. How to develop performance measures that ensure quality without motivating staff to achieve arbitrary targets at the expense of poor service?

To address the issues mentioned above, Moullin developed the Public Sector Scorecard (PSS) which is an integrated service improvement and performance management framework for public and non-profit organisations. PSS is a workshop-based approach driven by diverse inputs and focused on three fundamental considerations: capabilities, processes and outcomes (Robinson, 2015). The idea is that "capabilities lead to processes and processes lead to outcomes" (Robinson, 2015), see figure. The key features of PSS are:

- Focus on outcomes and evidence-based drivers of outcomes
- Provide a link between strategy, organisational culture and resource issues
- Incorporate service re-design, organisational culture and resource issues
- Ideal for use across organisational boundaries
- Integrated risk management
- Culture of improvement, innovation & learning (not blame culture). (Public Sector Scorecard, n.d.)

At the core of the PSS is that it focuses on effective performance management through collaboration, inclusion of frontline staff, end users and other stakeholders in establishing metrics that are constructive. Outcomes should be measured according to a variety of interested parties, and also be adjusted accordingly (Robinson, 2015).

Usability and impact

Whether one uses the balanced scorecard (BSC) or the Public Sector Scorecard (PSS), either offers a comprehensive picture of strategy, taking into account all its components. They offer a balanced view between outcomes and enablers of a strategy. Public sector organisations are increasingly under pressure to ensure that public money is allocated intelligently. They must be able to measure and report whether strategic objectives are being met, and whether stakeholders and customers support these objectives. It is about aligning aims, outcomes, outputs and enablers (or capacity). It is not merely about one step in the process, but the whole process, from start to finish.

This is very valuable in the development and implementation of a successful smart specialisation strategy. What is the aim of the S3 strategy? Is the aim shared by stakeholders and customers? Is there capacity to achieve the aim? Once the strategy has been laid out, the scorecard offers a tool to continuously monitor and evaluate the process and feed it back into the strategy to make adjustments if necessary, creating a loop for learning. It allows the effects of actions to be traced efficiently and any negative actions to be rectified through the adjustment of goals.

Required data

The method would require the stakeholder to be able to evaluate the goals that had been set and implemented in the region. It would require stakeholder input in order to analyse the customer perspective, economic data to analyse the financial perspective, data on businesses for the business process perspective, and lastly data on the internal working of businesses or employee input in order to manage the analysis of the learning and growth perspective. Public Sector Scorecard stresses the importance of involving stakeholders in the process – "the benefits of involving stakeholders – not just in judging performance but in devising how performance should be judged in the first place" (Robinson, 2015).

Relevant data sources

The Balanced Scorecard

- The Balanced Scorecard Institute (BSI): http://balancedscorecard.org
- The Advanced Performance Institute (API): http://www.ap-institute.com/strategy-management-articles/the-balanced-scorecard-a-complete-introduction.aspx
- Balanced Scorecard 2012 IAS Conference: http://ec.europa.eu/dgs/internal_audit/pdf/conference_2012/moueddene_pres.pdf
- The Public Sector Scorecard: www.publicsectorscorecard.co.uk

See also references used under this method.

Implementation roadmap

The key to the successful development of a balanced scorecard process is to link measurements to the strategy. According to Kaplan and Norton (2004), there are three main questions that should be asked during this process (slightly adjusted):

1. If the vision and strategy is successfully implemented, what difference will it have in terms of how:
    a. the customers perceive the organisation
    b. it affects the internal process of the organisation and
    c. it affects the ability to learn and grow.
2. What are the critical success factors in each of the perspectives in the value chain (perspectives)?
3. What are the key measurements that will signal that the organisation is addressing the success factors as planned?

The Balance Scorecard Institute has developed the *Nine Steps to Success*™ for building and implementing a Balanced Scorecard (BSC), starting at the top with *Assessment*. It is a practical approach to developing a strategic planning and management system based on the BSC. Important aspects of the framework are training, coaching, change management, and problem solving. The idea of the framework is to give organizations a way to 'connect the dots' between the various components of strategic planning and management, that is, there will be a visible connection between the projects and programs that people are working on, the measurements being used to track success, the strategic objectives the organization is trying to accomplish and the mission, vision and strategy of the organization. (Balanced Scorecard Institute, n.d.- b)

Figure 4 Nine Steps to Success™

Source: (Balanced Scorecard Institute, n.d.- b)

The logic of the integrated strategic planning and management with a BSC is presented with a pyramid (see below)

Figure 5 How does all of this terminology fit together logically?

Source: (Balanced Scorecard Institute, n.d.- b)

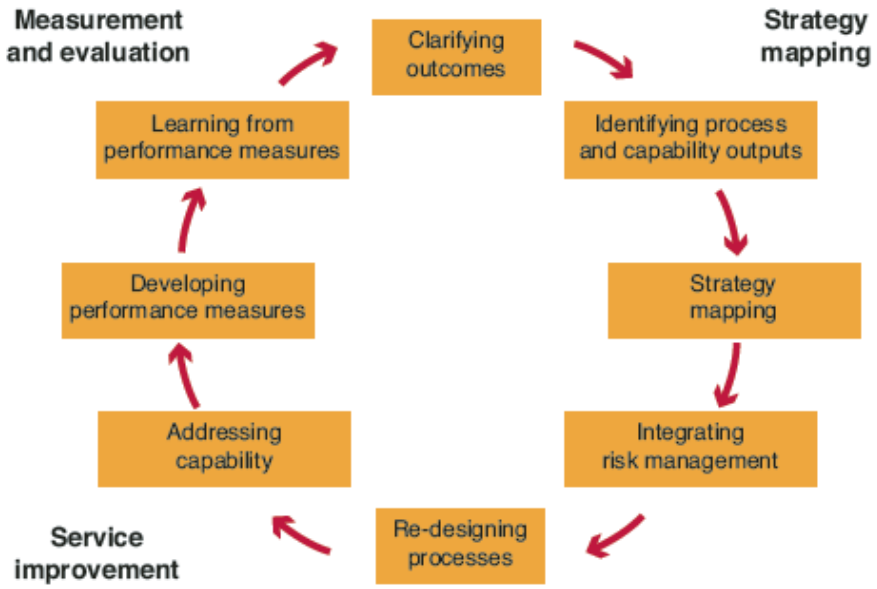
Balances Scorecard (Public view)
Taking the BSC from a public and non-profit sector perspective, Kaplan (1999) states that the "start of any performance management exercise must be to reaffirm or focus the organization's strategy: to define what it is uniquely qualified to do and to reject possibilities that will not deliver on the organization's mission and purpose". Furthermore, a well-articulated, focused strategy will help evaluation with the BSC.

The first thing public and non-profit organisations should do is to start by identifying an overarching objective for their mission at the top of their scorecard. Kaplan (1999) mentions that the financial and customer perspective of the BSC can be combined to provide a framework in which a government organisation has three high level themes: Cost Incurred, Value Created, and Legitimizing Support.

After the top-level scorecard has been created, the next step for public and non-profit organizations, similarly to private-sector organizations, is to deploy the process down through to its individual departments. The departmental scorecards must reflect the themes and objectives established in the top-level scorecard. The local scorecards describe how each department does its job to contribute to the top-level organizational objectives.

Public Sector Scorecard (PSS)
The Public Sector Scorecard is a workshop-based approach with three phases
- *Strategy mapping*, *Service improvement*, and *Measurement and Evaluation* (see figure).

Figure 6 The Three Phases of the Public Sector Scorecard



Source: (Robinson, 2015)

Phase one - Strategy mapping: is the key output of the PSS, showing the relationships between outcomes and process and capability outputs. The phase is centred around a number of interactive workshops attended by a wide range of stakeholders that work together to discuss desired outcomes – strategic, financial, user-centric, etc. and the processes and capabilities needed to achieve them.

Phase two - Service improvement: the strategy map is used as a quick way to appraise the effectiveness of different processes in satisfying the desired outcomes. This phase should become

more factual by using available evidence or data, supplemented where appropriate by tools such as process maps, systems thinking and lean management.

Phase three- Measurement and evaluation: here possible performance measures for each element of the strategy map should be considered, which should be selected on the basis that they provide value, are cost effective and minimise any perverse effects. According to Moullin (Robinson, 2015) "Performance measures don't have to be strictly quantitative ... In many cases – especially in some capability areas – more qualitative approaches are preferable".

What is important is that an evaluation strategy should be developed in an early stage project group, task force, etc., as it helps to form the strategies and processes to meet the desired goals.

Title of the method: 6.4. RIS3 beneficiaries and end users' satisfaction online survey
Applicable to the RIS3 phase: 6. Monitoring and evaluation

Background and rationale

This method will enable the collection of micro data directly from the beneficiaries and 'end-users' of public policies implemented through S3. It is intended to assist in understanding how well-suited measures were to the needs of firms, research institutes, universities, as well as civil society organisations such as NGOs. It allows also for cross-regional analysis of satisfaction and can inform the RIS3 update process. It could also be used for defining baseline values of satisfaction as well as target values. The method requires a well-designed online survey questionnaire. The questionnaire has to be general enough to capture all types of EU regions and policy measures, and specific enough that it is able to quantify overall satisfaction of beneficiaries. Multi-language functionalities and a strong dissemination strategy among end-users is needed.

One tool that can be used in monitoring and evaluation is the use of online surveys. The mapping exercise identified only four regions that applied online surveys for monitoring and evaluation purposes. In none of the cases was it indicated that surveys were used for measuring beneficiaries and end users' satisfaction in the public policies implemented through S3. By measuring their satisfaction levels, it is possible to adjust the policies according to the opinions of stakeholders who are most affected by the policies. To encourage regions to conduct these surveys, a ready survey template could be provided for them on the Online S3 platform. The template would save the policymakers a lot of time and also allow for cross-regional analysis of beneficiary satisfaction at the EU level.

Description of the method

Tool

The method will consist of online survey templates that are used for measuring satisfaction in RIS3 policies. For this purpose, two types of survey templates could be provided: one for measuring satisfaction in one individual policy, and another one for measuring satisfaction in multiple policies and the whole strategy at once. The templates consist of general well-defined questions that are applicable to all EU regions and policy measures. They could also be translated into all official EU languages.

The templates could be given in two forms. First, as downloadable templates that can be transferred to any survey platform manually or be distributed physically. Second, as a ready online survey that is automatically generated for the user by an app as part of the survey platform. The first option allows the user to choose any survey platform and to easily modify the templates. However, the second option saves time for the user since they only need to distribute the link to the survey. To help with the distribution, instructions could be given, for example, regarding the right channels, stakeholders, etc.

Use

The surveys would be used for the constant development and adjustment of public policies. The idea is it that when regions implement or plan public policies based on their smart specialisation strategies, they simultaneously distribute surveys to stakeholders in order to receive feedback on them. The feedback from the surveys is then used to adjust the policies. Additionally, the surveys are distributed periodically to ensure constant development of the policies. This also allows regions to follow the development of stakeholder satisfaction regarding policies over time.

Usability and impact

The surveys are an effective way to improve stakeholder participation in RIS3 strategies. They are easy to create and distribute, and they allow regions to receive direct feedback from the stakeholders on policies, an area that has been somewhat neglected previously. By creating a ready survey template, regions will likely use surveys since the regional policymakers do not have to spend their own time on creating them. Additionally, by providing a common template it is possible to compare the results between regions and to use the data, for example, for academic and development purposes.

Required data

This method requires well-though-out survey templates for measuring satisfaction in RIS3 policies. The questions should be applicable to every EU region and to a wide range of possible policies. Also, the survey should assume that the participant does not know what RIS3 means and what the implemented RIS3 policies are. Therefore, a clear but concise description of the strategy and the individual policies should be given.

In addition to background information, the questions of the survey could cover multiple aspects such as:

- Communication (i.e. Did the participant know about the policy or strategy?)
- Effect (i.e. How is the participant affected by the policy?)
- Satisfaction (i.e. Does the policy or strategy please the participant?)
- Improvement (i.e. How would the participant like to improve the policy or strategy?)
- etc.

Most of these aspects could be measured, for example, using a Likert scale and open-ended questions. Overall, the survey should give a sufficient view of the end users' opinion regarding the region's RIS3 and its policies.

Relevant data sources

Relevant data sources:

- Already applied surveys in RIS3 context, for example, by regions or studies

Survey platforms:

- Google (with API)
- **Webropol, SurveyMonkey, ZEF, etc.**

Implementation roadmap

To measure satisfaction in implemented policies:

1. Download a suitable template
2. Study it and modify it to suit the respective policy/policies
3. Host it on a survey platform
4. Advertise the survey to stakeholders
5. Analyse the results carefully
6. Adjust the results based on the results
7. Repeat periodically to maintain a constant development

Title of the method: 6.5 RIS3 social media analysis
Applicable to the RIS3 phase: 6. Monitoring and evaluation

Background and rationale

This online tool offers simple indicators on the RIS3 process by using data coming from social media sites, such as Twitter or Google trends with regards the overall process, or also allow for specific searches with keywords of key policies or programmes implemented in the region. Using natural language ontologies, it could allow for cross-regional comparisons or S3 social 'interest'. However, the mapping exercise did not identify any pre-existing method that is relevant to describe social media analysis in RIS3.

As reported by Charalabidis et al. (2012b), *"a considerable body of knowledge on how social media can be used effectively by enterprises for supporting and strengthening various functions, such as marketing, customer relationships, new product development, etc."*. Unfortunately, *"in contrast, the benefits of social media and the application of social media analytics for governmental organizations has not been observed comparably"* (Gotsch and Grubmuller, 2013).

Current research on the use of social media analytics in public sector reveals indeed that *"governments are just about to explore the opportunities that [are offered by] social media and the analysis of user-generated contents"* (Grubmüller et al., 2013). This is particularly evident in the field of RIS3, in which the application of social media analytics has the potential to track and capture satisfaction of beneficiaries with the RIS3 process overall and increase collaboration. Indeed, according to the Joint Research Centre's Institute for Prospective Technological Studies (Osimo, 2008; Pascu, 2008; Pascu et al. 2007; 2008), ICT-enabled solutions for the application of social media analytics can effectively support and facilitate the development and implementation process of Smart Specialisation Strategies.

However, the lack of case studies and literature dealing with the use of this method in the context of Smart Specialisation Strategies makes it difficult to explore its practical implications.

Description of the method

Despite this situation, however, useful insights into how to use social media analytics in the development of Smart Specialisation Strategies can be acquired by looking at the several research projects implemented over the years in the public sector thanks to the European Commission's financial support. In the last decade, the European Commission has indeed expressed a strong interest in this subject and funded several projects aimed at building ICT-based SMA (social media analytic) tools for gathering feedback, detecting future trends, stimulating collaboration and supporting evidence-based decision and policy making. Some interesting examples are:

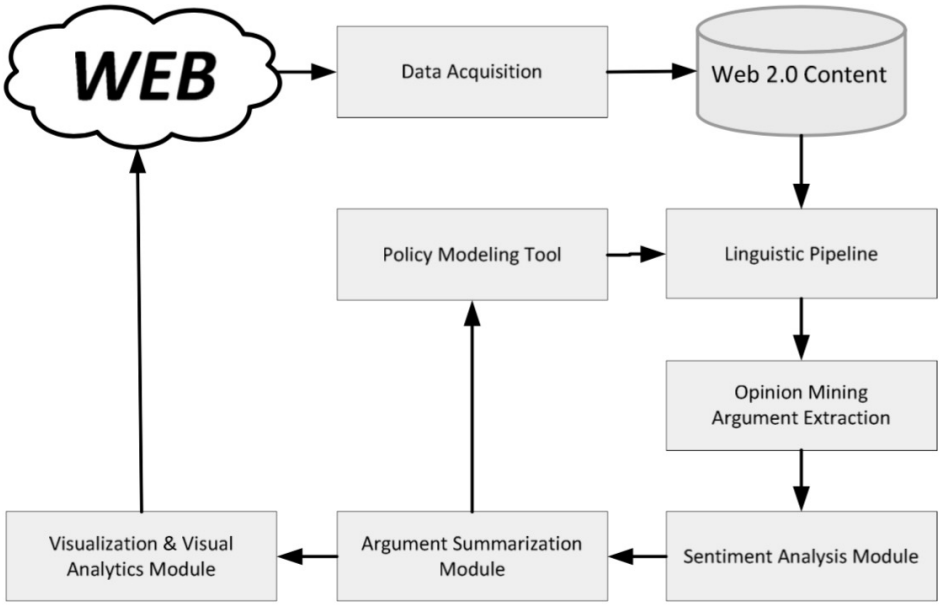
- NOMAD (Policy Formulation and Validation through non-moderated crowdsourcing)
- PADGETS (Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media)
- ImmigrationPolicy2.0 (Participatory Immigration Policy Making and Harmonization based on Collaborative Web2.0 Technologies)
- Puzzled by Policy
- UniteEurope (Social Media Analytics and Decision Support Tools Enabling Sustainable Integration Policies and Measures).

The tools developed by these projects are considered of great value to the ONLINE-S3 project because they highlight the potentials offered by the analysis of contents extracted by social media. Moreover, they provide useful knowledge and lessons on how to develop the ICT-driven services, tools and

applications for RIS3 social media analytics which are going to populate the ONLINE Platform for Smart Specialisation Policy Advice.

NOMAD (Policy Formulation and Validation through non-moderated crowdsourcing)
The project has produced a fully automated ICT-based SMA platform which allow decision-makers to analyse the vast amount of user-generated contents and opinions sourced from social media and blogs and use this data for supporting the development of public policies and strategies (http://cordis.europa.eu/project/rcn/102148_en.html). The architecture of the platform is shown in Figure 1 and its main components are the following: 1) Policy Modeling Tool; 2) Data Acquisition Module; 3) Linguistic Processing Pipeline; 4) Opinion Mining & Argument Extraction; 5) Argument Summarization; 6) Social Reaction Visualization (Charalabidis et al., 2012b).

Figure 2 NOMAD platform's technological architecture



Source: Charalabidis et al. (2012b)

PADGETS (Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media)
PADGETS has developed a prototype service for policy makers that uses social media technologies and techniques to: boost public engagement; enable cross-platform publishing and content tracking; and provide support to decision making. With the PADGETS platform, messages related to public policies can be disseminated simultaneously within multiple social media sites, but using a single integrated interface. This makes it possible to reach large user groups. Their feedback is then collected by the platform, that keeps track of and analyses the users' reaction by each message (Ferro et al., 2010). This system can therefore empower "*citizens to better participate in decision making processes and public deliberation of policies by increasing the impact of their opinions [and feedbacks] while dramatically reducing the effort and cost of projecting them in the public sphere*" (http://www.padgets.eu).

ImmigrationPolicy2.0 (Participatory Immigration Policy Making and Harmonization based on Collaborative Web2.0 Technologies)
ImmigrationPolicy2.0 has developed and piloted *"a range of citizen-centric services which facilitate the participation of citizens in the migration policy development process. [...] The services support [the] drafting [of] immigration policy text, develop and test policy models, evaluate scenarios ("what-if" process), as well as harmonizing policy text*". Moreover, they facilitate *"societal group of immigrants with migration background […] to get informed"* and can be used to *"evaluate various migration-*

related proposals and policies […]. The process [involved] the development of new models for citizens' legal residents' participation, as well as the collection and analysis of collaborative input from multiple citizens. The pilot services of the project [was] offered over a centralized, collaborative, trustful migration platform (conveniently called ImmigrationPolicy2.0 platform) enabling users (i.e. policy makers, politicians, decision makers, citizens) to identify, model, visualise, analyse and evaluate national migration policies, practices, monitor and accordingly harmonise easily their procedures and data formats relateding to their economic activities and documents involved (e.g. civil status documents i.e. (e.g. residence permits/certificates, work permits, civil status certificates, family unification certificates)" (http://cordis.europa.eu/project/rcn/191809_en.html).

Puzzled by Policy

Puzzled by Policy aimed *"to address the specific issue of immigration in a manner that likewise addresses the broader issue of widespread confusion about and disengagement from the policymaking process by providing all citizens [with] an informative and easy-to-use platform to engage topical policy issues".* To achieve this aim, the project's team has developed, *"tried and tested eParticipation […] tools such as EU Profiler and Debategraph with new widget applications to reduce the complexity of decision making at the EU level and 'push' the platform to popular social media sites such as Facebook and Twitter as well as to their own desk top and mobile devices"* (http://www.puzzledbypolicy.eu).

UniteEurope

UniteEurope has developed a software that analyses social media contents related to migrant integration at the city level. *"Through a sophisticated and automatized filtering of public social media contents, [this] tool [can] analyse migrant integration specific posts produced by citizens, communities, and organizations"*. The software helps policy makers to *"judge on current discussions on migrant integration issues; to proactively or reactively take actions; and to monitor effects on actions taken"* (UniteEurope Consortium, 2014a). The UniteEurope tool supports sources of three different stream types: Twitter, Facebook and Google+ (UniteEurope Consortium, 2014b).

Usability and impact

Considering the usability and impact of social media analytics in the public sector, which are shown by the above-mentioned projects, the use of this method in relation to the design and implementation of Smart Specialisation Strategies can provides the governance system with the possibility to integrate valuable stakeholders' insights, opinions and feedback, detect future trends, stimulate collaboration and support evidence-based decision making processes by taking public opinion into account. This method can also help increase transparency (United Nations - Department of Economic and Social Affairs, 2012; European Commission 2016). What is more, the World Bank (2012) reports that social media platforms generate higher public participation rates than other conventional e-government applications. These tools can play an even greater role in strengthening and widening the participation of and interaction with citizens (Charalabidis et al. 2012a; 2012b). Moreover, in the RIS3 context, social media analytics can help articulate the collaborative visioning process and better legitimate the selection of specific scenarios emerging during the strategy formulation.

Required data

Considering the projects previously described, RIS3 social media analytics require user-generated contents like posts, feedbacks, comments, etc. These contents can be gathered from: 1) the social media services belonging to the public authority which is developing its Smart Specialisation Strategy; 2) existing social media (See Table 1 in the next section), such as Twitter, Facebook, Google, YouTube and Wikipedia (Bakhshi and Mateos-Garcia 2016; Brainard and Edlins 2014; Yang and Rim, 2014; Gerber, 2014; Dehkharghani et al., 2014; Collins et al., 2013; Dehghani and Tumer, 2015; Askitas 2015).

Data for RIS3 social media analytics can also be extracted from online newspapers, blogs, online communities, etc. (Gotsch and Grubmuller, 2013).

Moreover, even if this aspect does not significantly emerge from the projects previously discussed, when talking about using user-generated contents extracted from social media in the public sector and in the RIS3 development process, one major implication is privacy. This generates some fundamental concerns for public authorities *"seeking to develop their own social media [groups] or strategies for engaging with other sites […]. Users willingly share their identities on social media sites such as Facebook and Twitter, yet this does not mean they do not care what happens to this information. Indeed, users have serious concerns about how secondary firms use their information as a source for data mining and surveillance […], and the extent to which social media sites passively facilitate or actively encourage these activities"* (Kietzmann et al., 2011). This may result in legal actions for invasion of privacy (Kravets, 2010).

Relevant data sources

The European project NOMAD (Policy Formulation and Validation through non-moderated crowdsourcing) offers a list of the 50 most used social media from which the user-generated contents can be collected (Xenakis et al., 2012). The list is reported in Table 1. Considering that no case studies can be identified in which social media analytics has been used in the field of RIS3, this table represents a list of potential data sources to be considered and tested.

Table 1 List of the 50 most used social media

N°	NAME	FOCUS DESCRIPTION	TOP POPULARITY	REGISTRATION	UNIQUE USERS
1	Facebook	Social Networking Service	Worldwide	Open > 13	845.000.000
2	Qzone	Social Networking Service	China	Open	536.000.000
3	Youtube	Video sharing	Worldwide	Open	490.000.000
4	Twitter	Social Networking Service/Microblogging	US	Open	380.000.000
5	Windows Live	Social Networking Service	Worldwide	Open	330.000.000
6	Wikipedia	Encyclopedia	Worldwide	Open	310.000.000
7	Blogger	News - Bookmarking	Worldwide	Open	300.000.000
8	Habbo	Social Networking Service	Worldwide	Open > 13	230.000.000
9	Skype	Voice Calls/Instant Messages	Worldwide	Open	200.000.000
10	Yahoo! Answers	Question-and-Answer	Worldwide	Open > 13	200.000.000
11	Renren	Social Networking Service	China	Open > 18	160.000.000
12	Badoo	Social Networking Service	EU (Italy)	Open > 18	121.000.000
13	Vkontakte	Social Networking Service	Russia	Open	121.000.000
14	Bedo	Social Networking Service	Worldwide	Open > 13	117.000.000
15	Yahoo! News	News	US	Open > 13	110.000.000
16	LinkedIn	Professional Social Networking Service	US	Open > 18	100.000.000
17	Google+	Business Social Networking Service	US	Open > 13	100.000.000
18	Myspace	Social Networking Service	Worldwide	Open > 13	100.000.000
19	Orkut	Social Networking Service	Brazil	Open > 18	100.000.000
20	Tagged	Social Networking Service	US	Open	100.000.000
21	Scribd	Document Sharing	US	Open	100.000.000
22	Friendster	Social Gaming	Asia	Open > 18	90.000.000
23	hi5	Social Networking Service	India	Open > 13	80.000.000
24	CNN	News	US	Open	74.000.000
25	MSNBC	News	US	Open	73.000.000
26	Netlog	Social Networking Service	India	Open > 13	70.000.000

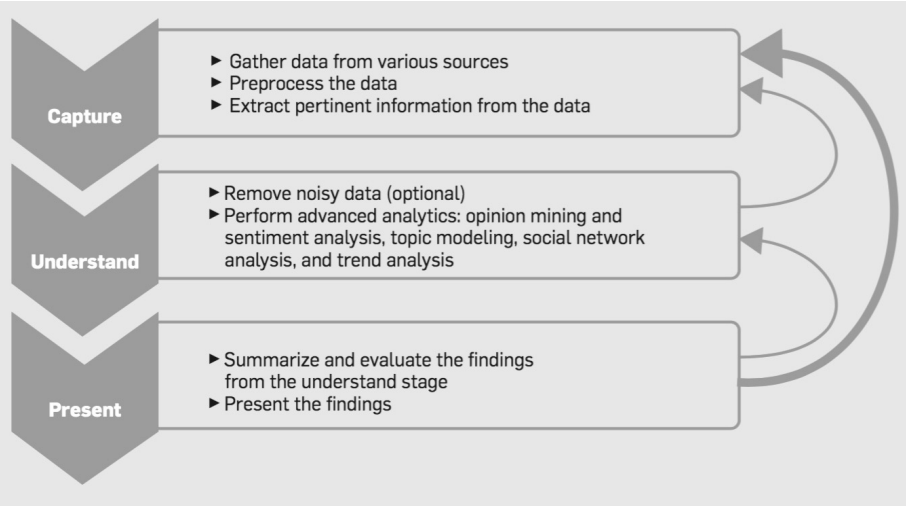
27	Google News	News	US	Open	65.000.000
28	Flixster	Social Networking Service	US	Open > 13	63.000.000
29	New York Times	News	US	Open	59.500.000
30	HuffingtonPost	News/Blogging	US	Open	54.000.000
31	MyLife	Social Networking Service	US	Open	51.000.000
32	Classmates.com	Social Networking Service	US	Open > 18	50.000.000
33	Douban	Online music, movie and book database	China	Open	46.850.000
34	Odnoklassniki	Social Networking Service	Russia/Ukraine	Open	45.000.000
35	Viadeo	Profeessional Social Networking Service	Worldwide	Open > 18	35.000.000
36	Reddit	Social News	Worldwide	Open	34.879.881
37	Flickr	Video/Image sharing	Worldwide	Open > 13	32.000.000
38	Fox News	News	US	Open	32.000.000
39	Last.fm	Music	US	Open	30.000.000
40	MyHeritage	Social Networking Service	US	Open	30.000.000
41	WeeWorld	Virtual World	US	Open > 13	30.000.000
42	Xanga	Blog	US/Hong Kong	Open	27.000.000
43	Digg	News-Bookmarking	Worldwide	Open	25.100.000
44	Washington Post	News	US	Open	25.000.000
45	LATimes	News	US	Open	24.900.000
46	Mail Online/Daily Mail	News	US/UK	Open	24.800.000
47	Mixi	Social Networking Service	Japan	Invite Only	24.323.160
48	Reuters	Business and Finances News	US	Open	24.000.000
49	Cyworld	Social Networking Service	South Korea/China	Open > 25	24.000.000
50	Gaia Online	Social Gaming	US	Open > 13	23.523.663

Source: Xenakis et al. (2012)

Implementation roadmap

A possible implementation roadmap for social media analytics in the development of RIS3 is presented in Figure 2. This roadmap is based on the analysis of the previous projects and research by Fan and Gordon (2014). ICT-enabled solutions for social media analytics can facilitate the development and implementation of this roadmap.

Figure 2 Social media analytics process



Source: Fan and Gordon (2014)

Phase 1. Capture

Relevant social media data are obtained by monitoring or listening to various social-media sources. This stage *"helps identify conversations on social media platforms related to"* the RIS3 process and can cover *"popular platforms (such as Facebook, Foursquare, Google+, LinkedIn, Pinterest, Twitter,*

Tumblr, and YouTube), as well as smaller, more specialized sources (such as Internet forums, blogs, microblogs, wikis, news sites, picture-sharing sites, podcasts, and social-bookmarking sites)". Data collected from the selected sources is used to prepare a dataset which is going to be used in Phase 2. *"Various preprocessing steps may be performed, including data modeling, data and record linking from different sources, stemming, part-of-speech tagging, feature extraction, and other syntactic and semantic operations that support analysis"* (Fan and Gordon, 2014).

Phase 2. Understand

After collecting the conversations related to the RIS3 process, their meaning needs to be assessed and the metrics for decision making needs to be developed. *"Since the capture stage gathers data from many users and sources, a sizeable portion may be noisy and thus has to be removed prior to meaningful analysis. Simple, rule-based text classifiers or more sophisticated classifiers trained on labeled data may be used for this cleaning function. Assessing meaning from the cleaned data can involve statistical methods and other techniques derived from text and data mining, natural language processing, machine translation, and network analysis. The understand stage provides information about user sentiment and their behavior […]. Many useful metrics and trends about users can be produced in this stage, covering their backgrounds, interests, concerns, and networks of relationships"* (Fan and Gordon, 2014).

Phase 3. Present

"The results from different analytics are summarized, evaluated, and shown to users in an easy-to-understand format. Visualization techniques may be used to present useful information; one commonly used interface design is the visual dashboard, which aggregates and displays information from multiple sources. Sophisticated visual analytics go beyond the simple display of information. By supporting customized views for different users, they help make sense of large amounts of information, including patterns that are more apparent to people than to machines. Data analysts and statisticians may add extra support" (Fan and Gordon, 2014).

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