Title of the method: **1.1 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 are they 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. Additionally, information about the role of communication in the RIS3 process and instructions for using the templates would be provided. The instructions would tell how to fill in the templates with own information, such as vision, contact details, etc., and how to use them to effectively communicate with the stakeholders.

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 standarised templates does not require the development of bespoke applications.

Communication with stakeholders takes place 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

Usability and impact

Overall, the method has a high probablility 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. 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

References

- Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., … Ortega-Argilés, R. (2012). Guide to Research and Innovation Strategies for Smart Specialization (RIS3). Luxembourg: Publications Office of the European Union. Available at: https://bookshop.europa.eu/en/guide-to-research-and-innovation-strategies-for-smart-specialisation-ris-3--pbKN3212216/.

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 requested fundamental features the **open-source software LiquidFeedback** appears to offer a promising method and 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).

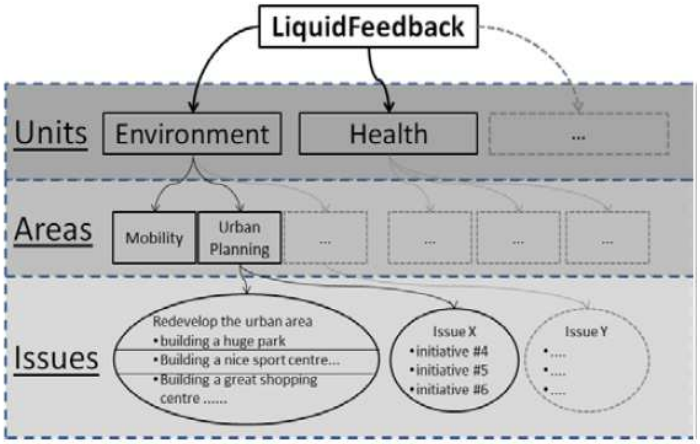


Figure 1. LiquidFeedback structure. Source: Bertone et al., 2015

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).

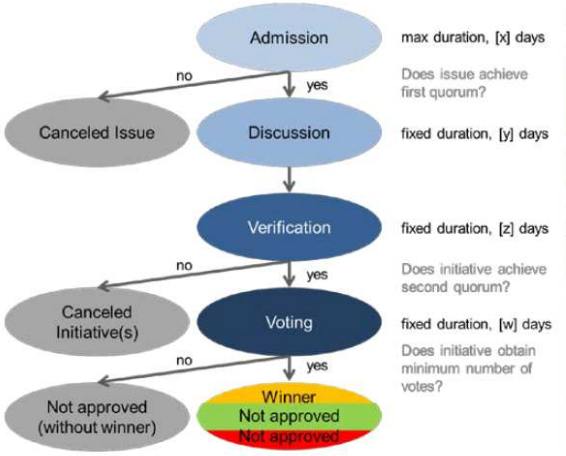
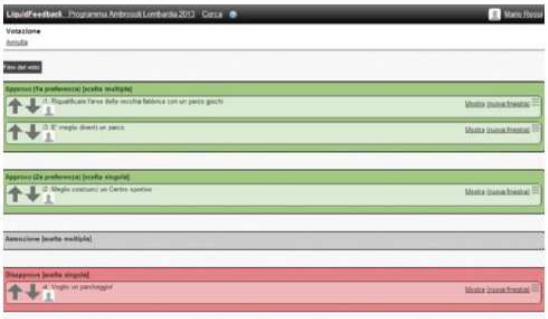


Figure 3. The deliberation path. Source: Bertone et al., 2015

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).



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*

Figure 4. Voting interface, generic example. 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.

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):

create a debate map to identify challenges to overcome,
create positions and sub-positions of the challenges,
write arguments – supportive and opposing,
include other scenarios and manage the graphs,
rank the arguments and ideas,
label the arguments and ideas by different people/stakeholders,
rate the significance and merits of the problems, positions and arguments,
pick out the arguments that are seen as weak and strong,
analyse, seek and relocate arguments around the map, and
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

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 a platform onlines3.eu, the iframe is necessary. Via the share link the code is offered.

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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:

1. **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.

2. **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).
3. **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).
4. **Sectoral structure:** Provides information on the intensity of the service-based economy, and the rate of the de-industrialisation of the region.
5. **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).
6. **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: Passengers carried per annum	2013	http://ec.europa.eu/eurostat/web/transport/data/database
	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 employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	Manufacturing (C),	2014	http://ec.europa.eu/eurostat/web/structural-business-

	Number of local units		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 of persons employed	2014	http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database
	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	2014	http://ec.europa.eu/eurostat/web/structural-business-

	support service activities (N), Number of local units		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 Institutions	Knowledge 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:

- Eurostat's Regional Statistics indicators (http://ec.europa.eu/eurostat/web/regions/data/database)
- the Regional Innovation Scoreboard 2016 indicators (http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en)
- 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: **2.2 Research infrastructure mapping**

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

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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:

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

Each enlisted facility should include information on:

- Hosting organisation and RI location
- Short description of the facility and the available equipment

- Open access status
- List of provided services and pricing, where available
- Average number of users per year (national, European, international) and average rate of usage, where available
- Keywords for identifying the facility in general search option.

2) A database of supported RI projects under H2020 and FP7

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

4) 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:

1) 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
2) Develop concise online guidance material that explains how best to exploit RI mapping for RIS3 development
3) 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 Clusters, incubators, and innovation ecosystem mapping**

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,[1] has revised the State aid framework allowing certain targeted support measures for cluster development,[2] 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.[3] 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.[4]

[1] See Community Strategic Guidelines on Cohesion for the period 2007-2013.
[2] 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.
[3] 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).
[4] 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

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

- 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;
- 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.

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

Rosenfeld, 2009).

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:

- Country

- Type of innovation eco-system (industrial cluster? Technological district? Research-based innovation hotspot?)
- Type of products/industry/technology
- Scientific domain
- Availability of a managing organisation, and type of governance

Each enlisted cluster should include information on:

- Location, size (e.g. n. businesses), geographical diffusion (highly clustered? Region-based clusters?)
- Industrial sector/s of specialisation
- Hosting organisation
- Economic, research and innovation indicators (e.g. patents, case-study material)
- Relevant recent changes in the local R&I system (e.g. creation of competence centres, incubation facilities, etc.)
- Availability of complementary research institutions and their specialisation
- Short description of the facility and the available equipment
- Average number of users per year (national, European, international) and average rate of usage, where available
- A database of participation in RI projects under H2020 and FP7

Information about ongoing (regional and national) support policy schemes.

Relevant data sources

1) **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.

2) **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.

3) **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.

4) **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.

5) **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.

6) **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:

1) Identify regional and national clusters with the support of national stakeholders
2) 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
3) Develop appropriate statistical matching tools
4) 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 regional/national 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[5] 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.

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

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

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.

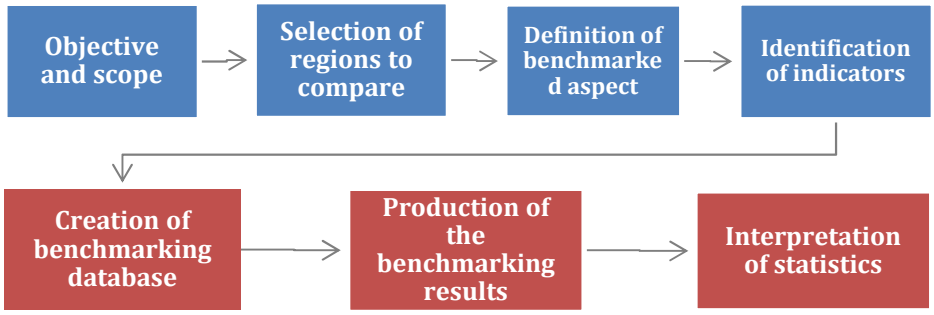
Step 4. Identification of indicators. The indicators that are selected should reflect the multifaceted nature of the benchmarking element more appropriately. For example, GDP is not a sufficient variable for the economic development of a region. Similarly with the previous step, the user can define the 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: **3.1. 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 synthesise 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.

Delphi- Foresight is a common method for RIS3 development (24% of studied 30 regions have utilized it) based on RIS3 mapping exercise (Task 1.2.). However, none of the regions studied have applied the Delphi method as described above in the development of smart specialization strategies. Some countries e.g. Lithuania, Poland and Romania have utilized Delphi method in the development of RIS3 (see case examples at the end of 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 to in the first round 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.

Required data

Key data are collected through expert surveys. Also desk research may be used to provide the initial set of trends and uncertainties for the survey, those for which there are obvious evidence such as aging population in Europe. Then, the experts may be used to provide additional trends and uncertainties those would not be able easily identified with pure desk research.

Relevant data sources

There are numerous applications for creating surveys (e.g webropol, Google Forms), which can be used as the basis to develop a RIS3 specific Delphi application.

Further information: Webropol, http://w3.webropol.com/news-4/

Implementation roadmap

1. Modify the Delphi survey questionnaire for regional use, e.g. adapt language if needed
2. Select and invite experts to participate in a Delphi survey.
3. Run the first round of survey, provide feedback and then repeat this for second and potentially third round of a survey
4. Write down survey results
5. Incorporate the results to RIS3 work, use them as basis for step 3.2. scenario development

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Case Examples

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