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Intelligence and Co-Creation in Smart Specialisation Strategies: Towards the Next Stage of RIS3

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a The paper presented here as a good-practice example is an excerpt of a longer paper of XXX pages originally published in 2018.

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He is the founder of URENIO Research and has coordinated more than one hundred projects under the European research and territorial development programmes (H2020, FP, CIP, LDV, Interreg, SEE, MED). His research interests are in two fields (1) intelligent / smart cities: formation and evolution; ontology; architectures of connected intelligence; intelligent city strategy and planning; smart city platforms for growth, sustainability, safety, and governance; smart city software design and development; smart cities and cloud computing, (2) cyber-physical systems of innovation: knowledge and innovation networks; innovating with data; user-driven innovation; platform-ecosystems; software applications and platforms for innovation; innovation strategies; smart specialisation strategies (RIS3); measuring of innovation performance. These are two interdependent fields of research, with cyber-physical systems of innovation being the problem-solving engine in intelligent cities.

b **Christina Kakderi** is an Assistant Professor of Spatial Development and RTDI Policies in the EU at Aristotle University of Thessaloniki (AUTH), School of Spatial Planning and Development. She is an economist (University of Macedonia, Greece), holds a master's degree on Urban Planning, from Cardiff University in Wales, and a PhD on Innovation Systems from Aristotle University of Thessaloniki, Greece.

As a member of Urban and Regional Innovation Research Unit – URENIO and, previously, of Spatial Development Research Unit, she has been involved in many EU and national funded projects related to smart cities and innovation policy. Her research interests focus on two main areas: a) intelligent ecosystems and innovation environments (use of technologies, emergence of intelligence, evolution, governance and resilience of smart cities and innovation ecosystems) and b) policies and strategies for regional and urban development including RTD (formation of smart city/ digital transformation strategies as well as of smart specialisation strategies (RIS3); technology assisted solutions for evidence-based decision making etc.).

c **Anastasia Panori** is an Electrical and Computer Engineer (Aristotle University of Thessaloniki) holding a MSc in Economics and a PhD in Economic and Regional Development from Panteion University of Athens. Her main research interests focus on regional and urban socio-economic development, data science, smart cities, and Smart Specialisation Strategies at a regional level. Since 2012, she has been working as a researcher and have participated in various H2020 projects funded by the European Commission.

d **Eva Garcia** has been managing R&I projects by European SMEs, institutions and corporations from 2003, having supported more than 350 projects during ideation, developing and exploitation stages, mainly focused into increasing their differentiation and innovative potential, improving their market fit and optimizing their business models. She also trained more than 2,000 people in this area, developing our own learning methodology, dynamics, tools and materials.

e **Katharina Fellnhofer** has been awarded the prestigious Marie Curie Fellowship, funded by the European Commission and hosted by the ETH Zurich and Harvard University. Her fellowship research initiative entitled ROLLER-COASTER (Cordis) focuses on entrepreneurs' and venture capitalists' entrepreneurial intuition during financial decision-making.

Prior to joining ETH Zürich, she has been a visiting scholar at the Weatherhead Center for International Affairs at Harvard University and an Erwin Schrödinger Fellow at the Lappeenranta University of Technology in Finland. She holds a doctorate in Social and Economic Sciences from the University of Innsbruck, Austria.

f **Alasdair Reid** joined Edinburgh Napier University in 2008 as a researcher specialising in sustainable urban development. He has since been involved in several high-profile research projects including SURegen, CLUE, EXPGOV, Smart Accelerator, Online S3 and Smart Kids, culminating in the publication of several academic papers, books and online literature. Alasdair is also a lecturer within the School of Built Environment. Alasdair holds a first-class honours degree in Estate Management (RICS accredited) and an MSc in City Planning and Regeneration (RTPI accredited). In addition, he holds a Postgraduate Certificate in Learning, Teaching and Assessment Practice in HE and is a Fellow of the Higher Education Academy.

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h **Mona A. Roman** focuses on open innovation, regional innovation systems and smart specialisation. Her research is based on qualitative in-depth case studies. She is currently working with research how to engage and facilitate the participation of citizens and civil society in the design of regional research and innovation strategies for smart specialisation.

i **Mark Deakin** is a leading academic who has provided a strong support to emerging scientific and technical developments on Smart Cities. He is author of 12 books and about 100 peer-reviewed publications on Sustainable Urban Development, Urban Technology Management and Smart Cities. These publications include Sustainable Urban Development (Volumes 1-3, Routledge 2005-2009) and Smart Cities: Governing, Modelling and Analysing the Transition (Routledge, 2013). In addition, Mark has directed several research projects dealing with Smart Cities and the Sustainable Development of Urban Environments for the European Commission, Economic and Social Research Council and Engineering and Physical Sciences Research Council in the UK. He recently

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The white paper on "Intelligence and Co-creation in Smart Specialisation Strategies" outlines some key conclusions from the Online S3 project, funded under the Horizon 2020 programme of the European Commission. The Online S3 project has produced an online platform composed of software applications and roadmaps that facilitate the design and implementation of Research and Innovation Strategies for Smart Specialisation (RIS3). Using a baseline set of methodologies for strategy design, Online S3 is advancing the understanding of RIS3 as a place-based and evidence-driven innovation policy, relying on large datasets and software for user engagement, co-creation and collective intelligence in policy design. In this white paper, the core building blocks of RIS3 are presented, as they appear in EU documents and related literature, such as ex ante conditionalities, stakeholder engagement, specialisation by diversification, entrepreneurial discovery, policy co-design, monitoring and assessment. This white paper also discusses weaknesses of the current period and what can be done better in the near future; thus, puts RIS3 in retrospect and prospect for 2021-2027. At the same time, it looks into critical dimensions for the next stage of RIS3, focusing on how strategies can be improved by datasets and software, enabling the implementation of complex methods; thus, facilitating collective intelligence and co-creation of solutions, which both are able to usher a transition from the triple to quadruple helix model of collaboration. Finally, the annex presents a short description of the 28 software applications and the 4 roadmaps hosted on the Online S3 Platform, which enable the use of datasets and sophisticated methodologies by policy-makers.

1. Introduction

The second decade of the 21st century brought-in a new thinking in the European innovation policy. Under Europe's 2020 strategy for smart, sustainable and inclusive growth, the research and innovation strategies for smart specialisation (RIS3) are institutionalised as a precondition for receiving financial support from European Structural and Investment Funds (ESIF). The preparation for these strategies started in 2011, and in May 2012 the Guide of RIS3 was pub-

completed research projects include: (1) CLUE: Climate Neutral Urban Districts in Europe (European Commission - INTERREG Programme); (2) Smart and Sustainable Cities (European Investment Bank - JESSICA Programme); (3) SmartCities (European Commission - INTERREG Programme); (4) EXPGOV (European Commission - IPTS Programme on Emerging City Governance Models); (5) SURegen: Sustainable Urban Regeneration (EPSRC Sustainable Urban Environment Programme); (6) Online S3: ONLINE Platform for Smart Specialisation Policy Advice (European Commission - Horizon 2020 Research and Innovation Programme). Mark is also in the Editorial Board of 6 academic journals. This includes the Journal of Urban Technology (Taylor & Francis), the Journal of Sustainable Cities and Society (Elsevier) and the International Journal of Intelligent Buildings (Taylor & Francis).

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Luca is a cum-laude graduate of Polytechnic University of Milan, where he obtained a BSc Degree in Science of Architecture, a MSc Degree in Architecture and, in conjunction with Polytechnic University of Turin and Polytechnic University of Bari, a Double PhD Degree in: (1) Innovation Management and Product Development; (2) Architecture and Urban Planning. Luca also holds a PgCert in Learning, Teaching and Assessment Practice in Higher Education, awarded by Edinburgh Napier University, and is a Fellow of the Higher Education Academy (FHEA) and a Fellow of the Royal Society of Arts (FRSA).

Over the course of his professional career, Luca has committed himself to improving our understanding of urban and regional innovation management in the digital era. His research is multi-disciplinary and connects urban studies and computer science with science, technology and innovation studies. His main research interests include: technology-related urban and regional innovation; sustainable smart urbanism; smart city development projects and strategies; Research and Innovation Strategies for Smart Specialisation (RIS3); and strategic planning for smart city transitions and RIS3.

Luca has a sustained track-record of producing high-quality publication outputs and has contributed to generate an overall University income of approximately £16 million through research and consultancy projects, mainly supported by EU funding schemes (EAFRD, 7FP, Horizon 2020).

lished by Foray, Goddard, Beldarrain, Landabaso, McCann, Morgan, Nauwelaers, and OrtegaArgilés, as a "methodological guidance for policy-makers and implementing bodies on how to prepare for and how to design, draft and implement a national/regional research and innovation strategy for smart specialisation (RIS3)" (Foray et al., 2012).

The new philosophy of innovation policy, which the smart specialisation agenda and RIS3 introduced, is founded on previous experiences of the European Commission (EC) on regional innovation and on theories that explain regional growth patterns based on knowledge and innovation, such as new growth theory, evolutionary economic geography, and learning regions. It is the result of a very promising amalgam of progressive policy-making and a robust theoretical approach. However, these theories and policy guidance have proven insufficient to change the mind-set of regional and national authorities in strategic planning for innovation. Many factors help explain the poor design of RIS3 which can be found in many regions. For example, the gap between theory and methods of implementation, delegation of power from central control to bottom-up participation, weaknesses in the mobilisation and engagement of stakeholders, lack of evaluation and monitoring mechanisms. All-in-all, these gaps, needs for delegations of power and methodological weaknesses, outline a precarious institutional setting and a situation calling for major reforms in the design and implementation of RIS3.

Funded by Horizon 2020 under the 'Science with and for Society' programme, the Online S3[1] project is founded on the disharmony between the poor design of RIS3 and the considerable funds that became available to implement smart specialisation strategies, aiming to tackle complex and interconnected societal challenges. The growth challenges of RIS3 are complex and often characterized by uncertainty and ambiguity, including not only dis-agreements within society, but also power games between interest groups (Bütschi, 2012). They require the existence of transdisciplinary knowledge, transparency and a plurality of values and opinions. Throughout the design of RIS3, policy makers should become proactive, develop knowledgebased and user-driven attitudes, whilst build internal capabilities to manage information and user engagement. Under this context, a significant challenge is the proactive attitude that must appear and evolve within an environment, that in many respects is precarious and without sufficient institutional and methodological tools.

In order to fill this gap in strategy development, competences and methods, the Online S3 project has been set out to develop a web-based solution that will facilitate the creation of a user engagement environment, easy access to datasets and implementation of complex methodologies. This has been achieved through the development of many software applications, targeting on providing a methodical process for the implementation of smart specialisation as an exercise in strategic planning. In this regard, it was anticipated that an e-policy platform, augmented with applications and online services, should be able to assist national and regional authorities to design more efficiently their smart specialisation strategies. In this respect, the Online S3 platform (http://s3platform.eu/) leverages on existing methodologies, initiatives and tools developed by the EC, enriching them with developments that strengthen the capacity for evidence-based and collaborative policy design.

The Online S3 platform has developed and tested innovative technologies, tools and e-services, which are in line with the methodological principles of smart specialisation as conceived by the EC, innovation experts, and academics. This is done by a consortium that assembles multiple partners, composed of three universities (Aalto University, Aristotle University of Thessaloniki, Edinburgh Napier University); four technology-led companies, (Innova Integra, Intelspace Innovation Technologies, Research and Innovation Management, and Research, Technology Development and Innovation); a not-for-profit policy research lab (European Future Innovation System Centre); three business related organisations (Edinburgh Centre for Carbon Innovation, Economic Institute of Maribor, Slovak Business Agency); and three regional authorities (Central Macedonia, Galicia, Northern Netherlands). Working in tandem, these organisations have developed a web-based platform, composing methodologies, software applications and roadmaps, which has been tested in real environments. A complete guide for the design and implementation of RIS3 is also available.

The "*Intelligence and Co-Creation in Smart Specialisation Strategies*" white paper presents some lessons learnt during this socio-technological experiment in research and innovation policy and sets out how the capacities the Online S3 project develops can be drawn on to improve the design and implementation of the smart specialisation agenda.

Introduction: RIS3 and the Online S3 Project

In Europe, RIS3 has become a leading political instrument of cohesion policy (Foray, 2014; McCann & Ortega-Argilés, 2015). Over the last decade, RIS3 has received a great deal of attention, not only by academics but also by European policy makers (Landabaso & Mouton, 2005; McCann & Ortega-Argilés, 2014). The basic principle of smart specialisation is that European regions should aim to explore and exploit key capabilities for global niche markets, with the intention of creating long term competitive advantages (Fellnhofer, 2017a; Foray, 2014; Reid & Maroulis, 2017). Thus, the overall objective of RIS3 is to create innovative, but place specific, capabilities which take advantage of available resources and competences within a process of diversification and transformation (Foray, 2014). In particular, diversification and transformational strategies should foster cross-sectoral links and/or cross-border cooperation (Gianelle et al., 2014a; Lämmer-Gamp et al., 2014). As Figure 1 illustrates, the 'smart' attribute of specialisation strategies is a consequence of the following principles (Landabaso, 2014):

1 ONLINE S3 – Online Platform for Smart Specialisation Policy Advice, Funded under the Horizon 2020, SwafS, GA no: 710659

- Creative linkages between research and innovation activities based on entrepreneurial discovery process, which allows. policy makers to focus on priorities that are set in collaboration with local stakeholders.
- A place-based approach with a global ambition that aims at exploring and exploiting local resources to generate competitive advantage.

The concept of smart specialisation encourages efficient and effective investments. Nations and regions are able to strengthen their innovation capacity and economic prospects in line with a creative entrepreneurial discovery process (EDP). In Europe the policy for smart specialisation requires a tailor-made, case-by-case approach for each nation and region rather than a 'one-size-fits-all' approach (McCann & Ortega-Argilés, 2014). Overall and as shown in Figure 2, there are five steps in the EDP that deserve particular attention (Komninos, Musyck, et al., 2014):

1. selecting areas meeting a critical threshold for productive activities;
2. exploring productivity gaps and use alternative paths for productive diversification taking inter- multi- and trans-disciplinary combinations and technologies into considerations;
3. evaluating possible scenarios by entrepreneurs and experts;
4. prioritising assessed scenarios weighing the value-added benefits; and
5. experimenting with small-scale pilot initiatives before full-scale implementation.
6. concept.

2. Building Blocks for Smart Specialization

According to guidelines and recommendations on behalf of the European Commission's Joint Research Centre (JRC), a RIS3 should promote the following (Figure 3):

- ***A place-based approach***, which builds on local available resources in order to explore and exploit entrepreneurial opportunities for economic growth.
- ***An evidence-driven decision-making***, focusing on few but well-identified priorities for smart knowledge-based investments to strengthen competitive potentials.
- ***An interactive stakeholder engagement*** that boosts the entrepreneurial discovery processes for setting priorities bottom-up.
- ***A broad view of innovation*** that promotes technological and practice-based social innovation based on socio-economic environments and policy co-design processes.
- ***A solid monitoring and evaluation system***, including effective and efficient revision mechanism should allow flexible adaption of strategic decision making.

The design and implementation of Smart Specialisation Strategies is an exante conditionality for public investments in research and innovation and smart growth. Exante conditionalities are policy and regulatory frameworks that ensure national and regional strategies are of high quality and in line with standards commonly agreed by Member States at EU level; comply with the EU acquis; and are based on sufficient administrative and institutional capacity (European Commission, 2013; Griniece et al., 2017; Komninos, 2016; Pessoa, 2016).

Figure 1. Core elements of smart specialisation

3. RIS3: Past and Current Challenges

3.1 RIS3 in the Past

The RIS3 was originally conceived of as comprising the entrepreneurial process of discovery (EDP) that would involve regions in a learning process resulting in decision on specialisation areas (Foray et al., 2009, p. 2). Through the EDP, RIS3 has proved to be quite successful in encouraging stakeholders' interaction, widening their participation, enabling more efficient functioning of multi-level governance, as well as enabling continuity of the process of planning and execution of a regional innovation strategy (see Gianelle et al., 2016).

However, there are issues concerning design and implementation of RIS3 when it comes to their underlying methodology. A survey of nine countries and twenty-one regions in Europe showed that the phases of the RIS3 were not followed sequentially or linearly (Griniece et al., 2017). Furthermore, 'the mapping exercise also highlighted that the robustness of methodological approaches varied and, in many regions, even the key concepts of the various RIS3 steps were not (fully) understood' (Griniece et al., 2016, p. 6; emphasis removed). Furthermore, very few online tools were used for designing RIS3 (Griniece et al., 2016, p. 7) at the time. Tools widely available before 2016, were quite limited in scope and came from the European Commission's sources.

Applications of the Online S3 platform (see www.s3platform.eu) have been developed to cover all phases of RIS3, from analysis of context, governance, strategy formulation, priority setting, policy mix, to monitoring and evaluation (for description of the phases see Foray et al., 2012), and include 28 methods and applications. Though since 2004 governance, not the regional context is the new priority, regions and countries should have a quality of governance at the level required to meet the challenges of the RIS3. The 28 Online S3 application can support this requirement. In addition, 4 'roadmaps' were developed by the Online S3 platform, allowing users to learn about and work on RIS3 in an intuitive and simple way, while working with and combining the online tools available to address specific problems and challenges.

It should be mentioned that two basic issues with the online tools for RIS3 have been identified. Online tools are generally faced with a bottleneck with regard to a general shortage of data that can be used for the design and implementation of RIS3 at the EU level. In addition, Griniece et

Figure 2. Five central steps for smart entrepreneurial discovery

al. (2016, p. 4) recognise a need for real-time data gathering and data visualisations that may help the entrepreneurial discovery process (EDP).

3.2 RIS3 at Present

At present, all new industrial and innovation policies – including policies for smart specialisation – share certain characteristics that confine them to the sphere of the private sector, actors of an innovation system, and markets in general (Radosevic, 2017). Societal stakeholders are not as involved in EDP as they should be (Marianelli & Perinez Forte, 2017). This essentially limits those policies as regards the choice of innovations that RIS3 focuses on. One recent exception may be the social economy partnerships in six EU regions that 'stimulate cross-border operations for mutual and cooperatives to enable them to use the full potential of the internal market in order to expand the activities of social economy, through interregional collaboration activities' (Smart Specialisation Platform, 2018). However, social innovations that have wide-ranging effects on well-being and that essentially create enabling conditions for other innovations themselves, should be taken into consideration more consistently.[2]

RIS3 should ideally be more integrative among R&D-driven innovation policy, cohesion policy, European value chains and networking initiatives, industrial policy, and grand challenges policy (Foray et al., 2018). This is consistent with mission-oriented policies[3] in the field of R&I that should have societal relevance and be multi-sectoral in nature (Mazzucato, 2018). That way RIS3 would expand the boundaries of its current scope and scale.

This has been recognised by the European Commission. Hence for the next programming period (2021-2027), it proposes, among other things, "*The bulk of European Regional Development Fund and Cohesion Fund investments will go towards innovation, support to small businesses, digital technologies and industrial modernisation. It will also go to the shift towards a low-carbon, circular economy and the fight against climate change, delivering on the Paris Agreement*".

Smart specialisation strategy in the next programming period will focus on several enabling conditions for the ERDF fund, listed below (European Commission, 2018a, p. 19): "*1. Up-to-date analysis of bottlenecks for innovation diffusion, including digitalisation 2. Existence of competent regional / national institution or body, responsible for the management of the smart specialisation strategy 3. Monitoring and evaluation tools to measure performance towards the objectives of the strategy 4. Effective functioning of entrepreneurial discovery process 5. Actions necessary to improve national or regional research and innovation systems 6. Actions to manage industrial transition 7. Measures for international collaboration*".

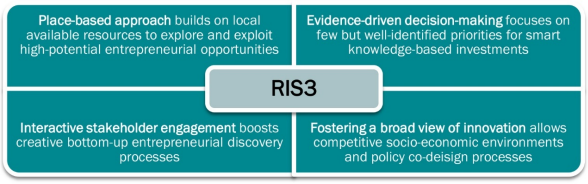

Figure 3. Core principles of Smart Specialisation Strategies

3.3 Current challenges of RIS3

The expansion of the RIS3 goals that should encompass societal challenges, and of its approach that should be more integrative, has repercussion on the analysis and on governance accompanying the process. With demands for industrial upgrading posed by digitalisation trends and key enabling technologies, RIS3 of the future needs to change. While aforementioned issues with RIS3 remain, new ones are potentially added to the picture, in anticipation of the RIS3 arrangements for the programming period 2021-2027.

Firstly, as many of the fulfilment criteria for the RIS3 enabling conditions generally require better governance (criteria 2, 3, 4, and indirectly also other points on the list), monitoring of governance during the process of design and implementation of RIS3 should be implemented. With a wider definition of innovations and the RIS3 that is truly multi-sectoral and long-term, the process of governance gets more complex and more demanding to follow. Secondly, monitoring and evaluation of RIS3 will require better databases that should not just provide more up-to-date data, but also allow for an analysis of main societal challenges. A proper multi-level governance of RIS3 would enable comparison of data across regions and member states

2 The European Commission (2018b) defines social innovations as ' new ideas that meet social needs, create social relationships and form new collaborations. These innovations can be products, services or models addressing unmet needs more effectively.'

3 Mazzucato (2018, p. 4) defines them as ' systemic public policies that draw on frontier knowledge to attain specific goals'.

of the EU. Thirdly, there is a need for tools capable of analysing innovation diffusion and their bottlenecks. This applies in particular to the sphere of digitalisation,[4] transformative potential of which is still largely untapped.

4. Moving RIS3 forward: Data- and software-based intelligence

Policy design, and specifically Smart Specialisation, is an inherently complex activity that in most cases involves multiple stakeholders and a plethora of insufficient information. Two features that have been identified as crucial for improving strategy formulation processes, such as RIS3, are extended quantitative analytical exercises and enhanced stakeholders' participation (Charalabidis et al., 2010; Komninos, Musyck, et al., 2014; Panori et al., 2016; Rowe & Frewer, 2004). A review of existing smart specialisation methodologies emphasizes the importance to map, monitor and assess regional assets to identify opportunities for innovation through existing and emerging activities (Foray et al., 2012; Griniece et al., 2017). Smart specialisation is not a 'one-size-fits-all' approach, but rather an evidence-based innovation-driven process, focusing on the economic transformation of EU regions towards higher added value and more knowledge intensive activities. Under this framework, data collection and analysis emerge as two of the most valuable assets, not only for entrepreneurs concerned with leveraging new market opportunities, but also for regions, which are required to design strategies for strengthening their economic growth models.

To date, various contributions and preliminary RIS3 evaluation reports highlight the difficulties in designing and implementing smart specialisation strategies (Capello & Kroll, 2016; Gianelle et al., 2016; Komninos, Tsarchopoulos, et al., 2014; Kroll, 2015; Reid et al., 2012). The initial European Commission's RIS3 planning documents provided little guidance to regional policy makers in the rather complex process of RIS3 design policy (Cooke, 2012; Iacobucci, 2014). Iacobucci & Guzzini (2016) try to identify different methodological ways to overcome the theoretical vagueness of the RIS3 guide in selecting regional priorities, while Boschma & Gianelle (2013) investigate the ways in which technological relatedness can provide significant input to the overall EDP process. Throughout literature, it becomes evident that the observed obstacles in designing the regional and national RIS3 strategies can largely be attributed to the lack of a clear methodological guidance and data sources, as well as the inability to adopt place-sensitive policy-support methodologies that define key aspects of the RIS3 process, such as related variety, priority setting, intervention logic etc (Capello & Kroll, 2016; Reid et al., 2012).

Currently the JRC S3 platform (http://s3platform.jrc.ec.europa.eu/) features several online tools designed for RIS3 strategy design processes, including mostly databases and mapping tools. More specifically, the tools aim to help users to extract information on the selected RIS3 priorities across European regions, understand the earmarked ESIF funding allocations, provide background information on sectoral trade patterns as a proxy indication for main competitor regions, as well as benchmark regions with similar structural characteristics. In other words, the available online tools offer mainly the opportunity to scope the emerging landscape of specialisations and identify benchmark regions for improved cross-border learning. Through a critical perspective, they offer limited analytical insights in supporting regional policy-makers and experts in charge of RIS3 processes, whereas they do not support more sophisticated online functionalities for RIS3 processes (Griniece et al., 2017; Panori et al., 2017).

On the other hand, advanced methods in smart specialisation include strategy development processes that rely heavily on large-scale user engagement, datasets coming from several sources, and high complexity computations. More specifically, there is a need to strengthen multi-level policies that require a wide range of combined evidence to collectively identify and select regional priorities (Kleibrink & Magro, 2018). Based on this rationale, effective RIS3 processes should result as an outcome of sophisticated and well-coordinated interactions between datasets, methods and actors, each one of them contributing in a different way to the overall strategy development (Ranga & Etzkowitz, 2012). Coordination and support of these interlinked building blocks could be a critical parameter towards increasing the effectiveness of RIS3 policy-design and monitoring processes.

In this aim, the emergence of digital platforms as an intrinsic feature of a continuously evolving economic structure, has opened new opportunities that relate to issues concerning stakeholder participation and the exploitation of advanced datasets. Platforms offer cyberspaces which enable the formation of new ecosystems, where users can effectively collaborate across a broad range of activities (Biber et al., 2017; Kenney & Zysman, 2016; Oskam & Boswijk, 2016). In this arrangement platform environments can be exploited for dissemination activities and sharing common vision goals, towards enhancing stakeholder collaboration and user-driven innovation during a RIS3 design process (Kakderi et al., 2018; Komninos, 2018). Smartness, in terms of innovation, collaboration and coordination, can be effectively elaborated through network-based relationships (Antonelli & Cappiello, 2016). To this end, the use of online platforms in policy and strategic planning could be received as an essential ingredient, given that big datasets, pilot experimentation and continuous assessment guide decision-making processes (Komninos, 2018).

The Online S3 Platform constitutes an experiment of reference towards empowering RIS3 processes by advanced methods, software and roadmaps for several reasons. First, it focuses on providing an online environment for managing the design process of a RIS3 strategy. Second, it tries to foster effective online collaboration between different actors, offering the opportunity to cover all quadruple helix stakeholders. Third, it ensures equal access opportunities to ex-

4 For data on digitalisation, see Eurostat https://ec.europa.eu/eurostat/web/digital-economy-and-society/overview

isting datasets and RIS3 methodologies (simple or more sophisticated), since all tools are freely available and open access. Finally, it provides a monitoring module, including a set of applications that focus on the implementation process of RIS3 actions and measures. The developed applications cover all existing phases of the RIS3 process, offering the opportunity to the users to better understand existing methodologies and their main rationale. The development of a set of roadmaps on the platform (see Annex pp. 43-44) aims on helping decision-makers to systematically organise their actions and enhance their effectiveness. More specifically, the Mini-S3 roadmap has been designed, including only a short list (14 applications) of the most essential methodologies and tools that should be used during a RIS3 design process. The applications have been chosen based on the importance of the corresponding methodology, as well as the feedback from the users regarding their user friendliness. At the same time, the EDP roadmap has been structured based on the EDP methodologies followed by the JRC and the World Bank, including three main tasks: knowledge production, stakeholder engagement and knowledge sharing and collaborative decision-making.

The last two roadmaps mainly focus on the identification of emerging and niche sectors of the regional markets that could be prioritized through a RIS3 strategy in order to boost regional economic growth. The Specialisation roadmap explains its role and usefulness in the RIS3 and describes three possible approaches to the analysis. A conceptual framework for specialisation analysis and accompanying methods for implementing it are presented, as well as a selection of 10 Online S3 applications that may be used in this process. On the other hand, the Vertical roadmap proposes a five-stage process for designing innovative investment projects per niche industry market, using a set of 14 Online S3 applications. These focus specifically on actions, such as: mapping sectoral and regional strengths, identification of actors per sector of interest, actors' engagement, collaborative project design, monitoring and evaluation

At this point, it should be noted that the success of an online platform, which is designed to facilitate a wide range of users with different background and levels of experience, largely depends on following co-creation principles, to get feedback from a multi-stakeholder audience, as well as its ability to adapt in different geographical and development contexts. The no-'one-size-fits-all' approach has also been followed in the Online S3 case in terms of software design, to ensure that all users can easily understand and personalize their strategic planning process. These principles have been incorporated in the Online S3 Platform throughout the design of the applications and the creation of the 4 thematic roadmaps (Panori et al., 2018). Therefore, the Online S3 Platform provides an essential effort towards reinforcing regional authorities capabilities for revising and enhancing existing RIS3 strategies through advanced methods, software, and roadmaps, opening the road to the Smart Specialisation 2.0 era.

5. Moving RIS3 forward:Co-design and collective intelligence

Collaborative co-design, data-driven intelligence and collective intelligence provide means to facilitate an inclusive, evidence-based process for RIS3 that is recommended in RIS3 literature. For instance, Gianelle et al. (2014b) argue that RIS3 should be based on a thorough understanding of the regional economic structure and competitive position of the economy. Furthermore, the RIS3 Guide states, "RIS3 needs to be based on a sound analysis of the regional economy, society, and innovation structure" (Foray et al., 2012). It also underlines "The fact that RIS3 is based on a wide view of innovation automatically implies that stakeholders of different types and levels should participate extensively in its design" (Foray et al., 2012).

The EDP is a core principle of RIS3. It should ensure that the views of different 'quadruple helix' stakeholders – academia, industry, public sector and civil society - are part of the smart specialisation strategy. Data intelligence serves as a key input for EDP providing information on the regional strengths and competitive advantages in relation to other regions. For instance, regional data on geography, demography and society, economy and labour, sectoral structures, business characteristics and innovation system are needed for regional profiling and to develop international comparisons (Kroll et al., 2011; OECD, 2013). In addition to the collecting and analysing data on the current stage of the region, it is important to gather data on future trends and uncertainties that can affect the future development of the region. Data intelligence on the current stage of the region and the future development provide sound bases for regional quadruple helix stakeholders to develop together a shared vision of the future and to identify key priorities for regional development.

Prior literature has called for collaborative co-design of a regional RIS3 action plan and RIS3 monitoring and evaluation system (Gianelle & Kleibrink, 2015). The engagement of regional stakeholders is vital to ensure stakeholders commit to RIS3 strategy and feel ownership of it (Gianelle et al., 2016). Indeed, prior literature has emphasized that EDP should be a continuous process to realize full benefits of smart specialisation (Gianelle et al., 2016; Marianelli & Perinez Forte, 2017; McCann & Ortega-Argilés, 2016; Roman & Nyberg, 2017). However, many regions have faced challenges in engaging different types of stakeholders to facilitate true interaction between the different stakeholder groups (Aranguren et al., 2018). Thus, regions are in need of further guidance to implement a truly participative EDP (Fellnhofer, 2017b; Gheorghiu et al., 2016). Methods like participatory foresight and horizon scanning are interesting ways of involving all regional stakeholders in the RIS3 development. Participatory foresight is demand-side driven and is meant to directly involve beneficiaries and users of the RIS3, providing insight into the demand for societal challenges. This method usually involves public consultations feed-in and steered with expert recommendations, in many cases facilitated by web-tools to carry the information flow (Griniece et al., 2016). Horizon scanning involves searching, finding, analysing and assessing how developments, emerging and existing, will have an effect on the 'pertinent' environment. The data comes from a wide variety of sources including government, commercial and scientific documents, but also from social media, events and conferences, through a variety of techniques including doc-

ument scanning, expert groups, surveys, social media and text mining techniques (Griniece et al., 2016).

As an example, at European level, the European Cluster Observatory has performed foresight analysis on industrial and cluster opportunities with the aim to explore new societal, technological and economic trends, as well as the ways in which cross-sectoral collaboration could affect value creation structures and innovation processes. The exercise followed a Delphi-related approach and used a mix of different methods such as desk research including a literature review, expert interviews, an online survey, internal and external workshops, horizon scanning and scenario planning (Teichler et al., 2015). Another example of broad foresight exercises is from Lithuanian RIS3 process that used a mixed of qualitative and quantitative methods including expert panels, surveys, statistical and bibliometric analysis, roadmaps, and analytical studies on the emerging trends and long-term challenges (Paliokaitė et al., 2015). Online tools and web environments were also developed to support co-design of innovation strategy and policy, such as the open innovation platform (https://goo.gl/jDzujB); the web environment for sharing applications promoting participation and collaboration in communities, local ecosystems and complex projects for the region of Lombardy (https://goo.gl/uSRW7A); the smart specialisation map (https://goo.gl/9768qd); the regional ecosystem scoreboard methodology to analyse regional development framework conditions (https://goo.gl/JAUf59).

The Online S3 project has aimed to bridge the gap between RIS3 theory and practice through the development of online tools for data intelligence such as Regional Asset Mapping and Scenario Building and for collaborative co-design such as the Intervention Logic tool. Regional Asset Mapping allows regions to compile their regional profile and to compare it to other regions. As part of the European Structural and Investment Funds (ESIF) agreement, all EU regions must produce a descriptive analysis on their regional assets, e.g. economic performance, employment and infrastructure. Regional Asset Mapping integrates the regional profile data into a searchable platform, to enable anyone to access, compare and produce visually appealing reports on regional assets across the EU. The application uses data provided by Eurostat and follow Eurostat's NUTS (Nomenclature of Territorial Units for Statistics) system for dividing the economic territory of the EU.

Scenario Building tool supports the development of regional scenarios and the assessment of their implications for the region. Not all regions have the competences and experience of scenario building, which motivated the development of the Scenario Building tool that consists of five templates that facilitate the implementation of each of the following key steps of the scenario building process.

1. Identify future trends and uncertainties (PEST analysis template)
2. Assess the importance of each trend and uncertainty (Impact analysis template)
3. Form scenarios (Scenario building template)
4. Describe scenarios in-depth (Scenario description template)
5. Assess scenario implications and plan for preparatory actions (Preparation plan template)

PEST (Political, Economic, Social, Technological) analysis is a framework which allows structuring trends along uncertainties and impact. Since there are a multitude of factors that may affect the region's future, the uncertainties and impact become easier to assess when they are categorised in the PEST categories. Assessing the importance and the level of uncertainty and impact associated with all trends allows the selection of scenario axes. This activity should involve all relevant regional stakeholders to identify together the most important and uncertain factors and objectives affecting the future development of the region. The trends with the lowest uncertainty and the highest impact form the best scenario to select.

After forming the regional scenarios, the next step is to develop in-depth descriptions of the scenarios. The more intriguing the scenarios are, the more they tease out creative thinking, solutions and preparation plans in the next phase. Thus, good scenarios should include storylines and detailed portrayals of what life is like in the region in the scenario. The assessment of scenario implications includes the identification of common opportunities or challenges across the different scenarios (For-Learn, 2008). These things should feed into the development of the regional strategy. While the desktop research supports the collection of data on regional trends and uncertainties, the involvement of regional stakeholders is necessary to analyse the data, to build scenarios and to assess their implications to understand different viewpoints and commit different stakeholders to the scenario work.

The Intervention Logic tool is based on the model of Gianelle & Kleibrink (2015). The Intervention Logic assists the regions to develop the links between their RIS3 objectives, targets, inputs, actions, outputs, results and longer-term outcomes. The overall objective is to provide the rationale behind the RIS3 strategy to all stakeholders and to promote consensus among stakeholders regarding the priorities and actions to select (Fig. 4).

According to Griniece et al. (2016), around 40% of regions have used this Logic of Intervention. Given that intervention logic should form the backbone for setting the overarching goals of smart specialisation, this seems to be a small share. Either regions are not well acquainted with the approaches to intervention logic design or they do not explicitly document their assumptions about causal chains of RIS3 policy intervention.

The Intervention Logic tool, developed in Online S3, starts with the user selecting a specific Thematic Objective and Investment Priority and incorporating the information from RIS3 strategic planning process regarding the regional context, vision, policy mix and monitoring. After this step, the user is to describe the connections between the main building blocks of the intervention logic. A set of 7 questions help the user to provide a precise description of the rationale behind the selection of the specific priorities, policy mix and monitoring indicators for the corresponding investment priority.

Data intelligence and collaborative co-design tools facilitate implementing inclusive, evidence-based EDP in the region. In addition, successful implementation of the tools and continuous participatory EDP requires strong commitment to smart specialisation at various institutional levels

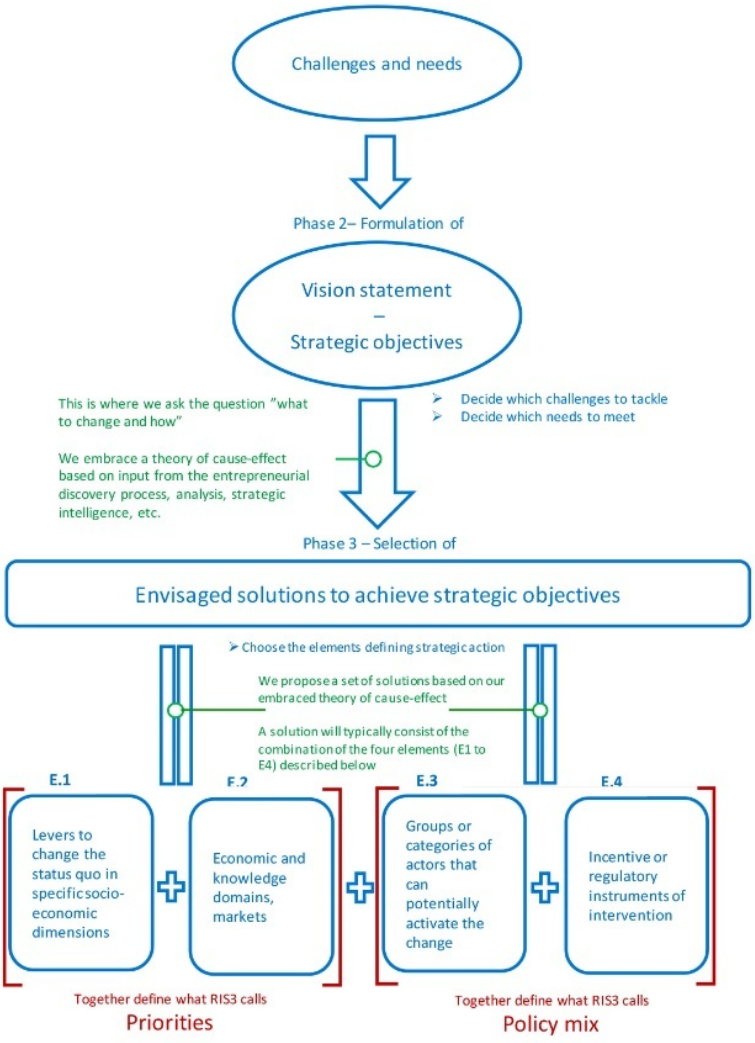

Figure 4. The model of Intervention Logic

Source: Kleibrink, A., Gianelle, C. and Doussineau, M. (2016).
Credit: Kleibrink, A.

(Grillo, 2017; Rodriguez-Pose & Wilkie, 2017).

6. Moving RIS3 Forward: Quadruple Helix Governance

Triple and Quadruple-Helix models of research and innovation are at the centre of the EPD. The Triple Helix appears to be the model of choice for Joanneum Research (2012), whereas the EC's Joint Research Centre (JRC) see the EDP as a platform of stakeholders broader than university, industry, and government (Foray et al., 2012). Given this commitment from JRC to a broadening out of the EDP, the following shall provide a synopsis of the Triple and Quadruple-Helix models and insights these representations of the EDP offer into RIS3.[5]

6.1 The Triple Helix Model

Advocates of the Triple Helix (like Etzkowitz & Leydesdorff, 1997; Etzkowitz and Leydesdorff, 2002; Leydesdorff, 2005; Leydesdorff & Meyer, 2006), find Mode 2 accounts of social change, cultural development and economic growth limited and explain the differences between (national and regional) research and innovation systems in terms of possible arrangements. The Triple Helix model suggests each research and innovation system remains in endless transition, but this does not mean anything goes, rather that emerging systems such as RIS3 should not be mistaken as something which is yet another variation on the theme. That is as the EDP of either a national or regional research and innovation system, because the interacting uncertain-

5 This synopsis of the triple ad Quadruple Helix of The EDP and insights they offer into the governance of RIS are drawn from Deakin et al. (2018) The research and innovation of smart specialisation strategies: the transition from the triple to quadruple helix, Book of Proceedings for the 27th International Scientific Conference on Economic and Social Development, pp.94-103.

ties, which surround the reflexive instability of any smart specialisation strategy, does much to determine the prioritisation of science and technology they reflect as the place-based polices.

This means the Triple Helix account of social change, cultural development and economic growth offers a neo-evolutionary model of research and innovation (Leydesdorff and Deakin, 2010) and as evolutionary systems society cultivates the environmental conditions of. These are: (1) the intellectual capital of organized knowledge production; (2) wealth creation and (3) the reflexive control of the science and technology they in turn govern the regional economic growth of (Leydesdorff & Deakin, 2011).

Within this model the EDP is represented as a broad collaborative platform of stakeholders from universities, industry and government and as the key components of an eco-system in which organized knowledge production is not only socially-constructed, but also cultivated as a process of wealth creation that is smart in the prioritisation of a specialisation strategy whose reflexive control of science and technology it in turn governs as a knowledge economy able to sustain the growth of regions (Deakin, 2014, 2015; Deakin & Reid, 2018; Deakin, 2016; Deakin, 2017).

6.2 The Quadruple-Helix Model

The EC's Guidance Notes for RIS3 also recognizes the virtues of the Quadruple-Helix as the model of knowledge-based production (Foray, 2015). This model of social change, cultural development and economic growth, switches attention away from the stakeholders that underpin the intellectual capital of organized knowledge production and focuses instead on an EDP of a wealth creation able to support the reflexive control of RIS3 (Carayannis & Campbell, 2012, 2010). Which is to say, on the EDP of that wealth creation in which RIS secures a reflexive control of science and technology and this system of knowledge-based production governs the economic growth of regions on behalf of the public. In particular, on behalf of the public as the user communities of a democracy, whose participation in this governance and science and technology cultivate environments able to sustain the economic growth of regions (Carayannis & Rakhmatullin, 2014; Carayannis and Rakhmatullin, 2017).

In this model, user-communities are not only understood to be engaged in the EPD, but also involved in shaping new types of research and innovation strategies, whose specialisation is smart in connecting users with other communities and as part of a knowledge exchange distributed across universities, industry and government (Carayannis & Campbell, 2012, 2014, 2010; Carayannis & Rakhmatullin, 2014; Carayannis and Campbell, 2017; Carayannis and Rakhmatullin, 2017). This means the Quadruple Helix sees the role of these institutions not as the agents of any intellectual capital, or organized knowledge production, but instead as the media of an emergent creative sector. The media of a creative sector, whose wealth creation and reflexive control of science and technology is democratic in the sense it allows the user-communities of this emergent creative sector to participate in the governance of civil society by cultivating environments able to sustain the economic growth of regions.

6.3 Online S3 for RIS3 Governance

As a result, it is the Triple and Quadruple Helix models of EDP that underpin the governance phase of RIS3 and assessment methods which support this, either as the institutional stakeholders, or media of an emergent creative sector. The Online S3 methods and applications in question are listed below:

- RIS vision sharing;
- RIS3 debate at a glance;
- RIS3 legal and administrative framework related to the Economic and Social Investment Fund (ESIF).

This synopsis of the models offers an initial insight into the Triple and Quadruple Helix and response of both the "RIS3 vision sharing", "debate at a glance" and "legal and administrative framework", to do what they call for, vis-à-vis restore public trust in science and technology and clear the democratic deficit by assembling a platform for the creative sector to participate in the governance of civil society (Deakin, 2014, 2015, 2018; Deakin, 2017).

It also serves to highlight the reflexive control science and technology as democratic and matter relating to a participatory governance in which the science and technology of civil society is able to cultivate environments that sustain the economic growth of regions (Carayannis & Campbell, 2012, 2014; Carayannis and Campbell, 2017). This results from a critique of the Triple Helix model which the Quadruple-Helix offers and the latter's representation of the former as a model whose vision od RIS3 and debate at a glance is that dominated by the proprietary system of an elite university-industry axis. That axis which is pre-dominantly corporate and whose research and innovation is organized as a knowledge-based production, in which the prioritisations of a any smart specialisation strategy that emerges, either by way of 'vision sharing", or through "debate at a glance", are proxies for a process of wealth creation whose reflexive control of science and technology is via a "legal and administrative framework for ESIF" which is not democratic in sustaining the economic growth of regions.

This goes someway to capture what distinguishes these two models of knowledge-based production. In particular, the fact they are not only research and innovation strategies, or an EPD, but also the source of (bottom-up and place-based) regional policies, whose visions and debates are constructed as the administrative framework of a RIS3 that is not only proprietary, but which is also democratic. The distinction between the models lying in the distance separating the respective vision, debate and framework on not what is proprietary, but how this system can also be democratic. In that sense, in the respective interpretations of whether-or-not any such vision, debate and framework can stand on the propriety of a research and innovation found in the university-industry axis of a smart specialisation whose strategy rests on either on the pre-dominantly corporate priorities of the independent sector, or in a system which is civic in the sense the wealth this creates assembles a platform for the third to reflexively control science and technology. For the third to reflexively control science and technol-

ogy as part of a democracy whose participatory governance of civil society in turn provides the creative sector this nurtures with the "media" to cultivate environments whereby the funding of priorities secures the investment to sustain the economic growth of regions.

6.4 From the triple to quadruple helix

As the discussions in the previous section on the vision, debate and framework for governance phase of RIS3 serve to demonstrate, the public trust gap which opens up as a democratic deficit, presents the research and innovation of smart specialisation strategies with trust deficit that has significant implications for both the Triple-Helix and Quadruple-Helix models, for it is not only seen to be a transgression of public trust, but a democratic deficit also regressive for civil society.

Here, the significance of the implications is summarized in the interests of reaching beyond any formal critique of the models and governance phase of RIS3 they relate to, by moving towards what might be best referred to as the discontent with the transgression of public trust by the Triple Helix and regression of this into the democratic deficit of the Quadruple Helix. In that sense, the dis-content, which circulates around this transgression, can be revealed as a regression that relates to:

- a lack of public trust in the EDP that underlies research and innovation strategies within university and industry and which surfaces as a gap between the knowledge economy this wealth creates and priorities such a smart specialisation sets for a reflexive control of science and technology, which is democratic and allows user-communities to participate in the governance of civil society. The reason given by the public for this deficit is that any reflexive control of science and technology does not tackle the major challenges which civil society confronts. In that sense does not tackle poverty, or combat deprivation and because of this, is either unethical or ecologically destructive. This also suggests the ethics of poverty, deprivation and ecological destruction, are ignored, because research and innovation is increasingly developed by trans-national corporations, whose intellectual property rights organize knowledge production in such a way the wealth created offers little opportunity for either the nation-state, or region to exhort any reflexive control of science and technology on behalf of the public, or as part of a democracy whose participatory governance sets the agendas for cultivating those environments able to sustain the economic growth of regions (the Triple Helix model).
- the democratic deficit within civil society which proposes that user-communities in the creative sector lack the reflexive control of science and technology needed for civil society to cultivate environments which sustain the economic growth of regions. The reason given for this being that such a deficit leads to civil society being excluded access to: 1) consultations on how to tackle poverty, combat deprivation and overcome environmental destruction; 2) deliberations over how the wealth, prosperity and ecological reconstruction of the knowledge economy, can meet these challenges by way of the reflexive control it exhorts over science and technology and through a democratic process, whose participatory governance of civil society cultivates environments able to sustain the economic growth of regions (Quadruple Helix model).

This transgression results because that trust which the public assume to be an abundant property of the EDP and readily available in methods such as: RIS3 vision sharing and debate at a glance, is that very intellectual capital which organized knowledge production in fact lacks and falls short of as the administrative framework of the EISF. That intellectual capital of organized knowledge production, which is assumed to be an abundant property of wealth creation, readily available and openly sourced, but that in reality turns out to be a system for the reflexive control of science and technology which is not democratic. Not democratic in the sense the very absence of any direct participation of the creative sector in the governance of RiS3 denies civil society access to a research and innovation strategy able to prioritize smart specialisation as the reflexive control of a science and technology credible enough for any vision of and debate over security, food, energy, mobility, health and well-being of the public to clear the trust deficit and for democracy to include those members of the public who are otherwise left out of such a framework.

In particular, those members of the public, who are otherwise left dis-empowered as user-communities and in that sense excluded from any reflexive control of science and technology, which the wealth creation of organized knowledge production should mobilize as a vision, debate and framework to confront the major challenges civil society faces in tackling the likes of food and energy poverty, combatting depravation and promoting the health and well-being of an ecological reconstruction as part of a research and innovation strategy. In that sense, the wealth creation of organized knowledge production any such vision should mobilize to scope out, discuss and frame the major challenges which civil society confronts in developing a research and innovation strategy smart enough for the wealth this vision of security, food, energy, mobility, health and well-being creates to reframe science and technology as a process of reflexive control that allows civil society to prioritize debates over poverty, deprivation and ecological destruction, by way of consultations and through deliberations. By way of consultations about security, food, energy, mobility, health and well-being and deliberations over poverty, deprivation and ecological destruction as interventions in the governance of RIS3 designed to restore public trust and clear the democratic deficit by cultivating a legal and administrative framework whose funding of such priorities secures investment to sustain the economic growth of regions.

7. Conclusions: Towards the Next Stage of RIS3

The decade of 2010s has been a period of introduction and experimentation on smart specialisation strategies and initial testing of their underlying growth assumptions. There is plenty of information on the content and chal-

lenges of RIS3 at regional or national levels - thanks to JRC peer review of strategies - and on difficulties in applying rigorous methodologies for RIS3 design, implementation and assessment. RIS3 linking regional, national, and EU policy frameworks, regulations and strategy objectives require a variety of evidence to define problems, priorities and objectives, and use suitable policy instruments to achieve them. But, how this variety of evidence become feasible in practice remains largely elusive (Kleibrink & Magro, 2018). The same decade has been also a period towards more mature Internet technologies, wider use of online services, web assistants, and large datasets that became available by online access to databases and user-generated content in social media.

Online S3 is positioned at the interface of these trends, offers web services and tools to implement RIS3 methodologies across regions and facilitate the design process with the use of datasets and software agents. Having developed online assistants for 28 methodologies, documented as the most used or useful in 30 EU regions, these web solutions have been tested in four regions (Scotland, Central Macedonia, Galicia, and Northern Netherlands). In the pilots, 142 stakeholders were engaged, 12,000 users, of which 1089 were contributed with ideas and comments by open consultation. The degree of acceptance of the proposed online applications assisting RIS3 methodologies was very high, with strong and very strong acceptance ranging between 58 - 82 percent. It became evident that online services contribute to smart specialisation strategies in three ways: (1) easier access to data, use of larger datasets, and data-based evidence on regional context and trends, (2) use of complex methods, transferring the complexity to algorithms, roadmaps, and routines embedded into software applications that facilitate their use, and (3) wider user engagement, easier dissemination of strategy vision, and collaborative elaboration of priorities and action plans.

In our mind, these directions are setting the scene for the coming programming period 2021-2027, in which the smart specialisation agenda and RIS3 will reach a more mature stage, enabling higher quality and more informed strategies.

7.1 The Significance and Contribution of Datasets

Easy access to data has a direct impact on the effort needed and productivity of the RIS3 management team. Take for instance, the Regional Assets Mapping. Finding regional data on 55 indicators by using this application and comparing with peer regions is a work of minutes. Doing the same by access to Eurostat databases needs effort measured in days. The gain in productivity is enormous. The same is true for disseminating the vision of RIS3, understanding the institutional and administrative framework of the smart specialisation, which can be done by direct access to mash-up applications and use of available templates avoiding duplication of efforts.

Evidence-based policy design is a matter of data. There is a pressing need of data for monitoring and assessment. A common EU monitoring and assessment model would be extremely useful in this regard. The first steps have already done by standardising the RIS3 actions by Thematic Objective and Investment Priority; also, by defining a pool of common outputs indicators (CO01 to CO46). But assessment needs more data. Time series by output indicator are not enough. Finding data from other regions, peer regions in particular, would enable benchmarking, and identifying the focus areas of each strategy in absolute and comparative terms. Moreover, assessing the regional impact of policy instruments demands data from many regions to investigate relationships and dependences between output and results indicators. This would reveal the real power of policy instruments to influence growth and sustainability. The Output and Result Indicators application that has been developed enables correlation and regression analysis, provided that datasets from many regions are available conformed to conditions of correlation and regression.

Another area in which data would improve the quality of RIS3 is related to user-generated content. Data from social media or user satisfaction surveys may directly inform about the added value and the acceptance of RIS3 actions. Much more effective would be content provided by stakeholders on actions already implemented, creating a European database of RIS3 actions, which would be extremely useful during the co-design process, avoiding not-invented-here attitudes. Finding datasets ready for analysis and visualisation (e.g. academic publications, patent data, specialisation data, etc.) would elucidate trends for which statistical agencies do not provide data at lower geographical nomenclatures.

7.2 The Contribution of Software to Methods

Together with data, software applications are proved very effective in improving the quality of RIS3. In combination with the guide for each application, a very clear understanding of the respective method, which is implemented by software, is obtained. There is no space of fuzzy definitions or misunderstanding on data and calculus. Moreover, when applications are open source – as happens in OnlineS3 - and the code is available on the GitHub, there is total transparency how calculations are set, and results are produced.

Standardisation is also a direct outcome of using software for method's implementation. The benefits of process standardisation are extensively discussed (Ash & Burn, 2003; Kuhlang et al., 2011; Stevens & Dimitriadis, 2005). There is improvement in technical communication and understanding, facilitation in exchange of know-how and easy technology transfer and learning, establishing of best practice how to carry out a process. All these improvements are translated to easier onboarding. Having a standard way of doing something, it becomes easier to transfer this knowledge. Standardising best practice and most efficient processes, higher productivity spreads across an organisation.

Moreover, through software applications complex methods or use of sophisticated procedures becomes feasible, even by non-experts. As know how is transferred from persons to machines, software applications in the case of RIS3, the effort needed for the implementation of methods is minimized. The machine takes over and replaces the complexity of the internal process by an algorithmic sequence.

The problem is solved at the stage of software design and development. Then, complexity is replaced by repetition.

Using software applications, RIS3 methodologies obtain transparency; access become easier; and productivity gains reduce the effort needed for a state-of-the-art strategy design.

7.3 The Significance of RIS3 Participatory Model

Given the social significance of the Triple and Quadruple helix models and especially the weight they each put on the democracy of this participatory governance, merely caricaturing the division between the Triple and Quadruple helix as the difference between say, the proprietary systems of knowledge economy and participatory governance of civil society, would do them an injustice. As would any suggestion either one of them is sufficiently powerful to bridge such a deeply rooted division by themselves. For any such claim would merely serve to exemplify how the ambiguities currently surrounding the entrepreneurial discovery of research and innovation strategies, not only run the risk of misrepresenting what Smart Specialisation is, but also ignoring the real consequences of the prioritisations selected to serve a knowledge economy whose deeply rooted social divisions bring any notion of reflexive control, democracy and user-communities in a participatory governance of science and technology to the fore.

The reason for uncovering the division in the Triple and Quadruple-Helix models is not to capture any errors in the conceptual schemas they advance in relation to the entrepreneurial discovery, or how research and innovation affect Smart Specialisation Strategies. It is instead done to reveal the deeply-rooted social division underlying all of this and which surfaces as a lack of public trust in the participatory governance of science and technology, and attempts made to meet the democratic deficit associated with any reflexive control of the wealth created from organized knowledge production. In that sense, the lack of public trust in the EDP and democratic deficit in Smart Specialisation Strategies, which make up any claim about the participatory governance of user-communities in science and technology. Moreover, and in spite of what the Triple and Quadruple-helix models both claim, that transgression of public trust and deficit in democracy, which user-communities perceive as the outcome of that reflexive control which is regressive, because of how Smart Specialisation prioritizes research and innovation as entrepreneurial discoveries related to the organisation of a knowledge production whose economy is only able to sustain regional growth at the expense of civil society.

Given the weight of significance which the statement: "at the expense of civil society" takes as a reflexive control that transgresses public trust, and which results in a democratic deficit believed to be regressive, it is a matter that not only warrants further examination, but which also calls for additional consideration. Not only because at first sight this lack of public trust is exactly what the Quadruple Helix is understood to offer the prospect of delivering as that knowledge economy which meets the governance challenge the Triple Helix leaves unresolved, but for the reason a closer examination of the Triple Helix model does also bring this democratic deficit reading of the transition from the Triple to Quadruple Helix into question (Lombardi et al., 2011; Kourtit et al., 2013; Deakin & Leydesdorff, 2014). For what such a deficit reading of the transition tends to ignore is the fact those advancing the Triple Helix model do meet the governance challenge without putting so much critical distance between the intellectual capital of organized knowledge production (Deakin, 2014, 2015, 2018; Deakin & Reid, 2018) and that democratisation of the public which the Quadruple Helix calls for. That democratisation of the public which it calls for as a basis for user-communities to gain trust and clear any deficit by participating in the governance of science and technology as members of civil society (Carayannis & Campbell, 2012, 2014; Carayannis and Campbell, 2017).

For what those championing such a "Advanced Triple Helix" are fully conscious of is that neither any democratisation of the public, nor user-communities which participate in the governance of science and technology, are the exclusive property of any social ecology this media cultivates, but instead attributes of that intellectual capital which underlies the organisation of knowledge production and that surfaces in the economy of a wealth creation which this governance exerts reflexive control over. Which this governance exerts reflexive control over and that calls, not so much for the addition of another helix dedicated to any democratisation of the public, but instead an extension of the Triple Helix model's reach from the intellectual capital of organized knowledge production out into the economics of wealth creation. Not just in terms of that entrepreneurial discovery which underpins the research and innovation of any emergent "knowledge economy", but as a process that also supports the priorities of such a Smart Specialisation as a platform for the reflexive control of this democratisation by the public as user-communities. Furthermore, by the public as user-communities which participate in the governance of science and technology and in a manner that does serve to clear any deficit in the system.

This way, vis-à-vis by way of the emergent properties of an entrepreneurial discovery process underpinning research and innovation and through the organisation of knowledge production into an economy supporting this process wealth creation, it does become possible for the priorities such a Smart Specialisation sets to act as a platform of reflexive control. In particular, that reflexive control which the public would not otherwise possess as user-communities and for the reason that for all intents and purposes, they lack the intellectual capital of organized knowledge production as a platform for the process of wealth creation to democratize the knowledge economy. That is, to democratize the knowledge economy as the public of those user-communities, which do possess the means, vis-a-vis "wealth of intellect" needed to participate in the governance of science and technology, not only as special interest groups, but as members of civil society with the "wisdom of the crowd" also required for them to sustain regional growth.

This is the only way it is possible to get any equivalence between the entrepreneurial discovery process of the research and innovation strategies championed by the Triple and Quadruple Helix models of Smart Specialisation, not

as a transgression of public trust whose democratic deficit is regressive, but as part of that participatory governance which is progressive. Which is instead progressive by virtue of the fact this Smart Specialisation does not turn on a strategy able to merely inflect some semblance of control over a knowledge economy, but instead demonstrate the reflexivity of that democratisation which the public is subject to and user-communities assume to be virtuous. Assume to be virtuous as a consequence of the trust which the public have in the user-communities that participate in the governance of science and technology and potential this Smart Specialisation has to clear the democratic deficit within civil society as part of a bottom-up search for place-based polices whose strategies are able to sustain regional growth.

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REFERENCES

Antonelli, G., & Cappiello, G. (2016). *Smart Development in Smart Communities*. Taylor & Francis. https://doi.org/10.4324/9781315641850

Aranguren, M. J., Magro, E., Navarro, M., & Wilson, J. R. (2018). Governance of the territorial entrepreneurial discovery process: Looking under the bonnet of RIS3. *Regional Studies*. https://doi.org/10.1080/00343404.2018.1462484

Ash, C. G., & Burn, J. M. (2003). Assessing the benefits from e-business transformation through effective enterprise management. *European Journal of Information Systems*, *12*(4), 297–308. https://doi.org/10.1057/palgrave.ejis.3000476

Biber, E., Light, S. E., Ruhl, J. B., & Salzman, J. (2017). Regulating business innovation as policy disruption: From the Model T to Airbnb. *Vand. L. Rev*, *70*, 1561.

Boschma, R., & Gianelle, C. (2013). *Regional branching and smart specialization policy* (pp. 6–2104) [JRC technical reports, (06/2104)].

Bütschi, D. (2012). *Knowledge based policy making* (Report on the First Parliamentary TA Debate Held in Copenhagen on June 18th, 2012.).

Capello, R., & Kroll, H. (2016). From theory to practice in smart specialization strategy: Emerging limits and possible future trajectories. *European Planning Studies*, *24*(8), 1393–1406. https://doi.org/10.1080/09654313.2016.1156058

Carayannis, E. G., & Campbell, D. (2012). *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems: 21st-Century Democracy, Innovation, and Entrepreneurship for Development*. Springer. https://doi.org/10.1504/ijtm.2009.023374

Carayannis, E. G., & Campbell, D. (2014). Developed Democracies Versus Emerging Autocracies: Arts, Democracy, and Innovation in Quadruple Helix Innovation Systems. *Journal of Innovation and Entrepreneurship*, *3*(1), 1–23. https://doi.org/10.1186/s13731-014-0012-2

Carayannis, E. G., & Campbell, D. F. J. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate to Each Other? A Proposed Framework for a Trans-disciplinary Analysis of Sustainable Development and Social Ecology. *International Journal of Social Ecology and Sustainable Development*, *1*(1), 41–69. https://doi.org/10.4018/jsesd.2010010105

Carayannis, E. G., & Rakhmatullin, R. (2014). The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and Beyond. *Journal of the Knowledge Economy*, *5*(2), 212–239. https://doi.org/10.1007/s13132-014-0185-8

Charalabidis, Y., Gionis, G., Ferro, E., & Loukis, E. (2010). Towards a systematic exploitation of web 2.0 and simulation modeling tools in public policy process. *International Conference on Electronic Participation*, 1–12.

Cooke, P. (2012). Knowledge economy spillovers, proximity, and specialization. In *Interactive Learning for Innovation* (pp. 100–111). Palgrave Macmillan UK. https://doi.org/10.1057/9780230362420_5

Deakin, M. (2014). Smart Cities: The State-of-the-art and Governance Challenge. *Triple Helix*, *1*(7), 1–16. https://doi.org/10.1186/s40604-014-0007-9

Deakin, M. (2015). Smart Cities and the Internet: From Mode 2 to Triple Helix Accounts of Their Evolution. In A. Vesco & F. Ferrero (Eds.), *Handbook of Research on Social, Economic, and Environmental Sustainability in the Development of Smart Cities* (pp. 978–971). IGI Global. https://doi.org/10.4018/978-1-4666-8282-5.ch002

Deakin, M. (2018). Smart Cities, Metrics and the Future Internet-Based Governance of Urban and Regional Innovations. *Scienze Regionali*, *17*(1), 39–56. https://doi.org/10.14650/88816

Deakin, M., & Leydesdorff, L. (2014). The Triple Helix Model of Smart Cities: A Neo-evolutionary Perspective. In M. Deakin (Ed.), *Smart Cities: Governing, Modelling and Analyzing the Transition* (pp. 134–149). Routledge. https://doi.org/10.1080/10630732.2011.601111

Deakin, Mark, Mora, L., & Reid, A. (2018). The research and innovation of smart specialisation strategies: The transition from the triple to quadruple helix. *Book of Proceedings for the 27th International Scientific Conference on Economic and Social Development*, 94–103.

Deakin, Mark, & Reid, A. (2018). Smart cities: Under-gridding the sustainability of city-districts as energy efficient-low carbon zones. *Journal of Cleaner Production*, *173*, 39–48. https://doi.org/10.1016/j.jclepro.2016.12.054

Etzkowitz, H., & Leydesdorff, L. (1997). Introduction to Special Issue on Science Policy Dimensions of the Triple Helix of University-industry-government Relations. *Science and Public Policy*, *24*(1), 2–5. https://doi.org/10.1093/spp/24.1.2

European Commission. (2013). *Common Provision Regulation (1303/2013)*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R1303

European Commission. (2018a). *Annexes to the Proposal for a regulation of the European Parliament and of the Council laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, and the European Maritime and Fisheries Fund and financial rules for those and for the Asylum and Migration Fund, the Internal Security Fund and the Border Management and Visa Instrument*. European Commission.

European Commission. (2018b). *Social innovation*. ec.europa.eu/growth/industry/innovation/policy/social_en

Fellnhofer, K. (2017a). Evidence revisited: Literature on smart specialisation calls for more mixed research designs. *International Journal of Knowledge-Based Development*, *8*(3). https://doi.org/10.1504/ijkbd.2017.086407

Fellnhofer, K. (2017b). Facilitating entrepreneurial discovery in smart specialisation via stakeholder participation within online mechanisms for knowledge-based policy advice. *Cogent Business & Management*, *4*(1), 1296802. https://doi.org/10.1080/23311975.2017.1296802

Foray, D. (2014). From smart specialisation to smart specialisation policy. *European Journal of Innovation Management*, *17*(4), 492–507. https://doi.org/10.1108/ejim-09-2014-0096

Foray, D. (2015). *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. Routledge.

Foray, D., David, P. A., & Hall, B. (2009). Smart specialisation–the concept. *Knowledge Economists Policy Brief*, *9*(85), 100.

Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C., & Ortega-Argilés, R. (2012). *Guide to Research and Innovation Strategies for Smart Specialization (RIS3*. Publications Office of the European Union.

Foray, D., Morgan, K., & Radosevic, S. (2018). *The role of smart specialisation in the EU research and innovation policy landscape*. European Commission. http://ec.europa.eu/regional_policy/sources/docgener/brochure/smart/role_smartspecialisation_ri.pdf

For-Learn. (2008). *Scenario building*. Spain: European Commission, Joint Research Center. http://forlearn.jrc.ec.europa.eu/guide/4_methodology/meth_scenario.htm

Gheorghiu, R., Andreescu, L., & Curaj, A. (2016). A foresight toolkit for smart specialization and entrepreneurial discovery. *Futures*, *80*, 33–44. https://doi.org/10.1016/j.futures.2016.04.001

Gianelle, C., Goenaga, X., González Vázquez, I., & Thissen, M. (2014a). Smart specialisation in the tangled web of European inter-regional trade. *European Journal of Innovation Management*, *17*(4), 472–491. https://doi.org/10.1108/ejim-10-2013-0113

Gianelle, C., Goenaga, X., González Vázquez, I., & Thissen, M. (2014b). *Smart specialisation in the tangled web of European inter-regional trade* (JRC Technical Reports; S3 Working Paper Series, pp. 472–491). JRC - European Commission. https://doi.org/10.1108/ejim-10-2013-0113

Gianelle, C., & Kleibrink, A. (2015). *Monitoring mechanisms for smart specialisation strategies, S3 policy brief series, 13/2015*. European Commission, Joint Research Centre.

Gianelle, C., Kyriakou, D., Cohen, C., & Przeor, M. (2016). *Implementing smart specialisation :a handbook*. European Commission, EUR 28053 EN. https://doi.org/10.2791/53569

Grillo, F. (2017). Structuring the entrepreneurial discovery process to promote private-public sector engagement. In D. Kyriakou, M. Palazuelos Martinez, I. Periáñez-Forte, & A. Rainoldi (Eds.), *Governing Smart Specialisation*. Routledge.

Griniece, E., Panori, A., Kakderi, C., Komninos, A., & Reid, A. (2017). Methodologies for Smart Specialisation Strategies: A view across the EU regions. *Proceedings of the 10th International Conference for Entrepreneurship, Innovation and Regional Development ICEIRD, Thessaloniki, 31 August - 01 September 2017*, 321–330.

Griniece, E., Rivera, L., Reid, A., Komninos, N., & Panori, A. (2016). State of the art report on methodologies and online tools for smart specialisation strategies. In *Report produced in the framework of Horizon 2020 project Online S3*. ONLINE Platform for Smart Specialisation Policy Advice.

Iacobucci, D. (2014). Designing and implementing a smart specialisation strategy at regional level: Some open questions. *Scienze Regionali*, *13*(1), 107–126. https://doi.org/10.3280/SCRE2014-001006

Iacobucci, D., & Guzzini, E. (2016). Relatedness and connectivity in technological domains: Missing links in S3 design and implementation. *European Planning Studies*, *24*(8), 1511–1526. https://doi.org/10.1080/09654313.2016.1170108

Joanneum Research & Austrian Federal Ministry of Science, Research and Economy. (2012). *The RIS3 KEY for Self-Assessment. Austrian Federal Ministry of Science, Research and Economy*. https://era.gv.at/object/document/494/attach/2014_August_ris3_englisch.pdf

Kakderi, C., Psaltoglou, A., & Fellnhofer, K. (2018). Digital platforms and online applications for user engagement and collaborative innovation. *Proceedings of the 20th Scientific Conference, Association of Greek Regional Scientists, Regions at a Turning Point: Post-Digital Communities, New Regionalism and Re-Nationalisation - Sustainable Development Implications*, 112–117.

Kenney, M., & Zysman, J. (2016). The rise of the platform economy. *Issues in Science and Technology*, *32*(3), 61.

Kleibrink, A., & Magro, E. (2018). The making of responsive innovation policies: Varieties of evidence and their contestation in the Basque Country. *Palgrave Communications*, *4*(74). https://doi.org/10.1057/s41599-018-0136-2

Komninos, N. (2016). Smart environments and smart growth: Connecting innovation strategies and digital growth strategies. *International Journal of Knowledge-Based Development*, *7*(3), 240–263. https://doi.org/10.1504/ijkbd.2016.078536

Komninos, N. (2018). Internet platforms, innovation and growth under the "smart everything" paradigm. *Proceedings of the 20th Scientific Conference, Association of Greek Regional Scientists, Regions at a Turning Point: Post-Digital Communities, New Regionalism and Re-Nationalisation - Sustainable Development Implications*, 119–125.

Komninos, N., Musyck, B., & Reid, A. (2014). Smart specialisation strategies in south Europe during crisis. *European Journal of Innovation Management*, *17*(4), 448–471. https://doi.org/10.1108/ejim-11-2013-0118

Komninos, N., Tsarchopoulos, P., & Kakderi, C. (2014). New services design for smart cities: A planning roadmap for user-driven innovation. *Proceedings of the 2014 ACM International Workshop on Wireless and Mobile Technologies for Smart Cities*, 29–38. https://doi.org/10.1145/2633661.2633664

Kroll, H. (2015). Efforts to implement smart specialization in practice—leading unlike horses to the water. *European Planning Studies*, *23*(10), 2079–2098. https://doi.org/10.1080/09654313.2014.1003036

Kroll, H., Baier, E., Heijs, J., Hollanders, H., Schricke, E., Stahlecker, T., & Wintjes, R. (2011). *Development of a methodology for the profiling of regional economies*. Fraunhofer ISI, UNU-MERIT, IAIF, Logotech.

Kuhlang, P., Edtmayr, T., & Sihn, W. (2011). Methodical approach to increase productivity and reduce lead time in assembly and production-logistic processes. *CIRP Journal of Manufacturing Science and Technology*, *4*(1), 24–32. https://doi.org/10.1016/j.cirpj.2011.02.001

Lämmer-Gamp, T., Köcker, G. M., & Nerger, M. (2014). *Cluster Collaboration and Business Support Tools to Facilitate Entrepreneurship, Cross-sectoral Collaboration and Growth*. http://ec.europa. eu/enterprise/initiatives/cluster/observatory/2014-10-10-eco-report-d4 1

Landabaso, M. (2014). Guest editorial on research and innovation strategies for smart specialisation in Europe: Theory and practice of new innovation policy approaches. *European Journal of Innovation Management*, *17*(4), 378–389. https://doi.org/10.1108/ejim-08-2014-0093

Landabaso, M., & Mouton, B. (2005). Towards a different regional innovation policy: 8 years of European experience through the European regional development fund innovative actions. In M. Heitor (Ed.), *Regional Development and Conditions for Innovation in the Network Society* (pp. 209–240). Purdue University Press.

Leydesdorff, L. (2005). Evaluation of Research and Evolution of Science Indicators. *Current Science*, *89*(9), 1510–1517.

Leydesdorff, L., & Deakin, M. (2011). The Triple-helix Model of Smart Cities: A Neo-evolutionary Perspective. *Journal of Urban Technology*, *18*(2), 53–63. https://doi.org/10.1080/10630732.2011.601111

Leydesdorff, L., & Meyer, M. (2006). Triple Helix Indicators of Knowledge-based Innovation Systems: Introduction to the Special Issue. *Research Policy*, *35*(10), 1441–1449. https://doi.org/10.1016/j.respol.2006.09.016

Marianelli, E., & Perinez Forte, I. (2017). Smart Specialisation at work: The entrepreneurial discovery as a continuous process. In *JRC technical reports, S3 Working Paper Series No. 12/2017*. Luxemburg.

Mazzucato, M. (2018). *Mission-Oriented Research & Innovation in the European Union: A problem-solving approach to fuel innovation-led growth*. European Commission.

McCann, P., & Ortega-Argilés, R. (2014). Smart specialisation in European regions: Issues of strategy, institutions and implementation. *European Journal of Innovation Management*, *17*(4), 409–427. https://doi.org/10.1108/ejim-05-2014-0052

McCann, P., & Ortega-Argilés, R. (2015). Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy. *Regional Studies*, *49*(8), 1291–1302. https://doi.org/10.1080/00343404.2013.799769

McCann, P., & Ortega-Argilés, R. (2016). The early experience of smart specialization implementation in EU cohesion policy. *European Planning Studies*, *24*(8), 1407–1427. https://doi.org/10.1080/09654313.2016.1166177

OECD. (2013). *Innovation-driven Growth in Regions: The Role of Smart Specialisation. Organisation for Economic Co-Operation and Development*. Committee for Scientific and Technological Policy.

Oskam, J., & Boswijk, A. (2016). Airbnb: The future of networked hospitality businesses. *Journal of Tourism Futures*, *2*(1), 22–42. https://doi.org/10.1108/jtf-11-2015-0048

Paliokaitė, A., Martinaitis, Ž., & Reimeris, R. (2015). Foresight methods for smart specialisation strategy development in Lithuania. *Technological Forecasting and Social Change*, *101*, 185–199. https://doi.org/10.1016/j.techfore.2015.04.008

Panori, A., Angelidou, M., Mora, L., Reid, A., & Sefertzi, E. (2018). Online platforms for Smart Specialisation Strategy and Smart Growth. *In Proceedings, 20th Scientific Conference, Association of Greek Regional Scientists, Regions at a Turning Point: Post-Digital Communities, New Regionalism and Re-Nationalisation - Sustainable Development Implications*, 96–102.

Panori, A., González-Quel, A., Tavares, M., Simitopoulos, D., & Arroyo, J. (2016). Migration of applications to the Cloud: A user-driven approach. *Journal of Smart Cities*, *2*(1). https://doi.org/10.18063/jsc.2016.01.005

Panori, A., Komninos, N., Kakderi, C., & Fellnhofer, K. (2017). Smart Specialisation Strategies: An Online Platform for Strategy Design and Assessment. *International Conference on Reliability and Statistics in Transportation and Communication*, 3–16.

Pessoa, A. (2016). Rectracted: Smart specialization in the EU: RIS3 conditionality, innovation and cohesion. *Papers in Regional Science*, *95*(2), 439. https://doi.org/10.1111/pirs.12201

Radosevic, S. (2017). Assessing EU smart specialization policy in a comparative perspective. In S. Radosevic, A. Curaj, R. Gheorghiu, L. Reescu, & I. Wade (Eds.), *Advances in the Theory and Practice of Smart Specialization* (pp. 1–36). Academic Press. https://doi.org/10.1016/b978-0-12-804137-6.00001-2

Ranga, M., & Etzkowitz, H. (2012). A Triple Helix System for Knowledge-based Regional Development: From "Spheres" to "Spaces." *VIII Triple Helix Conference*, 1–29. https://triplehelix.stanford.edu/images/Triple_Helix_Systems.pdf

Reid, A., Komninos, N., Sanchez-P, J. A., & Tsanakas, P. (2012). RIS3 National Assessment: Greece. Smart specialisation as a means to foster economic renewal. In *A report to the European Commission, DG Regional Policy*.

Reid, A., & Maroulis, N. (2017). From Strategy to Implementation: The Real Challenge for Smart Specialization Policy. In *Advances in the Theory and Practice of Smart Specialization* (pp. 293–318). Academic Press. https://doi.org/10.1016/b978-0-12-804137-6.00012-7

Rodriguez-Pose, A., & Wilkie, C. (2017). Institutions and the entrepreneurial discovery process for smart specialization. In D. Kyriakou, M. Palazuelos Martinez, I. Periáñez-Forte, & A. Rainoldi (Eds.), *Governing Smart Specialisation*. Routledge.

Roman, M., & Nyberg, T. (2017). Openness and Continuous Collaboration as the Foundation for Entrepreneurial Discovery Process in Finnish Regions. *Management Dynamics in the Knowledge Economy*, *5*(4), 517–531. https://doi.org/10.25019/mdke/5.4.04

Rowe, G., & Frewer, L. J. (2004). Evaluating public-participation exercises: A research agenda. *Science, Technology, & Human Values*, *29*(4), 512–556. https://doi.org/10.1177/0162243903259197

Smart Specialisation Platform. (2018). *Social Economy*. s3platform.jrc.ec.europa.eu/social-economy

Stevens, E., & Dimitriadis, S. (2005). Managing the new service development process: Towards a systemic model. *European Journal of Marketing*, *39*(1/2), 175–198. https://doi.org/10.1108/03090560510572070

Teichler, T., Talmon-Gros, L., Treperman, J., Bovenschulte, M., & Jetzke, T. (2015). Foresight report on industrial and cluster opportunities. *European Cluster Observatory*. https://ec.europa.eu/docsroom/documents/16264/attachments/1/translations/en/renditions/pdf