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Capacity-building barriers to S3 implementation: an empirical framework for catch-up regions

George Papamichail[a*], Alessandro Rosiello[b,c] and David Wield[a,b,d]

[a]*Science Technology and Innovation Studies, University of Edinburgh, Edinburgh, UK;* [b]*Innogen Institute, University of Edinburgh and the Open University, UK;* [c]*Business School, University of Edinburgh, Edinburgh, UK;* [d]*Development Policy and Practice, Open University, Milton Keynes, UK*

In this paper, we investigate the implementation challenge of Smart Specialisation Strategies (S3) in catch-up regional environments, through the lens of capacity building. We analyse capacity building at two levels: micro-level (individual organisations) and meso-level (regional inter-organisational networks). We use empirical evidence from 50 interviews conducted in the period 2015–2017 from two Greek regions dramatically hit by the economic crisis (Crete and Central Macedonia). We argue that in the Cretan and Central Macedonian context, the difficulty of implementing S3 is directly linked with firms' lack of adsorptive capability to exploit university-generated knowledge, university knowledge that is too abstract for firm's to easily acquire, as well as to the capability of regional actors to build inter-organisational networking that fits their strategic needs.

Keywords: capacity building; catch-up regions; smart specialisation; S3; Crete; Central Macedonia

1. Introduction

In this paper, Smart Specialisation Strategies (S3) are analysed in the context of place-based policy transformation (David, Forey, and Hall 2012; McCann and Ortega-Argilés 2014), regional diversification (Foray, David, and Hall 2011; Boschma and Gianelle 2014), structural change (Asheim and Grillitsch 2015) and economic development (OECD 2013b). During the last seven years (2010–2017), a rapidly expanding literature has informed S3 theoretical underpinnings, aiming to explain how its dynamics could gradually support European regions expand and diversify into new economic activities (Foray 2014; Asheim and Grillitsch 2015; McCann 2015). The paradox, however, is that while S3 has been accepted as a tool for regional turnaround, its practical realisation in the regional context is still fuzzy (Gianelle et al. 2014; McCann, Van Oort, and Goddard 2016).

The implementation challenge of S3 is due to different reasons, and can be studied by examining different conceptual frameworks. For example, there is a growing number of empirical studies which tend to relate the difficulty of S3 implementation with the lack of key local pre-conditions and capacities (Foray 2016). In this view, the S3 implementation challenge relies on conceptual frameworks which show that capacity building does matter for S3, as it supports regions identify potential entrepreneurial opportunities

*Corresponding author. Email: s1258376@sms.ed.ac.uk

(Von Tunzelmann 2009; Asheim and Grillitsch 2015; Foray 2016; McCann, Van Oort, and Goddard 2016). This view applies more in catch-up regions which are routinely backward in capacity building (Verspagen 1991), and possess limited abilities to diversify into new industries (Boschma, Heimeriks, and Balland 2014). Others identify a number of regulatory constraints and institutional inefficiencies as an important barrier for the realisation of S3 in various regional milieus (Gianelle et al. 2016).

In order to contribute to understanding the difficulty of executing S3 in the regional context, this paper draws attention to the first view, and examines the way S3 barriers are linked to the lack of absorptive and networking capabilities. Our analysis is conducted with a particular focus on the interfaces of industry and academe, given that one of the most profound barriers for the implementation of regional innovation policies in these particular environments is the enduring lack of strong collaborative linkages between universities and entrepreneurial firms (OECD 2005; Reid et al. 2012a; Papamichail and Saitakis 2013; EKT 2015). Inspired by the work of Von Tunzelmann (2009), who recognised the significance of examining capacity building beyond the boundaries of a single firm, our analysis is focused both on organisations' (micro-level) and regional (meso-level) capabilities. Hence, absorptive capacity is examined at micro-level, while networking capabilities are studied at the meso-level. For the purpose of this work, the micro-level refers to competences and capabilities developed at the level of organisations. The analysis at the meso-level goes beyond the boundaries of a single organisation and refers mostly to regionally based capabilities related to institutional configuration.

To build our empirical framework, we examine two European Union (EU) regional environments: Crete and C. Macedonia, and formulate the following research question: *How do capacity-building barriers affect the implementation of S3 in our selected regions?* We use empirical evidence from two case study regions: Crete and C. Macedonia. We analyse 50 interviews conducted in 2015–2017, and we show how the lack of absorptive and networking capabilities lead to practical barriers to S3 implementation.

The structure of the paper is as follows. It begins with a short introduction to ongoing research surrounding S3 applicability in the regional context. In this section, we highlight the implementation challenge of S3 and draw attention at the dynamics of capacity building. We also explain why the realisation of S3 is uncertain in catch-up regions particularly. In the following sections, we discuss our data collection process and provide a brief description of the profiles of our case study regions. Then, we develop an empirical framework to answer our research question, divided into two sections. The first section formulates a narrative to describe key S3 methodological practices conducted in both regions. The second investigates the way capacity-building barriers affect the implementation of S3 in Crete and C. Macedonia.

2. Implementing S3: critical research in progress

There is a growing recognition that our S3 understanding has to shift attention from theory (design) to practice (implementation); for example, see the work of (Gianelle et al. 2014; Capello and Kroll 2016; McCann, Van Oort, and Goddard 2016). At a theoretical level, the value of S3 has been well embedded in the regional innovation agenda (OECD 2013b; McCann, Van Oort, and Goddard 2016), concentrating both policymaking and academic interest. Shifting focus from a narrowly sectoral and national applicability to sub-national level (regional), S3 theoretical underpinnings have been studied in the local context analytically. The consistency of its concept and its theoretical adaptability at the regional level have been analysed thoroughly by studying how diverse European regions have

addressed the design of their S3 (Kroll 2015). In this respect, the theoretical part of S3 has been progressively informed, providing the concept itself with a diversified regional policy approach. Interestingly, this new approach intends to replace 'business as usual' models, with the objective of moving regional innovation paradigm forward; in particular, S3 principles reside in the idea that regional renewal is driven by bottom-up practices aiming to incite continued structural transformation and regional development.

At the practical level, however, our understanding as to how and under what policy conditions S3 can be executed in specific regional contexts is still limited. The implementation challenge of S3 is particularly profound in catch-up regions, which usually suffer from low innovation capacity and potential (Morgan and Nauwelaers 2004; Foray 2014). There have been several ways of classifying regions into different groups according to their capacity to innovate: *learning* (Lundvall and Johnson 1994; Florida 1995; Asheim 1996; Morgan 1997; Maskell and Malmberg 1999; OECD 2001; Lundvall 2010); *technology-followers* (Forbes and Wield 2002); *catch-up* and *backward* (Abramovitz 1986; Verspagen 1991; Fagerberg and Verspagen 1996; Cappelen, Fagerberg, and Verspagen 1999); *less-favoured* (Morgan and Nauwelaers 2004); and *transition* (Cooke 2011; EU 2015). What makes the investigation of S3 implementation challenges particularly relevant for catch-up regional milieus, is the fact that many of their structural characteristics contradict a number of S3 policy preconditions as identified empirically by (OECD 2013a). Furthermore, catch-up regions are usually characterised by fragmented regional innovation systems (Cooke, Gomez uranga, and Etxebarria 1997; Tödtling and Trippl 2005; Martin and Trippl 2014), weak learning capabilities and skills (Malerba 1992; Oughton, Landabaso, and Morgan 2002), low potential for absorptive capacity (Cohen and Levinthal 1990; Lundquist and Trippl 2013; Asheim and Grillitsch 2015) limited abilities to diversify into new industries (Boschma, Heimeriks, and Balland 2014); low entrepreneurial potential (Fritsch 1992); and considerable challenges in mobilising institutional and structural change (Neffke et al. 2014).

2.1. *Absorptive and networking capabilities*

An important part of S3 research is currently driven by the investigation of empirical evidence, aimed at explaining how less-favoured European regions can tackle the operational challenge of S3 (Morgan 2016), through the development of specific capabilities. In this paper, focus is given on two forms of capacity building which are seen crucial for S3 implementation: *absorptive capacity* and *networking capabilities*. As introduced previously, our interest is particularly in the relationships between universities/research centres and entrepreneurial firms for two reasons that are interrelated with each other and, in our view, are central for the implementation of S3. The first reason is because Crete and C. Macedonia are two Greek regions which although they have developed strong research communities (CRETE OP 2014; Region of Central Macedonia 2014), the impact of several industry-academia synergies remains very low (EKT 2015). A number of policy documents highlight the disconnect between science and businesses, identifying it as one of the most significant barriers which fragments the competitive advantage of the regions (OECD 2005). It is therefore crucial to investigate how university-industry relations are developing for the implementation of S3. The second reason rests on the central role that firms and universities are taking in the development of S3 as two of the most important designers and implementers of S3 (Kempton et al. 2013).

In this paper, absorptive capacity is studied at the micro-level, and it is understood as 'firms' ability to recognise the value of new external information, assimilate it and apply it

to commercial ends' (Cohen and Levinthal 1989). The literature is very rich about the impact that absorptive capacity building may have on regional innovation policies, industrial development and particularly on the implementation of S3 (Von Tunzelmann 2009; EC 2012; Foray 2012; OECD 2013b; McCann and Ortega-Argilés 2015). For example, the ability of a firm to recognise new entrepreneurial opportunities and diversify into new markets depends on its potential to adapt and use critical knowledge generated externally (Neffke et al. 2014; Boschma and Capone 2015). In this sense, firms' ability to develop absorptive skills is vital for leading the entrepreneurial discovery process, in which structural change and regional transformation can be triggered by knowledge flows among multiple players (Foray 2014). Thus, what is also crucial is an inter-organisational networking appropriate to facilitate the interaction among key local actors. As a result, networking capabilities are studied at the meso-level and they are understood as the 'organisations' abilities to develop and make use of inter-organisational relationships to gain access to various resources held by others' (McGrath and O'Toole 2013). A number of empirical studies highlight the importance of institutional networking in facilitating the design and implementation of S3 (Gianelle et al. 2016; McCann and Ortega-Argilés 2016). For example, in the EU context, it has been argued that the effectiveness of the self-discovery process is highly depended on the ability of diverse local players to create strong connections which each other and become able to take a joint role in developing S3 (Landabaso, McCann, and Ortega-Argilés 2014; Foray 2016). Similarly, in a Cretan and C. Macedonian context, what is currently considered crucial for the implementation of S3 is the creation of several systemic partnerships between private and public sector organisations to collectively identify and implement joint strategic priorities and actions (Region of Central Macedonia 2015; Region of Crete 2015).

3. Methodology and data

A qualitative research design was designed to address our research question. Our fieldwork was conducted in Crete and C. Macedonia. Data collection and analysis covered a period of roughly three years (2015–2017), including a longitudinal study for the region of Crete. Longitudinal research was carried out to examine S3 developmental trends and provide further validity to the study.

3.1. *Case study approach and sampling strategy*

We use two case studies as a research strategy to investigate and understand the way capacity building affects the implementation of S3 in our selected regions. Each region constituted one single case study and was examined separately as a unit of analysis. Both follow a descriptive and explanatory route (Yin 2009), seeking to examine S3 practices analytically. Our sampling strategy is purposive rather than random; precisely, we are interested in catch-up environments (at the NUTS2 level) and we select regions which (i) have been hit drastically by the Greek financial crisis and (ii) represent a relatively higher innovation and technological profile as compared to the Greek average and (iii) are in the process of developing S3.

3.2. *Data collection and analysis*

Data collection follows a triangulation approach (Bryman 2004) and analyses both primary and secondary resources. Secondary analysis uses existing data gathered by thematic

studies, statistics, regional innovation action plans and other available reports related to Smart specialisation published at the NUTS2 level. We also elaborated official speeches, public records and other relevant RIS3 documents that are freely available for the two regions. As regards the primary analysis, our evidence is gathered by using a mixed method approach. Observation and semi-structured interviews are the central means of collecting our data. Observation takes an ethnographic form through our direct participation in diverse S3 events, such as official presentations, informative workshops and public consultations that have been conducted for both regions in the period 2015–2017. Concerning interviews, we performed 50 semi-structured interviews with high-level national and regional innovation experts, academics from state universities and public-funded research centres, local entrepreneurs and representatives from varied intermediary organisations (e.g. science parks, incubators, business networks, chambers, etc.). All respondents had either a direct or indirect involvement in the S3 at different levels of development (design, implementation and evaluation), ensuring wide representativeness from the sub-national ecosystems of both regions. The composition of our respondents is presented separately for each region in Table 1.

Most of the interviews were conducted face-to-face. Skype technology was also used to reach a small number of our respondents mainly in the region of C. Macedonia. To facilitate our interviews and direct the conversation toward the topics of our research interests, we used a basic interview guide, which was adaptable according to our respondents' group. To organise and analyse our data we used NVivo 7. We grouped our interview transcripts from both regions into three main categories (public sector, academia and firms), and we coded our data into separate themes. We developed our coding scheme and developed themes to allow for flexible comparisons between the two regions and among the stakeholder groups of our interest. After first-level coding, we created nodes and checked in what ways emerging patterns and ideas from our interviews were related to different forms of capacity building barriers. We gathered all ideas closely linked to capacity building and selected those that referred more to absorptive and networking capabilities. We examined them together in a new node to identify representative quotes for our study.

3.3. *Methodological limitations*

We recognise some methodological limitations in our approach. A first limitation refers to representativeness, as our findings may not be necessarily transferable to other regional contexts. For example, since Crete and C. Macedonia possess regional particularities that do not regularly apply to other Greek regions (EKT 2015), for instance, high concentration of academic and R&D infrastructures, high percentage of innovative firms, etc., it

Table 1. Composition of respondents.

	Crete		C. Macedonia		Total	
Group of respondents	No. of respondents	(%)	No. of respondents	(%)	No. of respondents	(%)
Public sector	11	36.7	10	50.0	**21**	**42.0**
Academia	6	20.0	4	20.0	**10**	**20.0**
Private sector	13	43.3	6	30.0	**19**	**38.0**
Total	**30**	**100.0**	**20**	**100.0**	**50**	**100.0**

Source: Authors.

may be risky to simply generalise our empirical evidence without analysing other similar regional contexts. Second, given that our case study regions have not yet fully put their S3 action plans in place, it is difficult to identify and analyse all possible implementation challenges at once. Consequently, part of our analysis takes necessarily an indicative approach which remains to be proved during the implementation phase in both regions. The third limitation is linked with the longitudinal analysis which was conducted for one of our case study regions (Crete) due to time and budget constraints. This possibly raises threats for the longitudinal validity of the study. As a final limitation, we refer to the restricted availability of updated secondary data which has been used to analyse both regional contexts (e.g. reports, regional studies, etc.). The analysis of newly updated data might have increased further the reliability of this study.

4. Regional profiles

This section provides an overview of the regional profiles of Crete and C. Macedonia. It discusses socioeconomic factors that have gradually influenced the productive structure of both environments.

4.1. *Crete*

4.1.1. *Geography and local economy*

Crete (NUTS2: EL43) is the largest island of Greece and the fifth largest island in the Mediterranean area. Located in the southern part of the country, it covers 8.336 km^2 with a total coastline length of more than 1000 km. According to the General Population Census 2011 (ELSTAT 2016), the region is ranked the 5th most populous area in the country with 621.340 permanent inhabitants. Crete generates approximately 5% of the Greek GDP, specialising in services (tourism and shipping), and in agro-food (production of diversified wine varieties, organic cheese and olive oil). The macroeconomics of the island show that the Cretan GDP per capita in PPS has been reduced notably since 2008 – a 14% fall between 2008 and 2015 – with significant effects on the business enterprise sector; the GDP per capita in PPS (Gross Domestic Product in Purchasing Power Standards) in 2015 was €18.800 (ELSTAT 2016). Similarly, unemployment rates have almost doubled from 2010 to 2017 (first four months), reaching more than 20% in early 2017, raising

Table 2. Facts and figures of Crete and C. Macedonia.

Indicator	Value	
	Crete	C. Macedonia
Size (in square km)	8.336	18.811
Population (in millions, 2011)	623.065	1.882.108
GDP per capita in PPS (2008)	21.400€	19.400€
GDP per capita in PPS (2015)	18.800€	15.100€
Unemployment (2010)	12%	13,7%
Unemployment (2014)	24%	28,7%
Unemployment (Jan-Apr 2017)	20.2%	22.7%
Enterprises with New Product Development (%)	10,7%	13%
Enterprises which collaborate for New Pr. Dev. (%)	7.5%	13,3%
R&D expenditure as *a percentage of GDP*	1,35%	0,7%

Source: data elaborated by authors.

important brain drain threats (see Table 2). Arguably, the current economic recession of the island is mostly due to the ongoing economic crisis which has an adverse impact on the local economy (Bank of Greece 2015).

4.1.2. *RTDI, networking and knowledge base*

Cretan R&D is largely dominated by the government and higher education sectors, which remain the largest sources of R&D investment of the island (OECD 2005). The existence of a number of internationally recognised research bodies and higher educational centres have contributed crucially to the creation of a strong local research community with international knowledge linkages. Crete demonstrates a significant concentration of scientific research potential, hosting a noteworthy number of well-established centres with scientific excellence in Key Enabling Technologies (KETs) (EKT 2015). In this respect, the island demonstrates an important agglomeration of public knowledge creators that have exerted a strong influence in generating, stocking and diffusing different types of scientific knowledge. The scientific expertise of the region is mainly concentrated in biology-biotechnology, laser technologies, digital technologies and ICTs. Contrariwise, the private sector seems less effective in creating and making sense of new knowledge-based incentives and assets (Region of Crete 2015). The absent of large-scale knowledge-intensive industries suitable to support technological development and industrial partnerships, strangles the ability of the region to collectively keep high levels of R&D investments in the private sector. Consequently, the business R&D expenditure (as a share of GDP) remains below the European average (OECD 2005).

In terms of inter-firm synergy and business networking, innovation networks are mostly concentrated in four industrial sectors: tourism, agricultural products, agriculture-livestock and construction. The most well-known are the winery network and a number of olive oil associations that are typically run by local producers. Traditionally, strategic co-operations in the private sector are not systematic; rather, they are conducted on an ad-hoc basis. The complexity of setting business and R&D networks is path-dependent affected by different types of systemic failure (e.g. market failure, government failure, etc.), as empirically found also by other similar studies in diverse regional environments, see for example (Von Tunzelmann et al. 2010). As a result, the commercialisation process and the linkages of the scientific community with the local companies remain relatively low with inevitably negative effects on regional innovation and competitiveness (EKT 2015).

4.2. *C. Macedonia*

4.2.1. *Geography and local economy*

Central Macedonia (NUTS2: EL52) is part of the northernmost and largest geographical unity of Greece, *Macedonia* which shares borders with the Former Yugoslav Republic of Macedonia (FYROM) and Bulgaria. It is the biggest region of the country in size, covering a total area of 19.166 km^2, and the second most populous area (after Attica), with 1.882.108 inhabitants, approx. 17.5% of the whole population of Greece, (ELSTAT 2016). The region generates approximately 15% of the national GDP, of which 11.7% is produced in the capital city Thessaloniki (ELSTAT 2016). Its regional production structure is distributed in primary, secondary and tertiary sectors, with particular

specialisation in the production of peaches, cotton and tobacco, as well as in processed food, retail and textile finishing products (Region of Central Macedonia 2014). In addition, other knowledge intensive industries including biomedicine, organic farming, food and chemicals (petrochemicals, plastics, polymers, etc.), furniture and metal products have also gained the bulk of the economic activity in the region. From a macroeconomic perspective, the GDP per capita (in PPS) decreased remarkably during the period 2008–2015 (by apr. 28.5%) while in 2010–2014 the official unemployment rates of the region grew dramatically (by 15%) (see Table 2) (ELSTAT 2016), leading to significant brain drain effects. This shows the vulnerability of the region to developmental problems imposed by the new situation of ongoing fiscal consolidation as well as the uneven effects of capital controls and other similar financial disruptions on the real economy.

4.2.2. *RTDI, networking and knowledge base*

The main characteristic of the regional innovation system of C. Macedonia is the continuous domination of the local scientific community, which concentrates high quality of indigenous research infrastructures with an international potential. Public research organisations make a major contribution to local research base of the region, while companies and other private bodies are found less influential in shaping the innovation regime of the region (Region of Central Macedonia 2014). In this respect, public knowledge creators have become the main players in the C. Macedonian technology innovation system. Local academia consists of public research centres, located mainly in Thessaloniki, and various educational institutes dispersed throughout the region with strong knowledge-based capital. Undoubtedly, local universities and research centres generate high-level scientific knowledge, providing the region with a significant multidisciplinary knowledge base. However, academic activity is not typically oriented towards cooperation with the local enterprise sector, and therefore, it is not found to have a particularly active and continuous role in the local value chain (Reid et al. 2012a). Data from ELSTAT (2016) show that the R&D expenditure of the region is predominantly localised at the public higher education sector (€97.29 m in 2013). The contribution of the government is also central in funding R&D activities (52.9 m in 2013, see Table 2). In general, the C. Macedonian R&D expenditure as a percentage of GDP (0.7%) remains below the EU-28 average which was approximately 2.0% in 2015 (EKT 2015). Similarly, while the percentage of innovative enterprises for the period 2010–2012 was more than the half (53%), local businesses are not well synchronised with the scientific research, suffering from the lack of cross-scale inter-sectoral linkages.

The industrial specialisation of the region is mostly based on service sector activities, related to tourism and agro-food, which traditionally do not achieve critical investments in R&D and do not follow a science-based approach (Reid et al. 2012a). Likewise, no R&D clusters or business networks exist at present to promote intersectoral integration in the region. Co-location of firms with the aim of generating specialisation externalities, diversification and technological spillovers does exist but it is relatively weak (Region of Central Macedonia, 2014). Empirical studies show that while academic institutions seem to play a pioneering role in generating and delivering the innovation potential of the region, their linkages with the local economy remain at low levels (Avranas and Nioras 2011). 'Invent here – exploit elsewhere' practices are broadly found in the case of C. Macedonia, as business local capacity to absorb new research outputs remains weak (Region of Central Macedonia 2015).

5. Empirical evidence from Crete and C. Macedonia

5.1. *S3 practices in Crete and C. Macedonia: a brief overview*

This section provides a brief description of the basic methodological steps conducted by both regions to develop S3. It develops a narrative which is largely based on the analysis of our interviews.

5.1.1. *Crete*

Crete is one of first regions in the country which incorporated the logic of S3 and adopted its principles in a regional context. The first initiatives were launched by the Managing Authority[1] (MA) of the Region of Crete in 2012, and took a structured shape at the end of the same year when an informal S3 working group was set and approved by the regional governor. The main outcome of the working group was the preparation of a draft document, suggesting four central domains of priority: *agro-alimentary complex; cultural-touristic complex; environmental complex; and knowledge complex*, as well as the use of ICT with a horizontal application. The agro-alimentary complex refers to a set of activities linked to the primary sector and aims at 'producing high added value food that has high nutritional value' (Region of Crete 2015). The cultural-touristic complex targets activities in the tourism and cultural sectors such as hospitality, transpiration, promotion of cultural resources, etc.. The environmental complex refers to energy saving, renewable energy, climate change, while the knowledge complex focuses on the research and university institutions of Crete which promote state-of-the-art technologies in nanotechnology, biomedicine, biology, microelectronics, materials, etc.

The Cretan policymakers followed a specific policy approach to develop entrepreneurial discovery in the region. Methodologically, practices in Crete followed a rather narrow-to-broad approach, in the sense that during its first steps there was a deliberately limited

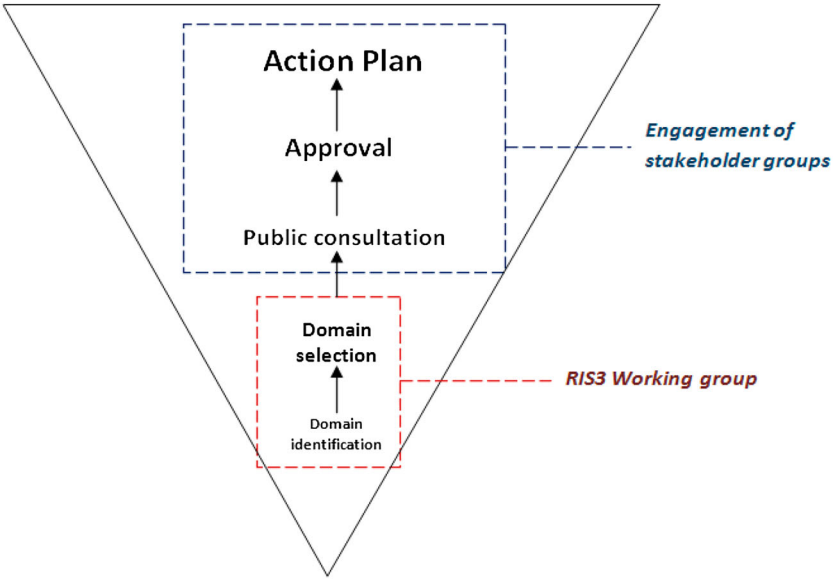

Figure 1. Entrepreneurial discovery process in Crete: a narrow-to-broad approach. Source: Authors.

participation of local stakeholders, which was later expanded to an increased number of participants. The entrepreneurial discovery consists of five concrete stages as illustrated in Figure 1.

The outcome of the first two stages (domain identification and domain selection) was influenced by specific (narrow) attributes and closed practices (in the sense of limited stakeholders' participation), which put the basis for the early stages of the design of S3; the other three stages stimulated and included a broader engagement and contribution of the different productive structures of the island. Notably, in these first stages, a broad-based engagement of the local community was restricted to achieve flexibility and fast S3 response, which, however, according to S3 coordinators it was offset later by a series of public consultations. Moreover, once S3 priorities were approved at an official level (regional and national), a series of public consultations were conducted to inform local society about the selected domains and start an open and continuous dialogue with the academic and business community of the island. Public consultations were seen as means of legitimising the decision making and, therefore, minimising the possibility for accusing policy options in the future. The process of consultation led to formal approvals (at the level of the EU) and allowed the preparation of the first S3 action plans. Officially, the implementation phase of S3 in Crete began in the middle of 2017, under the supervision of the General Directorate of Development Planning.

5.2. *C. Macedonia*

Moving its regional innovation agenda forward, C. Macedonia began S3 practices in the first quarter of 2013 (April), when the regional governor approved a diverse network of experts responsible for the development of S3 in the region. Following a slightly different methodological approach comparing to Crete, this broad network consisted of an increased number of experts, who officially represented a wide range of different stakeholder groups including various regional authorities, local academia and business sector, as well as, other key players from the productive system of the region. In order to move S3 progress forward, several thematic teams were later grouped into one working team consisted of a limited number of participants. Our C. Macedonian respondents suggest that this option provided further flexibility and speed up the process.

The regional authorities considered entrepreneurial discovery as a continuous and dynamic procedure divided into two separated phases. The adoption of a two-phase approach is a particular strategic decision for C. Macedonia which indicates the way local policy experts addressed S3 in practice. The first phase refers to the practices carried out for the prioritisation and final selection of the S3 domains; its analysis remained at a rather general level. In this first part, the main aim was to examine specialisation at a broad level through the exploitation of quantitative data and statistics (e.g. trends of markets, economic areas with strong competitive advantages, available innovations and technological applications, etc.). Once domains were identified and justified, the second phase was more focused, aiming at proving further specialisation by identifying particular areas of actions within the selected domains (e.g. specific areas of expertise with increased potential for future economic development).

The first methodological steps of C. Macedonia to develop the self-discovery process were based on a broad-to-narrow approach, followed by widely open and transparent practices (see Figure 2). This option fits well with the ongoing S3 literature, which indicates broad practices and expanded stakeholders' engagement during entrepreneurial discovery (Foray 2016; McCann and Ortega-Argilés 2016; Sörvik et al. 2016). In contrast with the

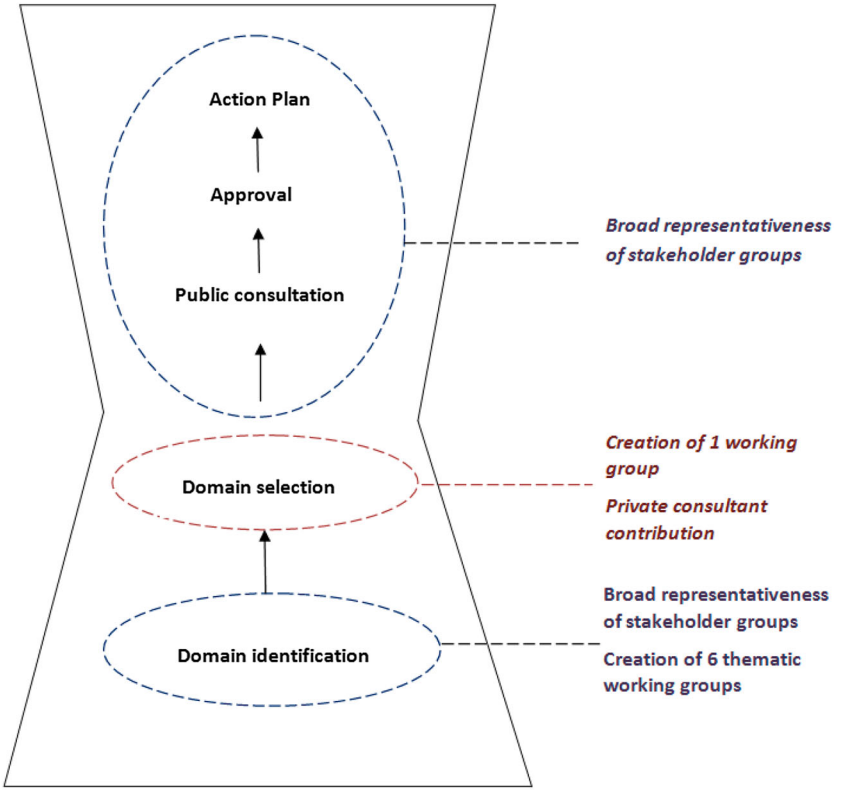

Figure 2. Entrepreneurial process of discovery in C. Macedonia: a snapshot. Source: Authors.

early stages conducted by Crete, various local actors from different stakeholder groups were mobilised and encouraged to participate in a continuous self-discovery for the identification and prioritisation process of the region. This was the first collective effort of C. Macedonian authorities to examine what local adaptation would be more relevant to address the new RIS3 framework.

The finalised S3 document for C. Macedonia included the macroeconomic characteristics of the region, the current entrepreneurial trends of the business community, the characteristics of the local academic system, a detailed SWOT analysis, and a thorough explanation of the selected R&D domains and their governance framework. It came up with five main priorities: *agro-food; tourism; materials; textiles and clothing;* and *ICT (energy and environmental technologies, transport and logistics)*.

5.3. *Capacity-building challenges to S3 implementation*

In this section, we use empirical evidence to examine the way capacity-building barriers affect the implementation of S3 in our case study regions. We found that the inability of firms to exploit university-generated knowledge, university knowledge that is too abstract for firm's to easily acquire, as well as the ineffective institutional setup of the regions to build effective networking among firms, universities and public authorities are two central barriers to S3 implementation in the Cretan and C. Macedonian context. Both findings are discussed and analysed below.

5.3.1. *Absorptive capacity of firms*

We saw that the lack of absorptive capabilities at the level of firms is a central barrier to S3 implementation in the Cretan and C. Macedonian context. Our analysis indicates that the majority of the firms located in our case study regions lack capacity to absorb and commercialise university-generated knowledge, which is seen crucial for generating innovation-driven growth and for realising effective entrepreneurial discovery (Foray and Van Ark 2007). Our findings are based on the following evidence.

A widespread consensus in our respondents' views across regions shows that a high percentage of local firms have not yet developed the capacity to acquire university-generated knowledge for commercial purposes. Zahra and George (2002) have shown that a first step in the absorptive capacity process is the acquisition of knowledge, which refers to firms' ability to identify and acquire external knowledge. The authors have also identified other capacity building stages, which take place later and compose firms' overall absorptive capability: assimilation, transformation and exploitation of knowledge. We believe that, in the case of our selected regions, firms encounter difficulties in developing acquisition capabilities (the first stage), and, in fact, this fragments any other endeavour to move absorptive capacity building forward (e.g. get access and exploit incentive knowledge acquisition facilities and resources).

This idea comes out from a common acceptance of our business community interviews, which reveals a combination of two main views, as to why university knowledge cannot be effectively used by local firms to identify new areas of specialisation to diversify the regional economy. From the one, there is a discrepancy between areas of academic research and selected S3 specialisations. As an example, we refer to tourism which, although it has been selected by both regions as a key S3 domain for future specialisations, local academic research is not oriented towards tourism studies and research. Indicatively, our desktop research shows that there is no tourism department at a university level for tourism studies, while there is no research lab predominantly focused on tourism research in both regional environments. On the other, local entrepreneurs are not familiar with research conducted in universities, and therefore, firms are not able to identify and acquire knowledge, which is rather too abstract and cognitively far from them. These problems are indicated by the local communities of Crete and C. Macedonia (academia and business) and expressed as *university-generated knowledge is disconnected with local entrepreneurial activities and tends to be too abstract to be acquired by the local economy.* In our respondents' view, this is a key barrier to S3 implementation, because it strangles entrepreneurial discovery and prevents science-business actions to implement S3. The critical issue is that firms cannot acquire externally-generated knowledge which is essential for developing an actual role in the self-discovery process on the one, and important for reviewing their entrepreneurial mindsets and practices on the other. Moreover, they believe that this occurs because of specific technological attributes that entrepreneurs and firms have developed over years. For example, they refer to firms' small size, low technological profile, lack of R&D activities, limited scientific personnel with strong technological background, lack of collaborative culture and inefficiency in developing permanent networking mechanisms. The latter is analysed later in more details. We present an indicative, yet representative set of quotes from our interviews' records to point out the inefficiency of firms to develop absorptive capabilities, and to show how this inefficiency raises barriers to S3 implementation:

> The paradox is that although local research institutions accumulate high-quality scientific knowledge, companies have not yet developed high-level capabilities to absorb this

> knowledge towards creating innovative products and services. (SCA, interview, science park manager, 01.08.2014)
>
> I believe it's a matter of size, we usually have small firms that cannot afford in-house R&D departments. They have low technological profiles and their readiness to receive and exploit high-tech knowledge from external sources is very low. (MKK, interview, entrepreneur, 30.09.2014)
>
> We seek a large participation of the productive sector in the entrepreneurial process of discovery. However, we see the difficulty of identifying companies that are able to adopt and use high-tech knowledge from our universities and research centres, and this is a main problem in having a good number of science-business proposals for the implementation of smart specialisation. (DKX, interview, S3 co-ordinator, 11.07.2017)

The last quote shows clearly how the inability of Cretan and C. Macedonian firms to identify and acquire academic knowledge, creates practical barriers to implementation. In particular, the difficulty of companies to get access to academic knowledge decreases the number of science-business actions that could be potentially financed and implemented in the S3 framework, affecting the implementation progress of S3. Simultaneously, limitations in knowledge flows from academia to industrial sectors contradict the principles of S3 theory, which underline the increasing importance of enhancing inter-sectoral collaborations in entrepreneurial discovery, especially between universities and local businesses (Foray 2014).

This evidence is linked with outcomes of other empirical studies which illustrate a relatively low performance in setting an adequate number of industry-academia partnerships due to knowledge flow limitations (Reid et al. 2012a; EKT 2015). Partnerships and collaborative synergies between academic and industrial actors have been collectively attempted through the development of various regional and national programmes conducted over the last 15 years (e.g. RITTS, CRINNO, the Regional Innovation Poles, etc.). However, it is argued that most of these efforts were not fully successful and failed to meet their policy objectives due to several barriers including the inadequacy of local businesses to exploit university knowledge assets for generating innovation (Komninos 2013).

An exception to this view is possibly the case of academic start-ups and spin-offs which, by default, have a closer knowledge proximity to universities and research centres, and therefore are more likely to demonstrate better capabilities in acquiring intensive knowledge (Papamichail and Saitakis 2013). However, while spin-offs and knowledge-based start-ups should be developing a key S3 role in leading regional diversification and economic development, their overall impact on the S3 practices remains low due to the lack of critical mass. In addition, we have seen that the effects of the ongoing financial crisis have also played a central role, as local firms and especially start-ups and spin-offs face significant difficulties in getting the required financial accreditations required in the S3 context.[2]

5.3.2. *Networking capabilities at the institutional level*

As a second barrier to S3 implementation we found the systemic failure to build collective networking capabilities at the regional level. In this respect, we evidence that an important challenge for the realisation of S3 in Crete and C. Macedonia is due to the weak institutional linkages, currently existing among key regional actors. We set our interviews to examine the extent to which institutional connections among key local players are gradually affecting the implementation progress of S3 in Crete and C. Macedonia. In our

analysis, we recognise firms, universities/research centres and regional authorities as three of the most essential stakeholder groups in shaping the S3 practices in Crete and C. Macedonia. In particular, firms take an increasingly important role in driving the domain identification process, which is seen as a continuous and proactive process for the transformation of the local economy (Hausmann and Rodrik 2003). Universities and research centres bring S3 opportunities for supra-regional networking and knowledge transfer through their connectivity with global knowledge networks (Kempton et al. 2013). Regional authorities should be there to govern and run S3 practices according to the regulatory principles of the EU (McCann 2015).

While we have seen empirically that firms, universities and public authorities should work together to promote and encourage new entrepreneurship in the S3 context (EC 2012), our respondents indicate weak and rather rare connections among them. This finding fits well with previous empirical evidence which shows a relatively low capability of key regional players to build technological and strategic co-operations (Reid et al. 2012b; Komninos 2013). We found that the inadequacy of building strong institutional networking among key regional players is due to diverse reasons. First, it is very much related with the lack of trust, which is observed among different stakeholder groups. For example, responses from our interviewees tend to show that universities and firms do not trust each other to participate in joint S3 projects, while the latter are not yet fully convinced by the regional authorities that the S3 is aimed at supporting their entrepreneurial activities and the creation of new developmental paths. Trust building problems in the ongoing S3 practices are associated with policy inefficiency coming from the past (e.g. limited policy impact on companies through their participation in previous innovation programmes) and, arguably, they constitute central barriers to an optimal implementation of S3. Trying to understand why regions are still facing major difficulties in building institutional inter-organisational networks, we also identified the lack of permanent mechanisms to promote organisational networking and partnering. While science parks, business incubators, liaisons offices, and other technology transfer mechanisms have been established in both regions since years, their potential to connect diverse policy initiatives and actions is relatively low. This is what we have captured from representatives from the two largest science and technology parks of Greece located in Crete and C. Macedonia (Science Park of Crete and Thessaloniki Technology Park) who see the high degree of policy discontinuity as a main challenge. Policy discontinuity has been also highlighted in the case of Crete by OECD studies (OECD 2005). In addition, the inability of specific regional authorities to maximise their efforts due to the lack of appropriate human resources is also seen crucial. Despite the remarkable endeavour of the S3 coordinators to run the entrepreneurial discovery and implement the S3 (an attitude which is broadly observed in our data, particularly for the implementation phase in both regions), the lack of an adequate number of specialised personnel is seen as an important limitation, which is closely linked to the effects of the Greek financial crisis.

Second, we found that the lack of a culture of collaboration and the different understanding of strategic networking between public and private sector organisations do prevent S3 practices to take a progressive route. As an indication, we pay attention to the industry-academia partnerships, which in our view, develop an increasingly important role in leading S3 practices and, therefore, should be the main focus of our analysis. Specifically, we refer to a representative sample of our respondents who highlight the different attitudes that universities and firms usually have when building networking capacities. In their view, universities and research centres tend to look for scientific excellence when building their networks, while firms focus on the practicalities needed to

generate sales. Therefore, science-business synergies do not usually lead to commonly expected outcomes. For example, academia is engaged in industry-academia projects to publish scientific work and strengthen its science linkages further, while companies usually participate to cover payrolls and other costs of doing business. From an S3 perspective, this contradiction creates critical obstacles as to how universities and firms could build close connectivity to facilitate inter-organisational knowledge flows, with the aim of identifying new entrepreneurial paths for regional development. In this respect, it also raises uncertainty in the way S3 policy prioritisation will be conducted to stimulate regional specialisation and diversification into new industries, as empirically indicated by Neffke, Henning, and Boschma (2011). The following quotes, provided by a university professor, are indicative and reflect on our interviews findings:

> Researchers are thinking of publications and papers while entrepreneurs are thinking of money; they speak different languages, they look for different things and the outcome of their work is different. (ASP11, professor, interview, 17.01.2015)

Even in the S3 framework, public-private connectivity remains very low, since networking is still seeing as a means to meeting the requirements of S3 (which put private-public sector collaborations as an eligibility criterion), instead of covering organisations' real strategic needs. The lack of strong motivations for building common collaborative attitudes, increases the risk of having strategically weak inter-organisational partnerships, which may be proved inefficient in meeting the objectives of S3. In this regard, inefficiency takes the form of a less systematic implementation of the entrepreneurial discovery where efforts to identify new entrepreneurial opportunities for the regions will be limited and rather weak. In this respect, almost any S3 study highlights that the self-discovery process requires constant and in-depth investigations which cannot be merely based on the outcome of temporary inter-organisational linkages, see for instance Capello and Kroll (2016). Rather, it should be based on processes where all participatory bodies will be oriented to develop strong networking capacity for building meaningful inter-organisational linkages for the purpose of S3. We find interesting the following quotes from our discussion with an entrepreneur from the local enterprise sector:

> Universities and research centres may have good ideas for collaborating with businesses, but their approach to us is because of the networking requirements set by the proposal. If researchers are looking for business partnerships only because of the requirements set by the programme, we cannot talk about effective networking, we don't want academia to remember us every 3 years when a new call is published, networking doesn't work in this way. (VKL, interview, entrepreneur, 09.08.2017)

6. Conclusions

In this paper, we discussed the implementation challenge of S3 in catch-up regional environments, by drawing attention to the importance of capacity building. We used empirical evidence from two catch-up regions in Greece (Crete and C. Macedonia), and developed an empirical framework to study the way capacity-building barriers affect the implementation of S3 in our selected regions. Specifically, we analysed fifty in-depth interviews conducted in 2015–2017 with the objective of understanding how shortcomings in firms' absorptive capacity and inefficiencies in building institutional networking have affected the realisation of S3 in Crete and C. Macedonia.

From a general perspective, we argued that shortages in both types of capacities raised difficulties in the optimal implementation of the S3 in both regional milieus. Concerning absorptive capacity, we showed that the main barriers to S3 implementation were due to the limited ability of the local firms to acquire university-generated knowledge and develop a leading role in developing S3 action plans. This argument rests on the fact that companies are not able to exploit scientific knowledge, critical to meet the objectives of S3 in a collective and systematic manner. Practically, this is translated into limitations in gathering a large number of science-business proposals that could be potentially implemented in the S3 framework. With regard to institutional networking and inter-organisational connectivity, we saw that the relatively weak linkages among firms, universities and regional authorities raise the risk of implementing less systematic entrepreneurial discovery, which will lack meaningful policy outcomes. The absence of a culture of collaboration at an institutional level, the different understanding of strategic networking across key S3 actors, and the lack of trust-based relationships compose three central barriers to S3 implementation, which prevent S3 practices from taking a progressive path. We believe that once these practical barriers are removed from the Cretan and C. Macedonian environments, a more effective S3 policy prioritisation and implementation can be achieved.

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Notes

1. The Managing Authority is responsible for the Regional Operational Programmes implemented within the National Strategic Reference Frameworks.
2. A required condition for the local firms to participate in S3 projects and get state funding is the provision of letters of credit usually issued by Greek banks. However, banks issue letters of credit only if appliers have the required assets or credit, which in a crisis period this looks unrealistic for many local companies.

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