SMARTSPEC

Entrepreneurial Search Dynamics

Reflection Paper

Work Package 1

Authors

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Contents

1. Introduction

The intended objectives of *Smartspec* Work Package 1 are (i) firstly to identify related variety and value chain components within EU regions to inform specialisation choices and (ii) secondly, to identify the role of organisations and their interaction for the development of entrepreneurial discovery and to assess the role of network connectivity in facilitating intra- and extra-regional asset combination. In order to examine the various questions regarding the network and institutional factors enhancing or mitigating entrepreneurial search processes, in this work package we employ a twin-track multi-methodology approach comprised of two parallel streams of enquiry, one of which is primarily empirical and quantitative in nature, and one of which is rather more conceptual and qualitative in nature. Each of these parallel streams of work is designed to progress and develop alongside the other, with various junctures built into the programme for mutual reflection and cross-fertilisation of ideas.

This reflections paper discusses the major ideas underpinning the various elements of the work package and outlines the essence of our research approach. The work package combines quantitative and qualitative approaches and seeks to identify many of the key structural features enhancing or inhibiting the development of linkages between local and non-local actors. The Reflections Paper is a synthesis of more detailed working papers produced to explore particular concepts in this strand of activity. These working papers will be published at a later date and made available in open access forums.

The reflections paper is structured as follows. The next section discusses the issues associated with the relationship between entrepreneurial search processes and regional innovation. Section 3 discusses the importance of considering the local and non-local network issues related to innovation, the role of networks in fostering entrepreneurship, and the role played by geography in facilitating these mechanisms. Section 4 examines the ways that institutional bottlenecks may play in inhibiting network development and sketches out a framework for identifying these bottlenecks, with a view to using smart specialisation policies to help to overcome them. Section 5 then moves the debate onwards by considering notions of related variety, embeddedness and connectivity in

regional settings, setting out how *SmartSpec* is able to explore the real-world manifestations, and implications, of these concepts. Finally, section 6 outlines some brief conclusions.

2. Entrepreneurial Search and Regional Innovation Issues

Key to the Smart Specialisation concept is the entrepreneurial discovery process. As Foray et al. (2011) put it, smart specialization is "… largely about the policy process to select and prioritize fields or areas where a cluster of activities should be developed, and to let entrepreneurs discover the right domains of future specialization" (p. 7). It concerns bottom-up policy that aims to promote search activities by entrepreneurs, as "entrepreneurs …. are in the best position to discover the domains of R&D and innovation in which a region is likely to excel given its existing capabilities and productive assets" (Foray et al. 2011, p. 7). Smart specialisation reflects a systems-type of approach to what is understood as a systems-issue, as the proponents of the concept always made explicit. Therefore, from an analytical perspective we can discuss the issue from two sides simultaneously. On the one hand there is entrepreneurial search processes – and the ability to regions to generate the scale and variety of entrepreneurial actions to drive the region's growth processes; on the other hand there is the question of the entrepreneurial domain – and the extent to which the entrepreneurial actions which are taking place have the goodness of fit and long run potential to develop and grow themselves, and thereby the region itself. Although these two perspectives regarding entrepreneurial dynamism are not entirely distinct from each other, the former aspect is more a question of search processes while the latter aspect is more a question of structure. From the policy point of view, the crucial issue is the extent to which these two sides dovetail or not, and the *Smartspec* project aims to tackle these issues via a systematic and integrative approach. Our ultimate goal is directed at operationalising the concept of smart specialisation in a manner which accounts for different regional settings and which is useful to policy actors.

Entrepreneurship has long been recognized as a main driver of economic development. Through entrepreneurship, resources are combined in novel ways and as such, it is a mechanism of economic rejuvenation also governing the creation of new jobs (see Fritsch, 2011, for an overview). In addition, the creative destruction associated with entrepreneurship makes it a driver of regional economic industrial restructuring, which is a primary element in regional smart specialization processes. However, the extent to

which particular entrepreneurial search processes operate in specific places remains largely unknown. In particular, our knowledge base requires more understanding of how the entrepreneurial search process is affected by regional factors, such as the location of regions, their economic size, their industrial diversity, the degree of related variety in regions, the degree of connectedness within and between regions, and their institutional and governance structures. Not all regions have equal opportunities to make this entrepreneurial discovery work, as their own regional history provides opportunities but also set limits to this discovery process. It is clear that in response to the critical role which entrepreneurship is understood to play in regional economic development, an extensive literature has emerged mapping and explaining regional differences in the occurrence of entrepreneurship, usually measured in terms of new firm formation (see Sternberg, 2011, for an overview). In such studies, however, new firms are typically considered as one homogenous group. We know, however, that there is considerable heterogeneity among new firms on aspects including their industry, innovative power, job creation and survival. To inform policies regarding smart specialisation strategies, it is therefore crucial to better understand the underlying heterogeneity in entrepreneurship, and in particular the heterogeneity associated with being in a regional context and also the heterogeneity of the regional context itself.

In *Smartspec* Work Package 1 we examine the heterogeneity of entrepreneurial search dynamics from two different but closely related angles. Firstly, we aim to identify and examine regional differences in 'high-impact' entrepreneurship. We know that 'most new firms start small, live small and die small' (Davidsson et al., 2005, p.7). As a result, most start-ups have little impact on job creation (Acs, 2011) or on regional economic development more generally. We aim at identifying regional patterns in the occurrence of those new firms that do succeed in making a mark and driving rapid employment creation and knowledge-enhancing capabilities of the region. In the light of smart specialisation strategies, high-impact entrepreneurship can be seen as an indication of the quality of the economic adaption mechanisms available to a region. Secondly, we aim to examine the role played by entrepreneurship in driving industrial specialisation and diversification. We know that regions are likely to diversify into industries that are related to the industry

base already present in the region. Development is highly path dependent. The mechanisms governing these structural changes are, however, still unclear particularly when it comes to firm dynamics (Breschi and Lissoni, 2001; Boschma and Frenken, 2011). In the analysis, we aim at establishing to what extent new firm formation builds on the existing industry structure in regions and whether there are regional differences in the industry match of new firms and incumbents.

However, treating entrepreneurship as largely one homogenous phenomenon masks much of the underlying heterogeneity in the types of firms that are started and the impact they have on the economy. Both from a policy perspective and from a scientific perspective identification of the new firms with the biggest impact on local job growth is an important step forward. Fritsch (2011) sees the identification and understanding of high-impact entrepreneurship as being one of the main challenges in the field of entrepreneurship and job creation. High-impact entrepreneurship relates to different dimensions including product and process innovation, the competition spurred by the new firms, and job creation and survival. In our work we focus our analysis on three such measures, namely: job creation, survival and turnover. Such measures of success have been studied at the firm level, but this study is the first to do so at the regional level. At the same time, however, we observe that industries do not develop equally across space. If anything, industries appear to cluster together to an increasing extent. Why is it that, given a certain industry mix, some regions are able to develop entrepreneurship in key industries whereas others are not? It is likely that there will be regional differences in the occurrence of high-impact entrepreneurship. Although country level institutional arrangement will impact on the occurrence of high-impact entrepreneurship, entrepreneurship is mainly a local event (Sternberg, 2011). This is a result of the observation that the entrepreneurs' knowledge of networks and markets attenuate quickly with distance (Dahl and Sorenson, 2012). As such, entrepreneurs derive their resources for production primarily from local networks that they know intimately. The characteristics and quality of the local networks are thus likely to be crucial in establishing high-impact entrepreneurship. In support of this idea, it has been argued that high-impact entrepreneurship is stimulated by local knowledge pools (Acs et al., 2009)

and the presence of viable business opportunities (Shane, 2003; Shane and Venkataraman, 2000). Also, given the high knowledge content in high-tech industries, the local industry structure is seen as an important mediating factor (Audretsch and Keilbach, 2007; Golman and Klepper, 2013). As such resources, in addition to potential entrepreneurs, are not spread evenly across space, the local context is crucial in understanding high-impact entrepreneurship (Sternberg, 2011). Understanding the factors determining not only start-up survival and longevity, but high impact start-up growth which allows the region to diversify and develop are critical issues for smart specialisation logic and approach.

One of the central issues here appears to be something of a seemingly paradoxical relationship concerning the role of entrepreneurship in regional industrial restructuring. On the one hand, the development of new industries is by definition driven by entrepreneurship, either by diversifying incumbent firms or by people that start their own firm. However, on the other hand, empirical studies have shown that deviating from the beaten path is a risky strategy, and at the individual level, we observe that entrepreneurial success is strongly driven by industry-experience. Starting a business outside of the industry in which work experience has been built up significantly decreases the chance of long-term survival. At the regional level, it is shown that regions are likely to develop industries in which they have a strong presence to begin with (Klepper, 2001) or that are closely related to core industries present (Klepper, 2001; Neffke et al., 2011). In short, there are few incentives for entrepreneurs and firms to deviate from their core strengths. As a result, also the occurrence of high-impact entrepreneurship is likely to be conditioned by the industry structure. Regions may simply happen to be specialised in industries that show little promising entrepreneurship. In addition, however, it may be the case that the mismatch between the existing industry structure and the industries in which people start their firms is too large for high-impact entrepreneurship to occur. We therefore aim at identifying and analyzing the industry association between the industry mix of new and existing firms and the relation to high-impact entrepreneurship.

Smart specialisation explicitly acknowledges that the success of entrepreneurial opportunity is likely to be heavily conditioned by the industry structure present in a

region, and a second line of empirical enquiry we adopt is to examine how high impact entrepreneurship is associated with patterns of regional specialisation and diversification. On this point, it is understood that smart specialisation should not aim for more sectoral or technological specialisation (as this increases the problem of overspecialization and regional lock-in), nor for diversification *per se* (as this runs the risk of new economic activities that are not embedded in the region), but for specialised diversification into related technologies which generates new economic activities that are rooted and embedded in the region. When the degree of related variety is higher in a region, the more learning opportunities are available at the local level, and the more knowledge spillovers across industries are likely to occur. The local presence of a wide range of technologically related industries provides learning opportunities and growth potentials for existing industries as well as local sources of growth for new industries. The higher related variety, the more opportunities to make new re-combinations, and the more opportunities to diversify into new and growing industries, and to develop new growth paths in regions. This has been defined as regional branching, in which new industries branch out of technologically related local industries from which existing capabilities are exploited and recombined in new activities.

There is evidence that countries and regions tend to expand and diversify better into sectors that are closely related to their existing activities. In this latter respect, related variety may spur diversification and true economic renewal in regions by making new re-combinations between related industries possible and extending into new related arenas, a process known as 'branching'. The importance of related variety for regional growth and regional diversification has already been confirmed in recent empirical studies (e.g. Frenken et al. 2007; Boschma and Iammarino 2009; Neffke et al. 2011; Boschma et al., 2012; Colombelli et al 2012; Rigby 2012; Boschma et al. 2013a and b; Essletzbichler 2013; Van Oort et al 2013). However, sectoral relatedness may reflect a rather crude measure of relatedness and it may be the case that skill-relatedness and knowledge relatedness may be better indicators for knowledge transfer. Also of interest is that regime analysis shows that medium-sized and smaller regions offer good opportunities for employment growth in relation to variety (productivity growth is important in large

and medium sized regions alike). Yet, the reasons why these patterns are observed in different cases still remain unclear, and from the smart specialisation imperative require us to consider other issues governing these entrepreneurial dynamics. Of particular importance appear to be the roles played by knowledge-networks and institutional-systems in either fostering or militating against the types of entrepreneurial search processes essential for driving smart specialisation. We will first discuss network issues and then proceed to discussing institutional issues, before finally discussing the empirical issues.

2.1 Network Issues: A Local and Non-Local View of Innovation and Entrepreneurship Mechanisms

It is widely accepted that the factors helping to drive high impact entrepreneurship and related variety-enhancing mechanisms are context dependent. However, this context is likely to be partly local in nature and also partly non-local in nature, and concern the ability of local actors to generate, acquire and transact the knowledge and information needed to foster innovation. Within endogenous models of regional growth, knowledge is also considered to spill over to other organizations, resulting in the generation of increasing returns, principally via innovation (Roberts and Setterfield, 2010). In this case, however, knowledge is not in fact considered to be a purely public good, but one that is at least partially excludable—such as through the use of intellectual rights—given that organizations often consider there to be incentives for investing in its creation. Similarly, models seeking to explain innovation outputs, such as patents, are based on a knowledge production function in which organizations (i.e. firms) intentionally pursue new economic knowledge as a means of generating innovation (Griliches, 1979; Audretsch, 2000). This pursuit is generally considered to consist of the appropriation and exploitation of the knowledge spilling over from other organizations (other firms, universities and the like). Despite these theoretical developments, endogenous growth theorists throw little light on the mechanisms by which knowledge is transmitted across organizations (Storper and Venables, 2004), suggesting the need for a better understanding the role that investments in spillover conduits make in generating innovation and growth (Audretsch and Feldman, 1996).

Part of the reason for this lack of progress is that such models do not explicitly consider the nature of the knowledge being generated, acquired or transacted. Knowledge can be generally defined as information that changes something or somebody, either by becoming grounds for action or by making an organization capable of different or more effective action (Drucker, 1989). More generally, knowledge is broadly used as a scientific notion for the most important and dynamic driver of the modern economy. Unlike simple information, knowledge concerns action and is function of a particular stance (Nonaka and Takeuchi, 1995). Of course, knowledge takes many different forms, with one of the most familiar typologies suggesting that knowledge is either explicit/codified or tacit. In general, explicit knowledge refers to information that can be easily communicated among individuals, whereas tacit knowledge - such as skills, competence, and talents - is more difficult to directly communicate to someone else in a verbal or other symbolic form (Huggins and Izushi, 2007; Nonaka and Takeuchi, 1995). More codified forms of knowledge are usually considered to be relatively less space sensitive than tacit knowledge (Bathelt et al., 2004). Reductions in transport costs and improvements in communications are considered to have increased access to codified knowledge, rendering it less important as a source of competitive advantage. Tacit knowledge, on the other hand, is considered not to travel well, making it a key factor underlying 'the geography of innovation' (Asheim and Gertler, 2005). More granulated knowledge typologies include Blackler's (2002) distinction between embrained knowledge (conceptual skills and cognitive abilities), embodied knowledge (practical thinking rooted in specific contexts) (Lam, 2002; Lam and Lundvall, 2006), encultured knowledge (meanings and shared understandings resulting from socialization), embedded knowledge (systemic routines) and encoded knowledge (signs and symbols). These forms highlight the potential problems in accessing knowledge due to its intangible, non-standardized and inseparable nature (Howells, 2012). According to Antonelli (2008), the first major shift in the economics of knowledge occurs when the notion of knowledge as a public good is challenged, and knowledge becomes regarded more as a quasi-private good with higher levels of natural appropriability and exclusivity.

Knowledge is now usually viewed as a collective process characterized not only by partial appropriability and shared property rights, but also by the role of the intentional effort, participation and contribution of interactive agents (Antonelli, 2008). This knowledge requires intentional and often complex efforts to access and assimilate. Indeed, knowledge, but especially combinatorial knowledge, underlies the complexity of economic systems (Jensen et al., 2007; Martin and Sunley, 2007; Mattes, 2012). The notion of combining knowledge through miscible flows—i.e. the extent to which different types and forms of knowledge can be combined and mixed to create value—is similar to Romer's (1996) idea of creating new recipes from existing knowledge. As Storper and Scott (2009) argue 'knowledge has a tendency to grow indefinitely, for it can be endlessly re-used, is extremely leaky (and hence its circle of users continually expands), and can be combined and recombined in virtually unlimited ways.' (p. 148). In this sense, value is created when there is a 'collision' of knowledge.

Yet, although the role of knowledge access and entrepreneurship are commonly considered to facilitate regional innovation, there have been few attempts to formalize this relationship. The major exception to this is the knowledge spillover theory of entrepreneurship (Audretsch and Lehmann, 2005). The underlying premise of the knowledge spillover theory of entrepreneurship is that uncommercialized knowledge created in one serves as the source of knowledge generating entrepreneurial opportunities that ultimately contribute to innovation and economic growth (Audretsch and Lehmann, 2005; Acs et al., 2013). A key feature of this theory is the existence of knowledge filter, which is the gap between new knowledge and that which Arrow (1962) refers to as economic or commercializable knowledge, which requires intentional and often complex efforts to access and assimilate (Audretsch and Lehmann, 2005; Acs et al., 2013). A further premise of the theory is that knowledge acquisition requires spatial proximity, with the localization of knowledge suggesting that entrepreneurship will tend to be spatially located within close geographic proximity to the source producing knowledge (Audretsch et al. 2006; Acs et al., 2013).

In general, the knowledge spillover theory of entrepreneurship is important in developing and understanding of how entrepreneurial connections to knowledge sources promote

regional innovation and growth. However, it does explore the nature and dynamics of the connections, and, Hayter (2013) suggests, there is a need to integrate roles of networks into this theory. The available evidence suggest that the differing spatial and network dynamics of knowledge-sourcing activity can be of either a local or global nature, with there being potentially some interdependency between the two. In particular, successful connectivity in global spaces is often considered to be the outcome of an initial system of localized interaction, whereby it is the knowledge crossing hallways and streets that initially catalyses intellectual exchange and knowledge transfer across oceans and continents (Glaeser et al, 1992). However, unless the local systems keep abreast of knowledge emerging outside of their respective region, they run the risk of becoming rigid and outdated (Camagni, 1991; Izushi, 1997; Bathelt et al., 2004; Ter Wal and Boschma, 2011). This argument therefore posits that firms which are more active and experienced in knowledge sourcing from regional sources are more likely to embark on, and more actively engage in, global knowledge sourcing. Moreover, even in those locations possessing a knowledge-rich environment there is evidence of a greater role being played by non-localized networks (Saxenian, 2005). The key aspect of these developments is that the knowledge base of the world's most advanced local and regional economies is no longer necessarily local, but positioned within global knowledge networks (Wolfe and Gertler, 2004; Huggins and Izushi, 2007; Lorentzen, 2008). There is also a growing school of thought that non-proximate actors are often equally, if not better, able to transfer strategically relevant and valuable knowledge across such spatial boundaries providing a high performing network structure is in place (McEvily and Zaheer, 1999; Dunning, 2000; Lissoni, 2001; Davenport, 2005; Palazzo, 2005; Zaheer and Bell, 2005; Teixeira et al., 2006; Torre, 2008). Whereas firms with low levels of absorptive capacity (Cohen and Levinthal, 1990) tend to network locally, those with higher absorptive capacity are often more connected to global networks (Drejer and Lund Vinding, 2007; Van Geenhuizen, 2008).

According to Malmberg and Power (2006), 'knowledge in clusters is seldom created through local inter-organizational collaborative interaction . . . in a localized cluster the majority of firms tend to have most of their important suppliers and customers

somewhere else and innovation and knowledge creation tend to follow value chains that are most often global'. Contrary to Porter (1990), if the local market does not have the most sophisticated customers, firms are required to look for them elsewhere. Von Hippel (2005) highlights how markets and user-led innovation in a number of industries, such as design, are becoming increasingly international in scope. As Rodríguez-Pose and Crescenzi (2008) indicate, knowledge will spill over beyond regional borders as a consequence of the existence of different forms of inter-regional contacts, with flows of inter-regional knowledge acting as important agents of innovation. They further find that accessibility to extra-regional innovation is positively associated with regional growth performance, with the 'amount of knowledge' available in a region reinforcing the effect of local innovative activities (Rodríguez-Pose and Crescenzi, 2008). Similar results are produced by Badinger and Tondl (2002), who find that an inflow of knowledge has a positive impact on the growth of a region, with this effect having a larger magnitude if neighboring regions also exhibit high growth rates. Also, Andersson and Karlsson's (2007) analysis finds that differences in regional growth rates can be explained by differences in knowledge accessibility within and across regions.

2.2 Network Issues: The Role of Networks in Innovation and Entrepreneurship Mechanisms

In general, knowledge accessed from external organizations and external regions is considered to have become increasingly important to entrepreneurial firms, which often cannot generate internally all the knowledge necessary for innovation (Freel, 2000; 2003; Hite and Hesterly, 2001; Yli-Renko, 2001; Almeida et al., 2003; Huggins and Johnston, 2009; 2010; Doran et al, 2012). The role of inter-organizational networks and knowledge sources are increasingly recognized as potentially important assets for creating and sustaining innovation and competitiveness (Lechner and Dowling, 2003), and there is growing evidence that knowledge-network development is related to the growth of firms (Knoben and Oerlemans, 2006).

Emerging theories of the firm such as the knowledge-based view (Grant, 1996) and extensions of the resource-based view (Eisenhardt and Schoonhoven, 1996; Lavie, 2006) recognize that the need to access knowledge is a key reason why firms build or enter

networks with other organizations. These inter-organizational networks concern the interactions, relationships and ties existing between firms, and may arise through the need to access new technology, skills or expertise in order to keep pace with competitors (Ahuja, 2000). Inter-organizational networks in this context consist of the interactions and relationships organizations (principally firms) utilize to access knowledge beyond their market relationships. In other words, these networks consist of the means by which knowledge flows across organizations beyond the direct purchasing of it. As others have noted, inter-organizational networks of this kind generally come into being due to markets for knowledge being rare, since—with the exception of knowledge protected by property rights, such as patents and copyrights— they are difficult to create due to inherent asymmetry in the existing knowledge base of buyers and sellers (Arrow, 1971; Grant, 1996; Maskell, 2000; Audretsch and Keilbach, 2008; Malecki, 2010). Inter-organizational networks, therefore, are increasingly found to act as a conduit facilitating the flow of skills, expertise, technology, R&D and the like (Andersson and Karlsson, 2007; Weterings and Ponds, 2009). In particular, inter-organizational networks are an important aspect of the innovation process, with network scholars stressing that innovation is a complex process often requiring knowledge flow between organizations (Meagher and Rogers, 2004, Lichtenthaler, 2005; Sammarra and Biggiero, 2008; Tomlinson, 2010; Bergenholtz and Waldstrøm, 2011). Increasingly, this process is viewed as a systemic undertaking, i.e. organizations no longer innovate in isolation but through a complex set of interactions with other organizations (Chesbrough, 2003). It is through the networks underpinning these systemic processes that organizations access knowledge that they cannot, or do not wish to, generate internally.

It is possible to distinguish two general forms of inter-organizational network: (1) contact networks, through which organizations source knowledge and (2) alliance networks, through which organizations collaborate to innovate. Networks in the form of alliances usually concern formalized collaboration and joint ventures, and other relationships resulting in frequent and repeated interaction. Organizations gain advantages from networks by accessing the knowledge of the organizations in their network. This means that the advantage organizations are potentially able to gain is dependent upon the

knowledge profile of their network (Stuart, 2000; Ireland et al., 2002; Grant and Baden-Fuller, 2004). It has been proposed by a range of scholars that the investment in calculative relations through which organizations gain access to knowledge to enhance expected economic returns is itself a form of capital, which can be termed network capital (Huggins, 2010; Huggins and Johnston, 2010; Kramera and Revilla Diez, 2012; Kramera et al., 2011; Lawton Smith et al., 2012; Huggins and Thompson, 2013). Some scholars have pointed to networks endowed with social capital—in the form of interpersonal relationships—as a key lubricator of knowledge spillovers (Iyer et al., 2005; Tura and Harmaakorpi, 2005; Hauser et al., 2007; Lorenzen, 2007; Walter et al., 2007; Tappeiner et al., 2008; Cantner et al., 2009; Vorley et al., 2012). Although social or relational capital may explain a degree of knowledge flow within a particular region, it does not necessarily account for the large proportion of the flow of economically beneficial knowledge (Bathelt et al., 2004; Weterings and Ponds, 2009; Huber, 2012). In this sense, network capital is a specific form of relational asset, and it is important not to conflate it with concepts such as social capital, relational capital, or territorial capital. The network capital concept is rooted in the recognition that the leveraging of inter-organizational networks is an asset that can be shaped by firm, and is generated by investments in calculative relations. Network capital - consisting of relational assets in the form of more strategic and calculative inter-organizational networks designed specifically to facilitate knowledge flow and innovation and accrue economic advantage - is generated by the flow of knowledge stocks. This is significantly different from the type of social capital stemming from the social norms and customs present in a particular region (Capello and Faggian, 2005; Tura and Harmaakorpi, 2005). In particular, social capital largely refers to social governance mechanisms based on trust, while network capital consists of calculative relationships and interactions between actors that are contingent upon the flow of knowledge between them.

In order to compete successfully with large firms, entrepreneurial firms may need to develop external networks to access resources they do not possess internally (Kingsley and Malecki, 2004). As firms evolve it can be anticipated that their networks will evolve from more path-dependent social networks – which in the first instance will be highly

reliant on the pre-existing networks of the entrepreneur(s) – to more intentionally managed networks based on reputation and access to relevant resources and partners (Hite and Hesterly, 2001). Interestingly, Westlund and Bolton (2003) present a persuasive case concerning some of the negative aspects of social capital among entrepreneurial firms, arguing that the strong trust embedded in interpersonal relations can inhibit firm-level development. Most commonly, social capital consists of the perceived value inherent in individual and inter-personal networks and relationships generated through socialization and sociability as a form of social support (Borgatti and Foster 2003).

As well as accessing both local and non-local knowledge networks, these and other studies have found that firms with more dynamic configurations of both contact and alliance networks have a significantly superior innovation performance than those firms with more stable configurations (Huggins and Johnston, 2010). This indicates that more innovative firms are more likely to continue to develop new contacts and alliances as a means of accessing and utilising the most appropriate and state-of-the-art knowledge. Therefore, although for some observers network stability is usually considered to be a positive feature of knowledge networks (Podolny and Page 1998), it appears that more innovative firms are avoiding the type of network inertia (DiMaggio and Powell 1983, Kim et al. 2006) and lock-in (Arthur 1989, Adler and Kwon 2002, Labianca and Brass 2006) that may stifle innovation. In general, network-oriented firms tend to enjoy superior innovation performance (Huggins et al., 2012), which adds weight to evidence on the link between the inter-firm network activities of firms and their innovation capabilities (Powell et. al. 1996, Stuart 2000, Pittaway et al. 2004, Obstfeld 2005).

Network dynamism therefore also appears to be an important source of innovation, with such dynamism often more apparent among small firms (Huggins and Johnston, 2010). Increasingly, more fluid and temporary networks, such as one-off project-based collaborations and networks of contacts, appear to have grown in importance as sources of competitive advantage (McEvily and Zaheer, 1999; Bell, 2005; Salman and Saives, 2005; Zaheer and Bell, 2005) while regionally-located multinational firms (McCann and Acs 2011; Iammarino and McCann 2013)) provide key conduits for accessing global networks. The stability or dynamism of networks is dependent upon whether or not

network actors seek to form additional relationships with actors within an existing network or new relationships with actors outside an existing network (Beckman et al., 2004). Networks become unstable when members seek to explore new relationships with new partners, rather than further exploit the resources of their existing network (March, 1991; Beckman et al., 2004). This general trend mirrors a range of existing evidence on relative differences in the use of various types of network knowledge sources (Freel, 2000; 2003; Huggins et al., 2012).

Entrepreneurial firms invest in networks with these knowledge sources for a range of reasons, which are often overlapping, with these motivations consisting principally of supporting firms to meet its strategic requirements, particularly in relation to innovation (Huggins and Clifton, 2013). However, a further motivation for entrepreneurial firms is to support the strategic innovation requirements of customers, which highlights the dependent relationships small entrepreneurial firms often have with their customers (Lechner and Dowling, 2003). A third motivation is a rationale to economically exploit a particular opportunity to access knowledge that does not necessarily relate to the strategic requirements of the firm at that point in time. In terms of the search and selection of organizations with which to seek to network development, much of the extant literature has highlighted the role of prior embedded ties, either of an inter-organizational or interpersonal nature (Gulati and Gargiulo; Gulati, 2007). Among entrepreneurial firms these sources are found to be important, but they are complemented - to a greater extent than that suggested by the relevant literature – by the strong utilization of network facilitating mechanisms, mainly in the form of intermediary network brokers, such as agents, and networking fora. This is perhaps understandable, given that entrepreneurial firms are less likely to possess the density of embedded social and economic ties compared with larger and more established firms. In particular, new tie formation through network brokerage and network fora highlights how these firms seek to position themselves in the global knowledge networks of their relevant industry and disciplinary communities (Huggins and Clifton, 2013).

Overall, there are multiple mechanisms underlying the formation and development of inter-organizational networks, and firms usually utilise a combination of both knowledge

contact and alliance networks (Huggins and Clifton, 2013). It is through a range of complementary networks that firms are able to appropriately access and apply knowledge, and subsequently develop innovative goods and services. It is this complementary mix that ensures that they keep abreast of knowledge relating to latest industry trends, developments, problems and opportunities. For instance, through strong relationships with academia and customers, in particular, firms are able to engage in a continual process of innovation. Investments in network capital are likely to form a high proportion of overall investments as they search, screen, and select knowledge sources and potential network partners (Drejer and Lund Vinding, 2007). Through the process of combing new and existing knowledge, firms not only raise their absorptive capacity rates but engage in the first rounds of innovation that lead to the growth phase.

Network actors receive a greater proportion of the value created the 'nearer'—in a cognitive sense (Boschma, 2005)—they are to the collision. In general, new technology is the most frequently sourced form of knowledge, with newer starts tending to source new technology and skills most frequently (Huggins et al., 2013). More mature firms show higher rates of sourcing professional information and market intelligence, which may indicate the use of networks to maintain their position in their chosen markets (Beckman et al., 2004; Huggins, 2011). Similarly, the focus on technology and skills for the newer firms may represent the lack of internal capacity and capability with regard to these knowledge areas (Thorpe et al., 2005). However network capital investments may become ineffective if there is knowledge equivalence between organizations due to similarities in knowledge profiles, which results in network redundancy (Cowan et al., 2004). These inertial network forces highlight the issue of over-embeddedness, whereby the actors an organization is best connected to may not be best placed to provide solutions to current problems (Krackhardt, 1994; Monge and Contractor, 2003; Maurer and Ebers, 2006).

2.3 Network Issues: Knowledge-Network Interactions and Geography

A key dimension of the knowledge spillover theory of entrepreneurship is geographic distance, with the general argument being that knowledge spills over more easily within regions than at a distance (Jaffe et al., 1993). This suggests that local organizations may

often be embedded in regional knowledge channels (Breschi and Malerba, 2001; Breschi and Lissoni, 2009; Krätke, 2010), with ready access to local public or private research institutes and universities being facilitated through local knowledge flow routes (Mueller, 2006). However, while organizations may benefit from local knowledge spillovers as an undirected and spontaneous 'buzz' (Storper and Venables, 2004), they may also need to consciously build non-local 'pipelines' to tap into knowledge from outside their region (Bathelt et al., 2004). The constraining effect of distance on knowledge flow and transfer is considered by some to be gradually diminishing, and there is increasing evidence of the heightened role being played by international knowledge sourcing networks in many places across the globe (Athreye, 2004; Doloreux, 2004; Garnsey and Heffernan, 2005; Saxenian, 2005; Fitjar and Rodríguez-Pose, 2011). Many firms do not acquire their knowledge from within geographically proximate areas, particularly those firms based upon innovation-driven growth where knowledge is often sourced internationally (Davenport, 2005). If applicable knowledge is available locally, firms and other organizations will attempt to source it; if not they will look elsewhere (Drejer and Lund Vinding, 2007). For this reason there is now an increasing emphasis on the importance of understanding networks and knowledge flows in an environment that is simultaneously local and global (Simard and West, 2006; Andersson and Karlsson, 2007; Lorentzen, 2008; Van Geenhuizen, 2008; Maggioni and Uberti, 2009; Laursen et al., 2011; Broekel and Boschma, 2012). For inter-organizational networks, the roles of space and place are increasingly recognized as important features of network structure and operation (Pittaway et al., 2004; Davenport, 2005; Iyer et al., 2005; Giuliani, 2007; Glückler, 2007; Knoben, 2009; Mancinelli and Mazzanti, 2009; Huber, 2012; Shearmur, 2011; Ter Wal and Boschma, 2011; Molina-Morales and Expósito-Langa, 2012; Doran et al., 2012).

A key feature of this discourse has long concerned the role of both formal and informal networks of spatially proximate and co-located external organizations, such as universities, R&D labs, and other firms or individuals, within the innovation process (Keeble et al., 1999; Brown and Duguid, 2001; Cooke et al., 2004; Huggins and Izushi, 2007; Laursen et al., 2012; Mattes, 2012). Implicit in the argument stemming from observations of advanced local and regional economies is that the skills gained through

local interactions in such knowledge-rich environments better prepares firms for obtaining knowledge from distant sources, allowing them to benefit more from overseas knowledge (Sturgeon, 2003; Saxenian, 2005; Ter Wal and Boschma, 2011). For instance, knowledge spillovers are found to be greater in the presence of knowledge investments, and vice versa, with those regions possessing high knowledge investments experiencing a higher level of knowledge spillover—with interregional spillovers contributing significantly to regional knowledge production (Bathelt et al., 2004). A growing base of evidence suggests that knowledge is increasingly flowing across geographic clusters, resulting in heightened global knowledge connectivity. This has led some to question the view that tacit knowledge transfer is confined to local milieus, arguing that firms' source tacit knowledge from selected providers located outside the local milieu by investing in the building of new channels of communication (Wolfe and Gertler, 2004; Fontes, 2005; Gertler and Levitte, 2005; Fitjar and Rodriguez-Pose, 2011). Simply being in the same locality is often of little benefit for diffusing knowledge from creators to other actors in a locality, with there being a need for networked interaction between these actors (Singh, 2005). Many firms in close proximity do not necessarily share face-to-face interactions through either social or business contacts, reducing the scope for knowledge transfer (Watts et al., 2006). This suggests that propinquity is not enough, and increasing recent empirical evidence finds that high innovation and growing firms source knowledge more frequently, especially from overseas locations, and are more likely themselves to act as a source of knowledge for overseas companies (Huggins et al., 2010).

Many scholars therefore nowadays argue that entrepreneurship and innovation is not necessarily or even primarily a matter of being in the right place, but more about being a member of the right network. These approaches argue that in the past there has been too much reliance on the advantages of local knowledge networks and too little emphasis on the myopia and lock-in problems associated with repeatedly accessing too many of the same local knowledge which can potentially be harmful for innovation (Boschma and Ter Wal, 2007). Weterings and Ponds (2009) find that long-term contacts are not necessarily helpful in overcoming the uncertainty of more distant knowledge flows, nor are they more likely to be established within a region despite the higher frequency of face-to-face

inter-organizational interactions. They also find significant differences in the characteristics of regional and non-regional inter-organizational knowledge flows, and while regional knowledge flows are characterized by a higher number of face-to-face contacts, knowledge exchanged through non-regional knowledge flows is found to be more valuable (Weterings and Ponds, 2009). This indicates that the types of inter-organizational network existing across regions, and the nature of the knowledge flowing through these networks, will impact on levels of regional innovation. Therefore, the region innovation cannot be modelled in isolation, but must be considered in relation to the networks existing across regions. At a regional level, localized flows of knowledge may result in a higher proportion of the output distributed across networks being captured and retained within a particular region, i.e. by local organizations. However, limitations in the appropriateness of knowledge accessible through localized pools mean that access to appropriate knowledge may be inversely related to the geographical proximity of appropriate knowledge sources. As indicated above, even organizations located in globally leading clusters of knowledge are increasingly accessing knowledge through more global communities, rather than rely on their home base.

At the same time, there are also other issues which may either foster or militate against the successful formation of these intra and interregional knowledge-enhancing networks. These issues relate primarily to institutional and governance issues. In particular, the embeddedness of activities, technologies and sectors in an economy is an important and potentially advantageous aspect of the relevant domain element of the smart specialisation logic. At the same time, however, the over-embeddedness of actors in a regional context resulting in local monopoly positions may actually stifle new knowledge flows and innovation. The danger of existing institutions and actors forming local elites which will aim to counter the changes associated with new local innovation is also already explicitly acknowledged in the smart specialisation agenda. From the perspective of the smart specialisation agenda, finding ways to overcome these institutional and technological lock-in effects is therefore essential in order to help regions access more global knowledge flows. However, this requires a clear understanding of these issues.

3 Institutions and Governance

3.1 The Institutional Dimension

A theoretical understanding of the relationships between institutions and smart specialisation can be translated into the policy domain through the adoption of a regional innovation systems framework that is particularly focused on identifying the institutional bottlenecks and other forms of system failure in the interaction between participating actors (Asheim *et al.*, 2013). Innovation processes have been a particular focus of institutional approaches in an interdisciplinary literature to which economic geographers and regional economists have contributed significantly. This is centred on the concept of innovation systems of which there are several variants, both territorial (e.g. national and regional) and non-territorial (sectoral and technological) (Edquist, 1997), as well as comparable theoretical formulations such as the triple helix concept of university, industry, and government relationships (Etzkowitz and Leydesdorff, 2000). Common to all these models, however, is an understanding of innovation as the product of non-linear and interactive processes between different types of actors that comprise the system. This means that institutions are also central to these different innovation system concepts, albeit in a 'conceptually ambiguous' manner that mixes the meanings of concrete organisations and the normative or regulative structures that 'pattern behaviour' (Edquist, 1997). For Edquist and Johnson (1997) institutions (specifically in the latter sense) are understood as "a set of common habits, routines, established practices, rules, or laws that regulate the relations between individuals and groups" (p.49), which perform three basic functions in processes of interactive learning and innovation: reducing uncertainty by providing information, managing conflicts and cooperation, and providing incentives.

The forerunners to the regional innovation system concept were various national innovation system approaches that sought to explain variations in (mainly technological) innovation performance between different countries through reference to such historically-contingent factors as their industrial structure, institutional set-up, and government policy (Lundvall, 1992; Nelson, 1993). More specifically, Hollingsworth (2000) sees distinctive national innovation systems forming out of a complex of different

'institutional sectors' in a society, such as "the system of education, system of research, business system, financial markets, legal system and the state" (p.614). Similarly, Cooke and Morgan (1998, p.25-27) identify a number of different institutional elements of national innovation systems: public and private R&D activities, education and training institutions, the financial system, the network of user-producer relationships between firms, and intermediate sectoral organisations (e.g. trade associations) or territorial bodies (e.g. local chambers of commerce or regional technology transfer centres) (p.25-27). Each of these different institutional sectors will operate under their own specific set of regulative and normative institutions, but at the level of the innovation system as a whole the further intangible element of 'social capital' (e.g. social networks, norms, and trust) is identified by Cooke and Morgan (1998) as being vital to "facilitating co-ordination and co-operation for mutual benefit" (p.27).

This role of social institutions in underpinning the co-ordination of different actors in processes of interactive learning is perhaps even more to the fore in the regional innovation system concept (Braczyk *et al.*, 1998; Cooke *et al.*, 1998; Asheim *et al.*, 2011). This concept reflects established understandings of local agglomeration at a sub-national scale, but also draws on more institutional and evolutionary informed insights from within economic geography. So Asheim *et al.* (2011) differentiate cluster and regional innovation system approaches on the basis of their primary concern with, respectively, market-based connections between firms (clusters) and "regionally and institutionally embedded" network-based connections between firms and other organisations (e.g. research institutions) which are dependent on the active participation and co-operation of these actors (regional innovation systems) (p.879). In particular, regional innovation systems analyses have involved a particular focus on the articulation of knowledge generation/diffusion (e.g. public research) and knowledge application/exploitation (e.g. private company) components of the system (Autio, 1998; Tödtling and Trippl, 2005). Regional innovation systems also have to be situated in their multi-level setting of relationships with national and supra-national systems of innovation, which are often the more appropriate scale for understanding the variation of institutional elements that relate to the formal regulation or state governance of

education/training, research, and business systems as they operate at a regional level (Fromhold-Eisebith, 2007; Asheim *et al.*, 2011).

From the perspective of the local environment in which entrepreneurial search activities operate we can employ the description of institutions whereby "*Institutions consist of cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour. Institutions are transported by various carriers – cultures, structures, and routines – and they operate at multiple levels of jurisdiction*" (Scott, 2001, p.33; emphasis in original). This approach, whereby institutions are seen as both formal and informal phenomena, has become very influential in economic geography during the past two decades where the principal concern has been explaining how and why these institutional structures vary between different regions and what effect this has on economic processes and consequently patterns of uneven development (Martin, 2000). The term 'institution', of course, has a further widely-used meaning that is of relevance here: a particular type of economic, governmental, educational, research, financial, or associational organisation. For reasons of conceptual precision, Edquist and Johnson (1997) maintain a clear separation between institutions and organisations that have different roles in the innovation process, whilst recognising that between them exists "a complicated two-way relationship of mutual embeddedness" (p.60).

Processes of systemic innovation also illustrate the important point that institutions, whilst necessarily being stable enough to support consistent forms of behaviour, do also change over time through processes of co-evolution with new technologies, industries, and organisations (Cooke *et al.*, 1998; Uyarra, 2010). This reflects the historic overlap between institutional and evolutionary approaches within economics (Hodgson, 1998). In some recent evolutionary approaches in economic geography this institutional element has been located in firm routines (rather than regional or national level institutions) (Boschma and Frenken, 2006), but other evolutionary perspectives have re-asserted the importance of societal institutions at the level of a wider territorial political economy and particularly the role of the state as an institution in "shaping the evolution of the economic landscape" (MacKinnon *et al.*, 2009, p.136). More generally, Gertler (2010) has argued that institutional analysis in economic geography should pay more attention to

the agency of individuals and organisations in being able to modify and create new institutions, as well as to the role of institutions as a structural factor shaping economic behaviour. This can be seen in processes such as imitative institutional learning (Hassink and Lagendijk, 2001) or institutional entrepreneurship (Sotarauta and Pulkkinen, 2011). It is also a focus of the policy process to which we turn to now.

The system of organisations carrying out or supporting research and development in a region are, of course, a key factor in the development of effective innovation strategies based on smart specialisation principles. The contours of this sub-system are usefully delineated by Hamdouch and Moulaert (2006) in their concept of a territorial 'knowledge infrastructure' - "*the 'institutional complex' encompassing the wide range of organizations, institutions and networks (and their specific constituents) which contribute to the constitution and evolution of the knowledge base of a given spatial area, as well as the resources and competencies fuelling its innovative capabilities and dynamics"* (p.27; emphasis in original). They identify seven types of organisations that comprise this knowledge infrastructure: universities, other higher education organisations, public research organisations, private research institutes, consulting firms, manufacturing and service firms, and particularly those with internal R&D capabilities, and 'collaborative organizations', e.g. networks, joint ventures and other forms of association. This classification touches upon the different functions that these organisations should fulfil in the 'innovation ecology' of a region (see David and Metcalfe, 2007). For instance, while some organisations such as universities will be engaged in the production of new knowledge through basic research activities, other public or private organisations may have more of an intermediary role in carrying out applied research and development that provides a bridge to industry (Mina *et al.*, 2009; Goddard *et al.*, 2012). Educational and training institutions (including schools and vocational colleges as well as universities) are also vital in ensuring that members of the workforce have the necessary specialist knowledge and technical skills to support innovation relating to the sectors in which the region has an entrepreneurial opportunity (Cooke and Morgan, 1998). Recognition of the importance of reciprocal, complex relationships between these types of institutional actors in processes of interactive and non-linear learning are, of course, a cornerstone of

national and regional innovation system approaches. The exploitation of market opportunities from these new innovations will also be dependent on a range of enterprise support institutions. This encompasses the role of organisations and intermediary organisational forms such as spin-out firms, venture capitalists and other investors, university incubators and science/technology parks, and organisations providing support services or training to entrepreneurs in areas such as proof of concept or intellectual property rights.

3.2 Governance and S3

Governance has risen relatively recently and rapidly to prominence as a key concept in the social sciences (Jessop, 1998), where it has become a critical element in our understanding of economic development processes. It is by no means a straightforward concept, however, and is often confused as being narrowly associated with the decision-processes and activities of government (Sugden *et al*., 2006). This misconception is particularly important for smart specialisation debates, given that governments are only one of the many agents that are expected to engage in entrepreneurial discovery processes. Indeed, Foray (2009a and 2009b) initially argued that government should play a very limited role in these processes, acting essentially as a facilitator for discovery processes among 'entrepreneurs' that would include "firms, universities, higher education institutes, independent inventors and innovators" (Foray *et al.*, 2011: 7). There is increasing recognition, however, that governments should play a more active role where they have the capacity to do so (Aranguren *et al.*, 2013; Navarro *et al.,* 2012), recognising for example the risks associated with excessive private influence in regional strategies and the low entrepreneurial capacity of the private sector in some regions (OECD, 2011). In any case, it is clear that the relevant concept of governance with respect to entrepreneurial discovery processes extends much more widely than the activities of government.

Taking a broad view, then, governance refers to the emergence of some sort of 'order' for coordinating socioeconomic activities among a whole range of actors (and their associated interests) (Kooiman and Van Vliet, 1993; Jessop, 1998; Sugden *et al.*, 2006;

Aranguren *et al.*, 2008). Jessop (1998: 29), for example, starts from a very wide definition as "any mode of coordination of interdependent activities". Yet his specific focus is on exploring the role of markets, states and partnerships in economic coordination. As such, participants in governance can include public organisations (such as government at various levels), but also should include private organisations and individuals. Indeed, for Stoker (1998) the essence of governance is in mechanisms that do not depend on the authority or sanctions of government, which is also in line with Kooiman and Van Vliet's (1993: 64) view of governance as "the creation of a structure or an order which cannot be externally imposed". Rather than being externally imposed by a single authority, the structure or order that characterises any particular governance setting should result from continuous interaction among the range of different actors with a stake in the outcomes of the decisions to be taken in that setting.

It is no surprise therefore that governance forms a central concern in the smart specialisation debate, as reflected in its inclusion as one of six 'key steps' in Foray *et al.*'s (2012) *Guide to Research and Innovation Strategies for Smart Specialisation*.[1] As they highlight (p. 21), "the fact that RIS3 is based on a wide view of innovation automatically implies that stakeholders of different types and level should participate extensively in their design." Moreover they highlight the need to go beyond the usual 'triple helix' of industry, education and research institutions and government, to also include "innovation users or groups representing demand-side perspectives and consumers, relevant non-profit organisations representing citizens and workers" (*ibid*, p. 22) in a fourth 'market and civil society' sphere. This 'quadruple helix' of agents should all be involved in the governance processes that lead to the design and ongoing evolution of the RIS3.

When analysing the governance of RIS3, as with any other construct, *the* critical consideration is that different governance processes can result in different outcomes. Depending on who is involved, what form of interactions take place between them, and

[1] This focus on governance in the RIS3 concept can be seen as an extension of the concern with governance of different forms in the context of national and regional innovation systems (Braczyk *et al.*, 1998; Edler *et al*, 2003; OECD, 2005; OECD, 2011), and in related concepts such as clusters (Pitelis *et al*., 2005) and networks (Aranguren *et al.*, 2008).

how power dynamics are exercised among them, the outcomes in terms of the coordination of socioeconomic activities - in this case the priorities a territory should target in research and innovation - will be different. Indeed, following Bailey *et al.* (2006), in reality every agent or territorial system has a development path, and therefore a development strategy that is either explicit or implicit in shaping that path. In these strategies there are (conscious and unconscious) choices which orient the strategy towards different aims (Sugden and Wilson, 2002, 2005), meaning that the decision-making processes surrounding these choices must be at the heart of what we mean by governance and, in the context of RIS3, of what we mean by entrepreneurial discovery.

The centrality of entrepreneurial discovery processes to RIS3 implies a strategy that is 'alive', constantly evolving, and constantly engaging a broad range of agents in its definition, implementation and evaluation. This by definition requires new, dynamic and networked forms of governance that break with the more static and hierarchical forms that governments and other agents are used to when making strategic plans in relatively 'top-down' processes. Moreover, the need to understand how these new governance processes can be nurtured in practice is complicated by the multi-level nature of territorial governance relationships. In this respect, a failure to clearly recognise the different levels of analysis (and their articulation) required for a coherent regional strategy has contributed to the 'black box' effect with regards the associated entrepreneurial discovery processes. From the priorities that are identified during the process, to the concrete decisions of agents to take advantage of specific market or technological opportunities, to the degree and scope of the required participation of agents, the level of analysis clearly matters. Indeed, typically within a region there are cities and/or municipalities that are likely to have very different governance dynamics to those at the regional level, and the regional dynamic itself must fit somehow within inter-regional, national and European governance dynamics.

The new, dynamic forms of governance required for the entrepreneurial discovery processes of RIS3 do not have the luxury of being able to develop within an isolated single-level territorial system. From the outset they must take on board the multilevel elements that are inherent in the existing relationships that the firms, governments and

other agents involved are engaged. While they cannot be easily separated in practice, for analytical purposes it is useful to make a distinction between the sphere of government and the other three spheres of the so-called 'quadruple helix'.

3.2.1 The Government Sphere

It is useful to treat the government sphere separately for three reasons. Firstly, while governments are only one of many agents that should engage in the entrepreneurial discovery processes central to RIS3, they must play a key role in aligning their STI policies to support the prioritizations that emerge from these processes. Their role in entrepreneurial discovery processes therefore take on a specific importance from a governance perspective.[2] Secondly, in the European context it is ultimately governments that are responsible for presenting their RIS3 to the European Commission as a condition on receiving European funds. Thirdly, given that multilevel governance challenges are not new in the context of innovation policy, there is already a considerable literature treating elements of the challenges that occur in the government (or policy) sphere.

The rise of systemic approaches to innovation and the importance that this places on certain proximity-based relationships has corresponded in practice with a decentralisation in the governance of STI policies in many places, with certain competences shifting from national to regional and local levels. At the same time there has also be an extension of certain policy competences at supra-national levels in some parts of the world, for example the European Union. The result is that STI policies are today designed and implemented from several different administrative scales – city/municipality, regional, national, and supra-national. Policies that need a greater concentration of resources, such as the provision of certain STI infrastructures, tend to be found at national and supranational levels, while networking and cluster policies, for example, that rely on

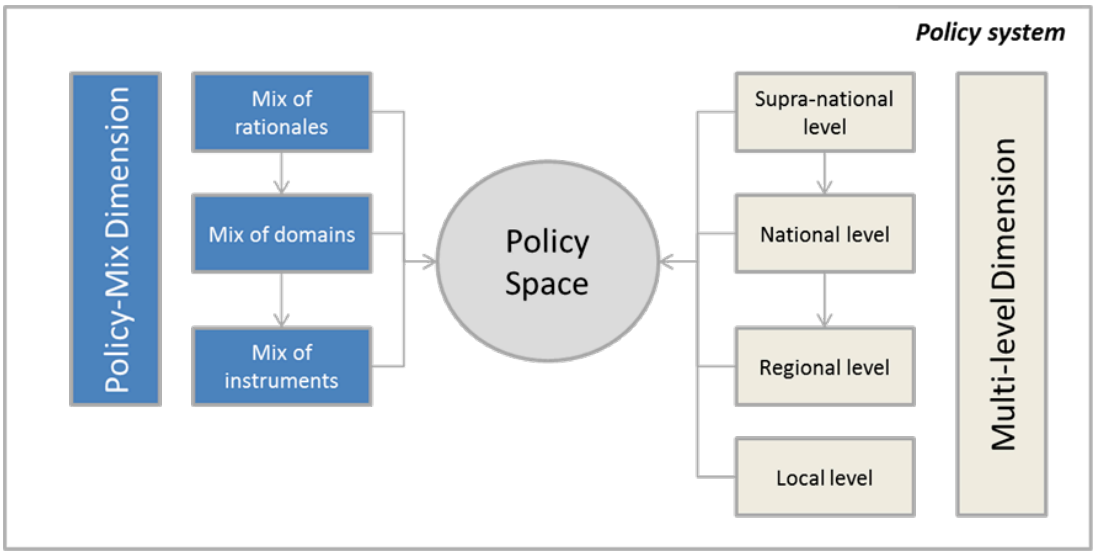
[2] In a dynamic, process-based strategy implied by the concept of RIS3 it is impossible in practice to separate the design, implementation and evaluation phases. Given that (i) the ultimate decisions on where to place policy resources will be taken by government and (ii) it is critical that there is coherence between these policy decisions and the emergent strategy, we cannot ignore that government is likely to play a particularly important role in the governance of entrepreneurial discovery processes. In this sense RIS3 processes bear certain similarities to strategic spatial planning processes, which Albretsch (2010, p. 1118) describes as a "government-led but negotiated form of governance" (p. 1118). He goes further to specify it as "a transformative and integrative public-sector led socio spatial process through which the visions or frames of reference, the justification for coherent actions, and the means for implementation are produced that shape and frame what a place is and what it might become" (p. 1119).

proximity relationships are more prevalent at regional and sub-regional levels (Koschatzky and Kroll, 2007; Koschatzky and Stahlecker, 2010). In practice, however, a wide range of STI policies are implemented at all administrative levels.

As a RIS3 becomes defined through its entrepreneurial discovery process and the needs from policy to support the identified priorities become clear, there is the possibility of a *governance gap* between the different levels of innovation policy administration that provide this policy support (Kuhlmann, 2001). In practice there is a danger that this may lead to incoherence among policy initiatives in terms of supporting the emerging RIS3.

This issue is related to recent interest in 'policy mixes' (Flanagan *et al.*, 2011) and the challenges that these imply for issues such as policy coordination and policy evaluation. Magro and Wilson (2013), for example, distinguish between two dimensions of the innovation policy systems that characterise what Uyarra & Flanagan (2010) term 'policy spaces' (see figure 3.1). The first dimension refers to the complexity among co-existing innovation policy rationales, domains and instruments within a single layer of government that corresponds to the policy space in question (for example a region). This presents horizontal governance challenges for policy-makers. The second dimension adds to this complexity by recognising multiple levels of government with innovation policy competences that have impacts in that 'policy space' (the region). This presents vertical governance challenges for policy-makers. In practice these horizontal and vertical governance challenges interact, not least because the governance required for different types of economic activities (for example different sectors or clusters, rooted in different technological systems) are likely to correspond to different territorial scales.

Figure 3.1: Dimensions of an Innovation Policy System



Source: Magro and Wilson (2013)

However, while there is a clear consensus that the impacts of policy are inter-related in this complex, systemic reality, it is also acknowledged that policy-making itself has not evolved very fast in terms of confronting the associated governance challenges (Braun, 2008). Indeed, while New Public Management techniques have led to improvements in the management of specific policies or instruments, there has been a fragmentation and multiplication of agents that can be seen to have exacerbated these governance challenges. In a given region, for example, it is common to find a lack of policy coordination among range of different government departments that deal with STI policy issues, operating alongside different agencies responsible for different phases of the policy-making processes (design, implementation and evaluation), and involving different sets of agents from the innovation system in their processes. In this respect it is useful to understand policy governance as a coordination mode among three different layers: political, administrative and operative (Boekholt *et al.*, 2002; Lindner, 2012, Magro *et al.*, 2013):

(i) The political layer refers to the space in which decisions are made from a systemic perspective. Governmental bodies such as ministries, departments and their advisory boards constitute this layer.

(ii) The administrative layer is that which is responsible for the implementation and management of particular programmes and instruments (e.g. taxes, R&D incentives, etc.). Normally, research councils, public agencies and those organizations that play a relevant role both in the funding decisions and in the management of research activities constitute this administrative.

(iii) The operational layer includes those actors of the system such as firms, knowledge infrastructures, investors, etc., namely organisations that are involved in the translation of the priorities identified in the previous layers into concrete action.

3.3.2 Other Elements of the Quadruple Helix

The multilevel dimension of industry is very clear given the global reach of production processes. In any region there will be a group of firms that produce goods and services locally, for local markets, with limited interactions outside of the region. However there will be a significant group of firms – large, medium and small – for whom engagement in production relationships spanning regions and nations constitutes a critical part of their activities. Engagement in production activities may be through direct ownership whereby the firms themselves internalise activities across territories to become 'multinational' (or 'multiregional') (Hymer, 1960; Kindleberger, 1969; Rugman, 1981; Buckley and Casson, 1985; Dunning, 1985), or through market and non-market engagement in what are variously termed global value chains, global production networks or global innovation networks (Parrilli *et al.*, 2012). In either case there are multi-level governance mechanisms at play that will determine key questions such as where different types of activities take place (R&D, design, production, marketing and sales), and the directions that they will take in the future. In this sense Cowling and Sugden (1998) maintain that control of 'strategic decision-making' is the critical factor for analysis in transnational

production relationships, whether inside or outside any one specific firm. It is indeed these strategic decision-making processes within multinational corporations and/or between firms in global networks that have important implications for the development of RIS3 in each territory.

A similar set of multilevel governance concerns are also apparent with respect to the education and research and the market and civil society spheres of the quadruple helix. These areas have not been immune to globalisation processes and are characterised by a similar nexus of regional activities in a broader context of global activities. Indeed, with regard to the market and civil society sphere many of the corresponding societal challenges (for example, climate change) are truly global, despite lacking effective institutions that can represent such interests at a global level. Groups representing users or consumers are also more typically configured at national or global levels than at the regional level, and in many countries it is also the national level that predominates with respect to worker representation or trade unions. A key issue is therefore how to engage with these national and global interests from a regional level in the context of a specific RIS3. With regards to non-profit organisations and educational and research institutions the scenario perhaps mirrors more closely that of firms. Agents often operate independently at regional level, but they do so in the context of a national and/or global network of relationships. Again, that they often have clear strategic interests also in other territories signals the need to be aware of dangers of capture of the regional RIS3 process by particular vested interests.

The case of universities is particularly interesting because around the world universities have been undergoing some profound changes that have strong implications for their roles in RIS3. On the one hand they are being asked to play more strategic roles in economic development processes, in particular at the regional and local levels (Feldman, 2001; Lazzeretti and Tavoletti, 2005; Drucker and Goldstein, 2007; Karlsen, 2007). However this is taking place simultaneously with a general trend towards their commercialization (Bok, 2003), one of the key components of which is their operation with an increasingly global scope (Wilson, 2009). While this globalization of universities' activities is not entirely new – students have travelled to be educated in

different countries for centuries – it has seen a dramatic acceleration in recent years and a change in nature. In particular, universities have become alert to the opportunities for entering foreign markets, establishing 'branches' in other countries (Wilson, 2009) in an internationalisation process that to some extent mimics that of multinational firms (Sugden, 2004). Again, therefore, universities are likely to have interests in multiple RIS3 processes in different territories, and for a given region there will be multilevel governance challenges in terms of how these interests are articulated in the development of their specific RIS3. Moreover, following Goddard *et al.* (2013) the national and global networks of regionally-rooted universities can be an important advantage in the development of RIS3 in providing external connections and access to foreign sources of knowledge.

3.3 Institutional and Governance Issues

Awareness of the fundamental role of institutions in economic development has increasingly spread to policy as well as academic debates (Tomaney, 2013). This has led to growing interest in the institutional or systemic 'bottlenecks' that can impede regional economic development and the types of policy intervention required in response. For instance, the Organisation for Economic Co-operation and Development (OECD) report *Promoting Growth in All Regions* found that institutional issues were the single most important factor determining regional performance and identifies a number of common institutional bottlenecks:

- poor mobilisation of stakeholders;
- lack of continuity and coherence in the implementation of policies by institutions;
- institutional instability;
- lack of common and strategic vision;
- lack of capacity and gaps in multi-level governance (MLG) frameworks.

(OECD, 2012, p.23)

The report identifies three other areas of bottlenecks in regional economies – relating to the policy paradigm, internal fragmentation and labour-market mismatch, and a shortage

of human capital - that may be connected to under-capacity or breakdowns in territorial institutional arrangements (OECD, 2012, p.23). The system-failures listed each reflect different types of institutional bottlenecks that regions face, some of which are due to bottlenecks in the institutional arrangements of the organisations that form the regional governance or research and innovation systems, or to bottlenecks in the institutional environments (formal and informal) in which these systems are situated. Both of these types of system failures due to institutional bottlenecks are relevant for smart specialisation discussions because a fundamental principle of the proposed smart specialisation approach to forming research and innovation strategies is that a range of innovation, business and civil society stakeholders should participate in the policy formation process (European Commission, 2012). Successful regional smart specialisation strategies will, therefore, be dependent not just on efficient local government institutions and leadership, but the presence of inclusive policy networks and collaborative norms that support 'associative' forms of economic governance (Cooke and Morgan, 1998; Amin, 1999). As discussed above, strong patterns of interaction and coalition between regional actors can lead to the formation of a common enterprise and economic development agenda (Amin and Thrift, 1994). Past examples of what could be called associative governance arrangements have been documented in countries with strong civic traditions (Putnam, 1993) or social democratic political cultures (Amin and Thomas, 1996). In other more liberal systems of political economy, however, levels of social capital and collaborative norms are not likely to be as developed, leading to barriers in collective strategy formation processes (Leibovitz, 2003). This is in spite of a recognised trend towards more 'entrepreneurial' modes of local governance based on arrangements such as public and private partnerships (Harvey, 1989).

As discussed above, in smart specialisation discussions the innovation system concept can also be applied as a policy tool to identify systemic failures and bottlenecks in particular contexts. However, as well different governance modes, one of the most fundamental bottlenecks in the European context is that research and development capabilities vary widely, so that strategies prioritising technology-based innovation will simply not be appropriate for some institutionally thin regions (Liagouras, 2010;

Camagni and Capello, 2013). Peripheral regions may also not have developed the entrepreneurial culture of norms, routines, and incentives (promoted through the regulatory systems governing, for instance, research funding and exploitation of intellectual property) which lead to organisations such as universities being configured as actors in the innovation process. In other regions, where knowledge generating capabilities are comparatively well developed in universities or other scientific institutes, there is no guarantee that these capabilities will be embedded in a coherent territorial innovation system. Institutional fragmentation may arise where the main indigenous fields of scientific and research strength do not match areas of national or regional industrial specialisation and, therefore, strong network links do not form between organisations such as universities and firms (see Laursen and Salter, 2005; Braunerhjelm, 2008). In regions that are locked-into particular industrial and technological paths, low levels of adaptability from overly-rigid inter-organisational relations and shared cognitive frameworks will be a source of institutional bottlenecks to the creation and exploitation of potential sources of novelty from within the region (for instance new scientific knowledge from universities, potential industrial applications that diversify from existing products). Lock-in can also arise from a failure of regional industries (or institutions such as universities) to develop links into extra-regional networks or value chains and a lack of openness to new ideas (Visser and Boschma, 2004; Boschma, 2005). At the same time there has also been a general increase in patterns of regional devolution in many European and non-European countries (Rodríguez-Pose and Gill, 2003). The shifting multi-level governance arrangements will create challenges of vertical coordination between regional, national, and European level in the formation of smart specialisation strategies, irrespective of the technological and institutional issues discussed here.

On the basis of all of the issues and literature raised here, it is possible to develop a classification framework which captures many of the major institutional bottlenecks which are likely to arise in different regional setting where smart specialisation principles are being applied. In order to do this we apply a tripartite categorisation built around the issues of institutional thinness, institutional fragmentation, and institutional lock-in, and

apply these firstly to the case of institutional and system arrangements and secondly to the institutional environment.

	Institutional or systemic arrangements	**Institutional environment (formal and informal)**
Institutional Thinness	Lack of effective national or regional governance organisations or capacity supporting RIS3 at the regional level. Underdeveloped non-governmental civil society or associational organisations supporting the RIS3 process.	Underdeveloped formal (e.g. democratic rules and processes) or informal norms, conventions or routines encouraging participation and collaboration by regional institutional stakeholders in the entrepreneurial discovery/strategy formation process for RIS3 at regional level. Absence of formal laws, regulations and sanctions that legislate against self-interested, rent-seeking or corrupt behaviour.
Institutional Fragmentation	Lack of coordination between governance structures or actors horizontally (within regions) or vertically (with national/European level). Institutional instability and lack of mid to long term continuity in regional governance arrangements. Sub-regional local governance arrangements leading to territorial fragmentation of regional governance.	Lack of shared norms, routines, and understandings promoting a common/coherent vision about the direction/content of RIS3 at the regional level.
Institutional Lock-in	Influence over direction/content of RIS3 over-concentrated in small number of governance/institutional actors representing regional economy status quo. Weak connectivity or coordination with complementary innovation strategies in other regions.	Conservative political culture and norms working against RIS3 agenda promoting industrial or technological change and adaptation.

Table 3.1. Possible institutional bottlenecks to smart specialisation in the governance system

The table here above lists some of the major possible institutional bottlenecks facing smart specialisation processes that will arise from problems of thinness, fragmentation, and lock-in in these governance arrangements and their allied institutional environment. Institutional bottlenecks relating to governance will be especially prevalent in regions with an undeveloped or thin set of government institutions and democratic processes. In particular, one of the most problematic issues facing smart specialisation is that of existing institutions and actors, who will seek to limit the diversification processes offered by smart specialisation in order to preserve their local monopoly positions, exactly as explained by McCann and Ortage-Argilés (2014). On this point, Rodriguez-Pose and di Cataldo (2013) describe the potential issues for the implementation of smart specialisation that may arise from this type of situation:

> [T]he risk is that vested interests from the most powerful regional stakeholders and lobbies may condition decision-makers, letting partisan politics become prevalent and often giving rise to problems of impacted information, insider-outsider problems and clientelism. In the absence of effective systems of control and of sanctioning inefficient and/or corrupt government behaviours, regional public officials may be influenced by strong external pressures from interest groups, more interested in either promoting their own private interests or preserving the status quo than in improving the overall innovative capacity of the region.

(Rodriguez-Pose and di Cataldo, 2013, p.4).

In such cases, Rodriguez-Pose and di Cataldo (2013) argue that the reform of government institutions should precede further investment in the science and technology infrastructure as a policy priority for RIS3. As discussed in the previous section, similar issues about the capture of the industrial agenda by a particular powerful group can also arise in more institutionally developed regions if a situation of industrial and political 'lock-in' develops to exclude certain potentially important actors from participating in the formation of smart specialisation strategies. The shift to more complex horizontal and vertical governance arrangements inevitably creates scope for institutional fragmentation between actors in different domains and at different levels. Indeed, as the OECD (2012) list of common institutional bottlenecks highlights, issues of fragmentation can also arise from instability or a lack of continuity in governance arrangements over time.

4. Understanding related variety, revealed competition and the entrepreneurial search process within and between regions.

An important novelty of this Work Package is the exploration of the economic connectivity of regions, presence of (un)related variety and economic embeddedness. This has important implications both for the potential, and reach, of entrepreneurial search process and for our understanding of the shape of the entrepreneurial domains present within regions and the spaces across which these operate. The quantitative empirical work being undertaken here provides a critical foundation for much of the accompanying qualitative and conceptual work developed elsewhere in this Work Package.

4.1 Agglomeration, Related Variety, Industrial Diversification, Structural Change and the Regional Entrepreneurial Search Processes

The concepts of agglomeration, (un)related variety, sectoral branching and evolution, structural change and the regional entrepreneurial search process are complex in nature and developed in various literatures. They all are potentially related to smart specialization strategies – but the exact nature of their mutual relation and causality are to be uncovered, as well as the implications for regional and EU policy. A prime empirical task in our work package is to identify the relations and conclude on the implications.

Our quantitative empirical research closely focuses on agglomeration circumstances influencing economic growth across European regions[3]. Empirical studies on agglomeration economies are characterised by a high diversity of approaches. Rosenthal and Strange (2004) present a brief review of papers focusing on urbanisation economies as advantages of cities and regions applying to every firm or consumer. Noteworthy is that most early (pre-1990s) works on agglomeration simply used cities' population as a measure of agglomeration. These studies assume that the population elasticity of productivity is constant. Rosenthal and Strange (2004) conclude that this literature has

[3] This section partly reflects the conceptual setting of a first empirical paper by Van Oort et al (2014) that is carried out for this workpackage.

found relatively consistent evidence: doubling the population of a city increases productivity by 3-8%. Since the findings of Glaeser et al. (1992), it has become more commonplace to analyse economic growth variables, suggesting a relationship between agglomeration and economic growth and thereby introducing the possibility that increasing returns in an urban context operate in a dynamic, rather than static, context. Sector-specific localisation economies, stemming from input-output relations and firms' transport cost savings, human capital externalities and knowledge spill-overs, are generally offset against the general urbanisation economies defined earlier using conventional measurements. A large body of literature builds on this new conceptualisation of agglomeration economies, as reflected in three recent overviews and meta-studies (Beaudry & Schiffauerova 2009, De Groot et al 2009, Melo et al 2009). These studies show that the relation between agglomeration and growth is ambiguous and indecisive with regard to whether specialisation or diversity is facilitated by (sheer) urbanisation as context. This makes policymakers, with some power over cluster policies and diversification policies, insecure on the effectiveness of their actions and instruments (Duranton et al 2010).

A step towards conceptual renewal as a possible way out of this currently seemingly locked-in debate is introduced by the concepts of related and unrelated variety. Jacobs (1969) initiated the idea that the variety of a region's industry or technological base may affect economic growth. Frenken et al. (2007) state that variety and diversification consist of related and unrelated variety, arguing that not simply the presence of different technological or industrial sectors will trigger positive results but that sectors require complementarities that exist in terms of shared competences. This need induces a distinction in related and unrelated variety because knowledge spill-overs will not transfer to all different industries evenly, due to the varying cognitive distances between each pair of industries. It is argued that industries are more related when they are closer to each other within the SIC classification system, when they share mobile labour, capital and production flows, or when industries persistently co-occur due to functional, knowledge and labour-induced linkages. Frenken et al. (2007) find that for Dutch urban regions, the positive results of knowledge spill-overs are higher in regions with related

variety, whereas regions characterised by unrelated variety are better hedged for economic shocks (portfolio effect). The authors also find marked differences between employment growth and productivity growth. An interesting theoretical contribution to the specialisation-variety debate that focuses on these explained variables has been provided by lifecycle theory, which holds that industry evolution is characterised by product innovation (and more employment growth) in a first stage and process innovation (and more productivity growth) in a second stage. This distinction does not imply that product innovation occurs exclusively at the time of birth of a new industry, with process innovation only occurring thereafter. Rather, product lifecycle theory assumes that product innovation peaks before process innovation peaks.

These concepts have until now been tested only at the country level in Europe (respectively in The Netherlands, Italy, Spain and Great Britain), and no pan-European test has been provided due to data limitations. The concept is proposed as an important possible contributor to new regional economic strategies in the S3 guide of the European Union (see, for example, European Commission, 2012, P.18) – yet policy seems to be ahead of empirics here. Empirical quantitative research in this work package will for the first take the concepts up in a European regional setting, linking the evidence to cluster-policies in European regions and the anticipated gains in employment and productivity (spillover argument) and unemployment (portfolio argument) to be expected from diversification strategies.

The links between high impact entrepreneurship and regional diversification in related industries, technologies, skills and knowledge-domains has not been investigated for many European regions. Nor have the issues associated with spatial heterogeneity been fully explored, and this is especially important in the EU case because not only may regional size be important, but also distinctions such as east/west, north/south, “institutionally ready” versus other regions, and in particular our case study regions. The institutional climate in regions towards smart specialization, economic structural change and diversification strategies is markedly different in the heterogeneous categories

mentioned – meaning that policy instruments that work in one type of region, may not be effective in other regions.

In this work package related and unrelated variety indicators are to be built-up from Bureau Van Dijk Amadeus data.. Applying various spatial regimes on the data will reveal the influence of different types of regions and cities on the processes. In order to undercover the key features of these related variety and branching processes, the SmartSpec project will examine the impact of related variety on how successful European regions are to diversify into new economic activities, and in order to do this we take up three main sub-questions: (i) to what extent is industry-relatedness a crucial driving force of regional diversification in European countries?; (ii) at what spatial scale (regional/national) are related capabilities driving this process of regional diversification?; (iii) to what extent is related variety in regions positively influencing diversification? We will build on previous studies on related variety and regional diversification to determine how to operationalise our variables and measure the degree of relatedness between industries.

As such econometric analysis addresses cluster and diversification policies in general, it does not show which knowledge transfer and network mechanisms actually contribute to relatedness and actual growth. Complementary empirical research will therefore set off network relatedness in value chains (demand induced growth) to local induced agglomeration (structural growth). Entrepreneurial processes (of firm formation, survival and growth) that are central in regional economic capacity building are besides their local embeddeding dependent on technological relatedness and connectivity which reflects, as the theory described above suggests, important knowledge and learning channels for regional economies. As well as considering the different relatedness dimensions associated with sectoral, technological, and skills-related features, there is therefore also widespread agreement that regional capabilities are a key input to the entrepreneurial discovery process. While cognitive capabilities at the regional scale are considered important for regional diversification, smart specialisation implies that another key factor is the degree of connectivity between agents and industries. We consider connectivity as

a crucial ingredient for smart specialisation because knowledge interactions between players are needed to enhance the innovation process and here the institutional structures at the regional scale may enable or constrain the ability of these connections to take place. The related variety logic suggests that there are strong grounds for believing that institutional structures may also impact on the effect of different kinds of relatedness on regional development and the argument proceeds as follows. A region is unlikely to exploit economically the full potential of related variety if the related industries do not interact. Therefore, if the institutional structure of the region is not able to solve this co-ordination problem, then not much knowledge would be expected spill over between related industries, and the economic effect of related variety in a region is expected to be lower. However, while it is possible to argue these points in principle, our empirical knowledge of these issues is as yet very limited, and from both an analytical as well as a policy perspective, we require a better understanding of how institutional settings at the regional scale, including governance structures, shape and influence the effect of entrepreneurial actions to enhance regional diversification via related variety mechanisms. Boschma and Capone (2013) have tested whether institutions of European countries have affected the nature of industrial diversification, and they found that more responsive institutional settings enabled countries to make a jump in the evolution of their industrial structure, and to diversify in more unrelated industries. However, this has never been tested empirically at the regional scale. We will also explore institutional literatures, such as the Varieties of Capitalism literature (Hall and Soskice), the social filter literature (Rodriguez-Pose, Crescenzi), the social capital literature (Putnam et al) and Hofstede's cultural dimensions, in order to operationalize the institutional variables at the regional scale. This will allow us to explore whether various institutional typologies of regions, including the OECD regional innovation typology, can be used in this respect.

A crucial element in analyzing the issues sketched in the above is the availability of longitudinal, geo-referenced, firm level data. Both the identification of high-impact entrepreneurship and the analysis of industry relatedness of new firms require information at the firm level at least identifying the industry of the new firm, its location,

and success measures. This study uses three sources of data, namely the Amadeus dataset of Bureau van Dijk, the 2012 EUROSTAT SBS data, an the new Eurostat Annual Business Demography database to be published at the end of 2013.

For the identification of high-impact entrepreneurship we focus on the cohorts of new firms and track the evolution of these cohorts over time. The data allows us to monitor over time success of the firms in terms of jobs, survival (drop-out from dataset), turnover and technological profiles. Using the location markers of the firms, we can then map the spatial pattern of high-impact entrepreneurship at the NUTS 2 level in Europe. In the next step of the analysis the patterns in the maps are explained in multivariate-analyses. EUROSTAT provides data for the explanatory variables in the analysis. These variables include controls for the regional context in which entrepreneurship takes place. This includes measures of agglomeration, demographic developments, educational level and economic growth. In addition to the overall assessment of industry changes and the characteristics of relatedness in entrepreneurship, we will use industry-specific start-up rates to determine to what extent, given the industry mix of a region, certain regions are able to develop promising industries. This information will be used in the remainder of the project to pinpoint interesting regions that can serve as case-studies. Why do some regions manage to develop an existing industry through entrepreneurship and diversification according to related variety, where others do not? The association between the existing industry-structure and the industry-structure of the emerging firms may partly explain differences in high-impact entrepreneurship, and for this, we will develop association measures using the distribution across industries for incumbent firms and new firms. This will also help us link our observations of the regional entrepreneurial characteristics to our analysis of the characteristics of the regional domain-structures, which comprises the second stream of empirical work in this work package.

4.2 Revealed competition and Global Value Chains

As mentioned in the previous section, connectedness between regions may be an important driver of development. Being economically connected to the right hubs, may influence growth opportunities and hence relevant policy options to a large degree. Innovation and learning opportunities are dependent on own specialization, the capacity of (firms, industries and institutions in) regions to diversify and capitalize on cross-overs, and the degree to which regional development can be connected to growth conditions in other regions. Value chain analysis offers an innovative perspective on distinguishing regional factors determining development opportunities, that can be influenced by regional policy makers, from international economic network determinants, that is much less easy to plan locally. Insight in this local-global blend of influences is important for distinguishing competitive strength and opportunities, and related to that location factors that locally can make a difference and may be subject to policy attention.

To provide an example of the added value of trade network analysis for smart specialization, we indicatively present some evidence on competitive advantages, trade relations, location factors, and regional development opportunities versus network dependence of the medium-tech production and service sector in the region of South-East Brabant (Eindhoven) in The Netherlands. The indicative figures and data are especially produced for this paper. It is based on preliminary data on multiregional European input-output data and locational data on NUTS2-level as described in Thissen et al (2013). For the empirical analysis to be carried out in later stages of the work package, these data will be cross-validated with national and worldwide data. It should therefore be repeated that the presented outcomes are preliminary and for illustrative purposes only. They do show the relevant potentials, pitfalls and concerns for smart specialization strategies and competitiveness of European regions and policy.

The economic geographical literature does not view the concept of regional competitiveness very favourably. Bristow (2005) argues that regional competitiveness lacks a clear, unequivocal and agreed-upon meaning within the academic literature. The

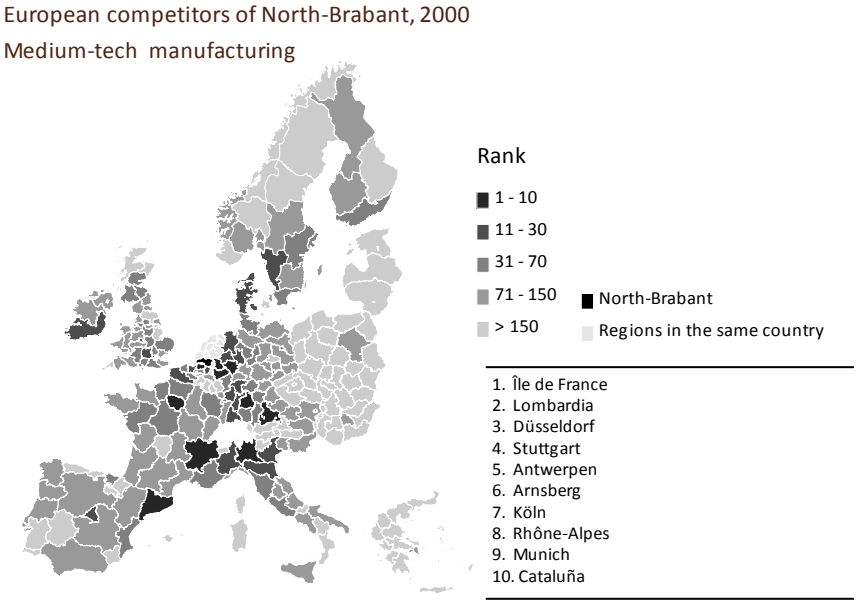
concept seems to refer to good governance and to numerous regional characteristics affecting business performance but not to identification of any explicit causal relationship between economic performance and such regional characteristics. Thus, benchmarks and composite indices present relationships between inputs and outputs of competitive processes without much discussion of causality or the weighing of inputs. Prevailing critical discourses in this area have highlighted the distinctiveness of regional environments as limiting the utility of what is considered 'copy-and-paste' and 'one-size-fits-all' policy-making, as regional stakeholders purport to transfer perceived 'best practices' from one region to another (Huggins 2010). Concerning regional development, Malecki (2002) and Tracey and Clark (2003) have drawn attention to the potential importance of global networks as sources of goods and knowledge in shaping firm competitiveness in a particular area. This international relatedness, together with interregional networks, is precisely what is missing from current empirical studies of competitiveness in (European) regions. The international network dimension must be brought into analyses of regional competitiveness to distinguish localised from network growth determinants. At the same time, for this network focus to be productive, a measure of international trade competitiveness is needed that addresses the profound weaknesses of earlier measures, particularly those concerning symmetry of relations, treatment of regional specialisations, inclusion of the network dimension, and treatment of temporal changes in competition due to regional economic growth. In the recent book of Thissen et al (2013), such an indicator is introduced based on the revealed competition between regions.

Using the revealed competition between sectors in regions helps us to identify the degree of specific market overlap between regions on specific product markets. It is a way to more unambiguously determine which region competes with whom, in which product markets, and where. It brings network relation into the debate, contributing to the academic and policy discussion by overcoming the fact that, in the words of Bristow (2005, p.296), "all composite measures of regional competitiveness, particularly those that develop composite rankings, fall into the trap of trying to make comparisons across very different regional entities, without exploring the extent to which these places are

indeed competing with one another in tradable and commensurable markets in a manner measurable on a common scale".

To illustrate the empirical relevance of revealed competition between regions, we present the competitive pattern for the region of Eindhoven in 2000 in Figure 4.1. We leave domestic trade out of the figure, as it would dominate the trade pattern. The most important competitors of Eindhoven, specialized medium high-tech production (Philips, ASML) are regions in neighbouring countries and Europe's main agglomerations, i.e., Paris, Milan, and Munich.

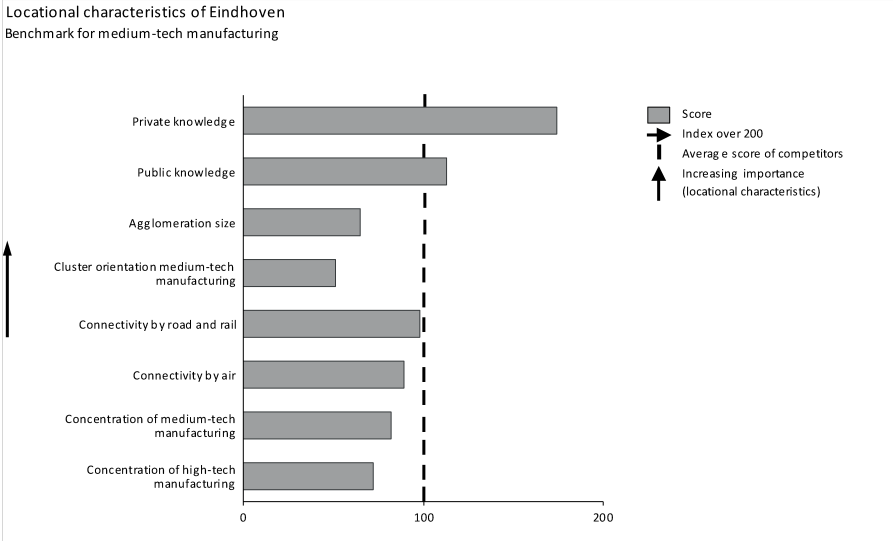
Figure 4.1: main competitors of Eindhoven region in medium high-tech manufacturing (the prime specialization of Eindhoven).



Once the "real competitors" (firms in regions operating on the same markets as Eindhoven firms do) have been identified, those real competitors can be compared with Eindhoven on location factors (figure 4.2 – only the most important factors out of approx.

75 are visualized). Compared to the average score of all relevant competitors, medium-tech firms in Eindhoven benefit less from agglomeration advantages (the competitors are located in larger urban regions) and from cluster orientations. In terms of private knowledge (Philips!), Eindhoven performs much better than their competitors do on average. This provides important clues for competitive advantages in smart specialization strategies, as it suggest for region-specific and industry-specific specializations which factors matter for a region's competitiveness. These kind of analyses will be performed for all our case regions (and in fact can be performed for most EU-regions), interpreting the results for policy makers. The investment made in the project to update the information into world trade consistent and longitudinal data, will enable us to analyze regional competitive advantages much more accurately than previously was the case.

Figure 4.2: Locational characteristics of Eindhoven – benchmark with medium-tech competitors (source Thissen et al. 2013, page 168)



A further application we will introduce in the empirical analysis of this work package concerns the relation of value chains with economic growth in regions. Economic growth is in general equivalent to producing and selling more products and services. This economic growth can have two distinct sources. It can be due to economic growth and demand from other regions, or it can be due to internal factors raising productivity. These internal factors that increase a region's competitiveness result in a gain in the market share of this region. In the case we represent the total economy as a large pie the first

source of regional economic growth is due to growth of the total pie, while the second source is due to a region gaining a larger share of the pie. The first source of regional growth cannot be influenced by the region's governments as it is due to the independent growth of a region's export destinations. The second source of regional growth is due to structural factors inducing an increase in market shares and thereby the result of an increase in a region's competitiveness. These structural factors can be influenced by the region itself. Demand induced growth (or decline) is beyond a region's sphere of influence. In other words, a region may perform excellent locally but go into recession because of a lack in demand from other regions. Vice versa it may be the case that a region underperforms but still grows due to external factors. In this last case a region would underperform relative to its potential. Obviously, this leads to important policy implications for smart-specialized regions: taking the network position into account – how "smart" are the specializations of our case regions?

Using longitudinal versions of the presented European regional trade data from 2000 and 2010 (other parts of the world are included in trade blocks, summing up to worldwide trade), figure 4.3 shows the decomposition of EU NUTS2-growth in the high-tech sector the specialization of Eindhoven), with Dutch regions indicated in red. Remarkably, Eindhoven is the far left red dot in the figure: despite a small positive demand-led growth effect in the period 2000-2010 (+5%), the region shows a relatively large negative structural effect (-39%) (see also table 4.1) representing a loss in market share in many regions. Other local specializations, like food processing, are associated with much better (positive) structural effects. Further analysis, using the final dataset made for this project, should reveal the robustness of these outcomes, also in relation to the resilience of the region for the current economic crisis.

Table 4.1 also clarifies to which international and European regions market shares are lost and gained. Our analysis will provide these insights for all case-regions. All values are presented in percentage of value added earned in the own region and are therefore completely in line with the global value chain analysis that also focuses on the income actually earned and not on the products being sold.

Figure 4.3: Decomposition of GDP in the Eindhoven high-tech sector: structural effect (market share) and demand effect.

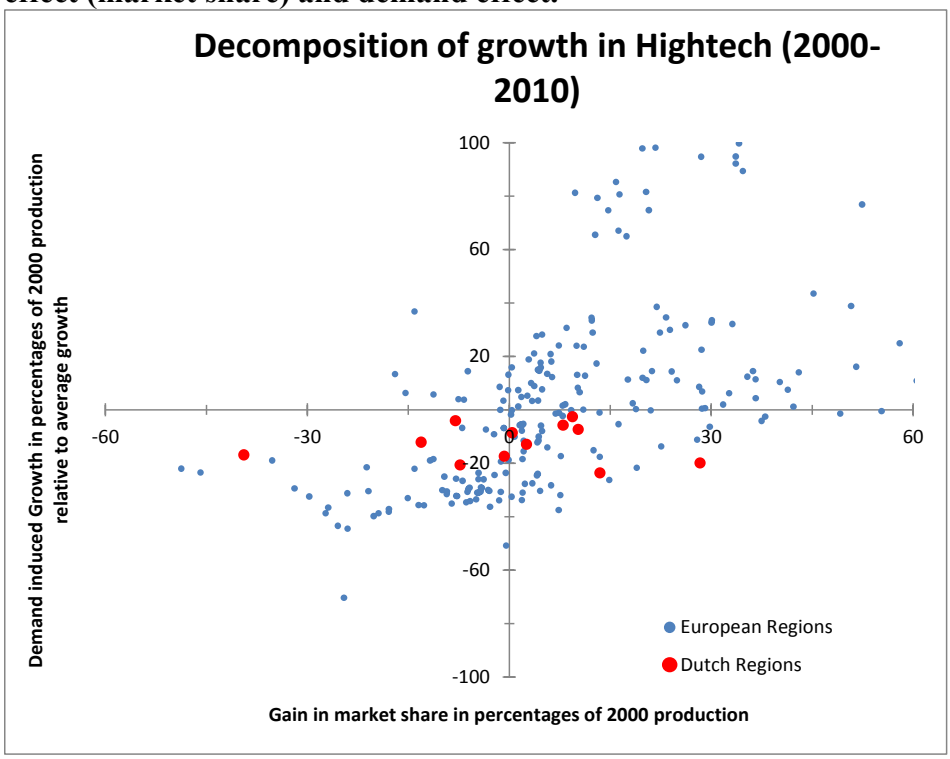


Table 4.1: Demand-induced and structural growth in the high-tech sector of Endhoven region.

North-Brabant-HIGHTECH GDP growth between 2000 and 2010 is -33,76% (European growth rate is 17,28%) - All figures are percentages of value added of this sector in this region						
	Type of growth				Competition growth	
	Demand induced		Structural		Structural	
	(total growth is 5,67%)		(total growth is -39,43%)		(total growth is -39,43%)	
rank	gain in	loss in	gain in	loss in	gain from	loss from
1	North-Brabant (3,38)	North-Holland (-4,06)	Stuttgart (0,16)	North-Brabant (-18,46)	China (0,18)	UnitedStates (-6,84)
2	Limburg (1,11)	South-Holland (-1,26)	Asia (0,13)	North-Holland (-6,47)	Praha (0,16)	South-Holland (-4,44)
3	Gelderland (0,85)	Utrecht (-0,95)	Africa (0,12)	South-Holland (-3,72)	ZapadneSlovensko (0,05)	Japan (-4,36)
4	Friesland (0,74)	UnitedStates (-0,15)	IledeFrance (0,08)	Gelderland (-3,08)	StredneSlovensko (0,03)	Limburg (-3,11)
5	Overijssel (0,68)	IledeFrance (-0,12)	Cataluna (0,08)	Utrecht (-2,01)	Bratislavskykraj (0,03)	Gelderland (-2,31)
6	Drenthe (0,42)	Stuttgart (-0,11)	ComunidaddeMadrid (0,08)	Overijssel (-1,76)	VychodneSlovensko (0,03)	Overijssel (-1,09)
7	Flevoland (0,4)	Vastsverige (-0,09)	RestofEurope (0,08)	Limburg (-1,49)	Galicia (0,03)	Friesland (-1,04)
8	Dusseldorf (0,39)	VlaamsBrabant (-0,07)	Arnsberg (0,07)	Groningen (-0,63)	Lietuva (0,03)	Drenthe (-0,67)
9	Munster (0,37)	BLimburg (-0,07)	Praha (0,06)	Drenthe (-0,35)	Mazowieckie (0,03)	SouthernandEastern (-0,65)
10	Groningen (0,37)	Lombardia (-0,05)	Severovychod (0,06)	UnitedStates (-0,34)	StredniCechy (0,03)	Asia (-0,57)
11	Koln (0,25)	EtelaSuomi (-0,04)	Darmstadt (0,06)	Friesland (-0,31)	Severovychod (0,03)	InnerLondon (-0,54)
12	Zeeland (0,18)	RhoneAlpes (-0,04)	Galicia (0,06)	Dusseldorf (-0,2)	Jihovychod (0,02)	BerkshireBucksandOxfordshire (-0,
13	Luneburg (0,18)	OostVlaanderen (-0,04)	VlaamsBrabant (0,06)	Flevoland (-0,17)	Malopolskie (0,02)	GloucestershireWiltshireandNorth
14	Thuringen (0,17)	ostraMellansverige (-0,04)	Karlsruhe (0,06)	Zeeland (-0,17)	Latvija (0,02)	Flevoland (-0,45)
15	BrandenburgSudwest (0,16)	InnerLondon (-0,04)	StredniCechy (0,06)	Munster (-0,16)	Slaskie (0,02)	OuterLondon (-0,44)

In order to understand the characteristics of the domain-structures in which entrepreneurial search processes take place, a second stream of our empirical work integrates two large and different datasets concerning value-chain relatedness. Firstly, we build detailed intra-EU interregional and disaggregated trade data using the datasets originally developed by Thissen et al. (2013). These data are then integrated with the

datasets available from the World Input-Output Database (WIOD), which has already been constructed at the University of Groningen. This later dataset provides extremely detailed trade and value-adding data at the international and global level, allowing for the decomposition of global value chains across countries. The WIOD analysis demonstrates that gross exports, both in terms of its level and its composition, does not tell much anymore about a country's competitiveness. The international fragmentation of production processes imply that the value of an exported product is no longer added in the exporting country only, but also in many other places, and this is also true for activities originating from other regions.

The WIOD evidence suggests that international production processes have started to become truly global, instead of being concentrated in a few big trade blocs. Within *Smartspec*, by linking interregional trade data with the WIOD data, we aim to see to what extent the value chains to which regions contribute are localized within countries, within trade blocs or truly global. With the data we are preparing, we will be able to distinguish between value chains for various types of products and also study the heterogeneous characteristics of these patterns. For smart specialisation this is very important because the geography of value-adding depends both on imports and exports, and using decomposition methods we should be able to determine which regional growth effects in which activities and sectors are associated with demand effects from outside the region from those which are associated with structural effects from inside the region. Then, following our interregional trade-structure and global value-chain approach, which explicitly accounts for all of the decomposition and spatial fragmentation of value-adding activities across space, our database and empirical work will lead to various direct outputs which are very useful for other *Smartspec* work streams and work packages (see also the example of Eindhoven introduced above).

(i) The integration of interregional trade data with the WIOD data should allow us to construct a set of indicators that measure bilateral trade dependence between regions and countries allowing for structural specialisation features as well as the international decomposition and fragmentation of value-adding activities.

(ii) The data will allow us to identify for individual EU regions which are their most important competitor regions, customer regions and supplier regions. Ultimately, it also allows regions to identify which are their most appropriate 'benchmark' regions in the context of increasingly complex trade and value chain evolutions, and allows us to move beyond simple benchmarking approaches based on a comparison on internal sectoral structures.

(iii) The trade matrices developed from this work stream should also be of use for inform the appropriate structure of the matrices employed to deal with issues of spatial dependence in the empirical models dealing with regional entrepreneurial characteristics.

(iv) Following the approach of Timmer et al. (2013) and extending this with the methodology of Thissen et al. (2013), we should be able to develop much more appropriate and meaningful indicators of regional competitiveness, and to develop a classification or taxonomy of regional types based on their global positioning.

(v) Following the suggested approach in the Eindhoven case presented above, we will be able to distinguish local, structural effects from demand-driven effects of growth. Only the former effects are subject to regional policy initiatives in the case of regional planning. Instead, interregional and network policies may be found appropriate as well.

Taken together, these five outputs should provide the most detailed information yet available regarding the trade-flow and value-adding network nature of the domain-structure in which regional entrepreneurial search processes operate.

To complement these data, we also aim to explore the possibility of using labour force survey data to allow us to examine the impacts of shifts in these trade-value-chain structures on different regional skills-sets and occupations, although the likely efficacy of this line of enquiry is not yet known.

5. Conclusions

These expected outputs from the quantitative and qualitative work stream highlight the explicitly outward-looking approach to smart specialisation as emphasised by the original proponents of the concept. From a smart specialisation policy perspective these outputs also ought to provide a greater awareness of the role which external demand effects as well as internal structural effects play in shaping the outcomes of regional entrepreneurial search processes. These qualitative and qualitative data are likely to impose a disciplinary pressure on regional smart specialisation strategies. For example, local innovation systems that mainly contribute to, and depend on, nationally localized value chains should design policies that are rather different from those regions that mainly contribute to international or even global chains. In contrast, local economic systems which are heavily intertwined with global value-chains may have to be more network-oriented and maybe less local than previously understood. The likely priorities here will centre on interregional and international network formation activities with other regions which are not necessarily in the same country or even geographically nearby. However, as well as building on the detailed data baselines the best ways for these smart specialisation strategies to proceed will also depend heavily on the institutional bottlenecks uncovered and equivalently on the institutional possibilities which are thereby identified.

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