SMARTSPEC

SMART SPECIALISATION FOR REGIONAL INNOVATION

Entrepreneurial Search Dynamics

Research Working Paper: Work Package 1

Deliverable 1.2

Philip McCann; John Goddard; Rob Huggins; Bart Los; Mikel Navarro; Frank van Oort; Mark Thissen; Paul Vallance; James Wilson,

January 2014

1. Background to the Issues Investigated by *Smartspec* Work Package 1

The reforms to EU Cohesion Policy implemented in the 2014-2020 programming period involved many different changes, instigating a major shift towards a more integrated and concentrated, a more thematic, and more results-oriented approach, all operating under the umbrella framework set out by the Europe2020 approach. As well as these broad changes of logic and orientation there are also many specific and legal changes to particular aspects of the policy framework and agenda including the use of conditionalities, a greater urban emphasis, and a shift away from grants and towards the greater use of financial instruments, amongst others (McCann 2015). This more strategic shift in the policy regarding not only the adoption of broader themes but also at the programme and project level also implies that policy decisions need to be based on very clear criteria.

Policy priortisation is always a thorny issue, because the influences on policy range from economic and financial influences to social, cultural and political influences. Policy decisions can often be made with several of these criteria in mind simultaneously. However, the incentive logic underpinning political decisions can often be mis-aligned with the regional economic development logic and this is particularly acute when it comes to the issues of resource concentration and the achievement of scale effects. There are two reasons for this. The first reason is that all political stakeholders will wish to receive some level of public funding from policy arenas in order to satisfy their constituents. However, this tends to lead to the dispersion and the resulting fragmentation of funding and this fragmentation can undermine efforts to concentrate resources. Therefore, finding ways to better align these incentives and decision-making logic in order to ensure resource concentration on key policy priorities is critical if the policy is to be successful. The second reason is that political decisions may not necessary choose policy-funding priorities which in economic terms are the most realistic, pragmatic and make the most sense. This is especially so if the most realistic and pragmatic choices are particularly eye-catching or visible in the short to medium term or imbued with an exciting narrative. In these cases there is little incentive for policy-makers to choose such pragmatic policy priorities because even if they are indeed successful their short or medium term political rewards may be minimal. Again, in these cases it is also essential to ensure that the policy-making choices incentives for policy-makers are aligned with the economic development imperatives of the region.

In order to address both the issue of resource concentration and also the issue of the appropriateness, realism and pragmatism of the chosen policy priorities, the reforms to EU Cohesion Policy have introduced the *smart specialisation conditionality* into the policy regulations. The reason is that the smart specialisation approach provides a powerful logic for framing and underpinning the difficult policy prioritisation process which all public policy-makers must engage in and which in today's economic climate face greater budget-constraint challenges than ever before. Because smart specialisation requires the building up of a robust and detailed local evidence-base designed to help inform policy decisions at each stage of the policy cycle, smart specialisation also helps to foster much greater self-awareness on the part of local and regional policy makers than other more politically-inspired development approaches.

The rather 'surprising' role and influence (Foray et al. 2011) that the smart specialisation approach has played in the reforming of EU Cohesion Policy is in part a result of timing, in that the approach offers a way forward for policy-makers to address policy-prioritisation challenges at a time of severe cut-backs in many EU regions. As such, the approach is both pertinent and timely. On the other hand, the influence of the approach is not so surprising in

that it reflects a confluence of ideas from many different fields (OECD 2013) - including economic geography, science and technology, policy studies, economics of innovation, and political science - which has led to a broad and wide-ranging consensus on the most appropriate framing of the new policy agenda. As Rodrik (2014) has recently explained, in certain situations and contexts good ideas can be sufficiently persuasive and powerful to break through logjams and to overcome the opposition of vested interests in order to bring about institutional change. The need for new ideas built on insights from a wide range of fields is especially important to break though institutional bottlenecks in a policy context such as regional policy, which tends to be characterised by the interactions between multiple different stakeholders and actors and where the interests of many different constituencies need to be considered and addressed.

As is by now well-known, the policy-prioritisation framework known as *smart specialisation* emerged originally out of specific observations of the structural and economic weaknesses exhibited by many of Europe's regions and member states. The insights of a EU commission of economists and technology advisers known as the "Knowledge for Growth Expert Group"[1] were particularly important in responding to the concerns which had been mounting over many years regarding the apparent under-performance of many parts of Europe during the 1990s and early 2000s relative to the North American economies, at a time when the EU Single Market would have been expected by many observers to have been associated with enhanced growth. The evidence and insights of this group pointed to structural weakness in the EU economies in terms of the ability of EU firms, industries and regions to adopt and adapt new technologies, new ideas and new innovations, into a wider set of new activities, and these problems were particularly acute when it comes to new information technologies. Yet, why this EU structural weakness was evident was central to the work of the expert advisory commission and their major insight that they arrived at based on the case-study and empirical evidence they had gathered was that in comparison to the North American economy, there are greater mis-alignments and mis-matches within EU regions and member states in terms of knowledge-transmission mechanisms between different firms, different sectors, different institutions and importantly different policy-settings (Foray et al. 2009; David et al. 2009).

The observation and identification of these structural weaknesses then acted as the catalyst for the expert group of advisors to develop an analytical framework designed to help European member states and regions to better overcome these mis-matches and to better foster more rapid and effective processes of knowledge and technology diffusion throughout the wider EU economic system. The analytical framework they developed is known as 'smart specialisation' (Foray et al. 2009; David et al. 2009). The original smart specialisation framework in some sense is rather conceptual and theoretical but within a few short steps can be demonstrated to quickly and easily translate into a practical and pragmatic way of thinking, well-suited to policy prioritisation debates.

Somewhat differently to previous development models, the smart specialisation approach aims to shift the emphasis away from prioritising the importance of new industries and sectors and also large firms and enterprises, and towards the technological enhancement and the upgrading of *existing* systems of activities, as being critical for growth. Moreover, the emphasis also shifts very much towards the importance of small and medium sized firms and their potential for driving development not only as a group, but also by their ability to reinvigorate other large firms via their links with these larger enterprises.

---

[1] http://ec.europa.eu/invest-in-research/monitoring/knowledge_en.htm

In conceptual terms, the smart specialisation logic is explicitly framed within a systems-type mode of thinking. This type of analytical approach is nowadays central in many discussions about issues such as entrepreneurship, innovation, competitiveness and technology-transfer, as well as issues concerning ecological and environmental issues. Indeed, the environmental approach is reflected by the fact that the smart specialisation approach begins by assuming that the knowledge-transmission mechanisms linking the spread of ideas, innovations and technology all operate within a 'knowledge ecology' context, or in more recent terminology, a 'knowledge ecosystem' context. Within this context, smart specialisation puts the link between entrepreneurship and innovation as being the central feature driving the economy. To this end the smart specialisation approach contends that promoting widespread and successful *entrepreneurial search processes* must be the central key feature of any regional or national growth and development strategy. The reason is that a wide array of entrepreneurial search processes will maximise the likelihood that entrepreneurial actions will result in innovations and facilitating such search processes is what development policy needs to prioritise this over all other issues. For these entrepreneurial search processes to result in the most significant impacts it is necessary to aim for entrepreneurial and innovative breakthroughs in those particular types of activities which are able to take advantage off, and hopefully leverage off, realistic opportunities for achieving scale. In the smart specialisation framework these realistic scale opportunities which entrepreneurial actions are able to leverage off, are known as the *relevant domain*. At the same time, in order to foster new pathways in which entrepreneurial search processes may operate as well as to stimulate both learning and technology diffusion, it is essential to build network *connectedness*. This network connectedness can be with other knowledge centres and is particularly important in contexts when it comes to innovation 'followers' rather than 'leader' regions. A concise way of understanding the different roles which each of these elements play in the 'knowledge ecology' system-type of framework is that the entrepreneurial search processes reflect the *distribution* of likely opportunities for turning entrepreneurial actions to innovations, the relevant scale captures the likely *magnitude* of the impacts associated with these opportunities, and the level of connectedness reflects the likely learning potential about such opportunities.

As mentioned above, and rather differently to many of the growth and development models popular in the 1990s which tended to popularise and prioritise new technology and high technology sectors over all others, the smart specialisation logic argues for innovation-promotion via the entrepreneurial actions aimed at the technological upgrading and differentiation of an economy's existing activities. This technological upgrading implies that there must be a process of diversification around the core and specialist areas in which the economy already exhibits scale and experience. At the same time, as with all systems-types of approaches, the emphasis of the smart specialisation logic tends to be on the weaker rather than just the stronger elements in the systems, because the strength of the overall systems is only as strong as its weakest link.

The original smart specialisation concept was entirely aspatial in its construction. However, it became increasingly apparent to the originators of the idea that it had meaningful and strong implications for spatial and regional questions. The work of the expert group found that many policies in European regions in particular were severely hampered by a lack of alignment or coordination between policies, and a lack of a clear vision regarding how different policies were supposed to dovetail together in order to achieve an overall set of goals. More specifically, in many cases the policy settings appeared to pay little or no real heed to the local economic conditions or the local economic context. A systems approach to innovation tends to emphasise that the overall system strength is heavily restricted by the weakest link in

the system and therefore in terms of fostering the links between entrepreneurship and innovation a widespread lack of policy coherence and a disconnection between policy-settings and the local economic realities is understood as automatically weakening and limiting the effectiveness of any policy actions or interventions. These arguments chime with the insights of other high-level research which suggests that so many of the processes driving entrepreneurship[2] and innovation are inherently local in nature (World Bank 2010; Morreti 2013; Hughes 2012), and conversely many of the factors inhibiting the ability of policy frameworks in Europe to promote entrepreneurship and innovation are also likely to be local in nature.

If we then apply these ideas in a spatial and regional setting, the smart specialisation approach potentially provides a workable approach to help a region to enhance its existing technological and skills profile in a practical manner which is based on its industrial fabric. Differently to previous growth models, the smart specialisation logic does not imply or argue for greater sectoral specialisation, nor does it advocate the prioritisation of high technology sectors, but instead argues for strategic and specialised diversification around a core sets of activities, technologies, skills and themes (McCann and Ortega-Argilés 2014) in which the promotion of entrepreneurship and innovation amongst SMEs is a key focus.

Yet, operationalising the smart specialisation approach into a workable policy framework which is suitable for specifically regional issues requires us to translate the aspatial conceptual elements into their explicitly spatial counterparts and this is essential for two reasons. Firstly, as the OECD have argued, although most of the elements contained in the smart specialisation approach were already evident in the international scientific literature, they were distributed in a scattered and fragmented across different literatures and as such there was no real overall framework for pulling together and organising these elements into a coherent schema which can then be operationalised (OECD 2013). Moreover, this is also the case with the explicitly geographical and regional literatures, which already contained many of these elements evident in the aspatial smart specialisation approach, but again in a rather scattered and fragmented manner. Therefore, in order to convert the original aspatial smart specialisation conceptual structure into a framework amenable to addressing regional issues it is necessary to translate the key aspatial elements of the smart specialization framework into their explicitly spatial and geographical analogues. Doing this implies that at the regional level smart specialisation policies are characterised by the technological upgrading of locality's existing activities and industries, and this is to be achieved by focusing on and building upon a region's features of *embeddedness*, *relatedness* and *connectivity* (McCann and Ortega-Argilés 2014). These three concepts, namely *embeddedness*, *relatedness* and *connectivity*, all of which are already well-known in the literature on economic geography and regional economics, together map directly onto the aspatial smart specialisation elements of *relevant domain* and *connectedness*, and therefore directly translate the aspatial construct into a workable model amenable to the design of regional policy interventions.

The concept of *embeddeness* is widely used in the economic geography literature and reflects the scale of, or extent to which, an activity, a technology, an enterprise, a firm, an institution, or an industry, is engaged with other actors and institutions in the region. In other words, embeddedness captures the depth, the scale and the range and breadth of the various types of different roots which activities, technologies, firms or other institutions exhibit in the local economy. The fact that the concept of embeddeness can be applied to such a broad range of

actors and institutions also implies that the ways in which engagement embeddedness may be captured and measured are also likely to differ.

The concept of *relatedness* captures the extent to which a new technology, a new innovation or a new skill-set is linked or is similar to the existing technological profile or the existing skills profile of an economy (Frenken et al. 2007; Boschma and Frenken 2011; Boschma and Iammarino 2009; Boschma et al. 2012; Neffke et al. 2011). The relatedness concept emerged from evolutionary economics and from evolutionary economic geography lines of thinking and is essentially a Darwinian-type framework, The key point about the relatedness idea is that economies appear to develop in the most successful manner via what is known as *related variety* (Frenken et al. 2007), in other words by diversifying around those technologies, activities and skills-sets in which they are already well-represented or in which they already have a strong presence or competence. This argument, which is essentially Darwinian in nature, provides an important and alternative viewpoint regarding whether local, regional and urban growth is better suited by sectoral specialisation or diversity, a debate which has continued for more than two decades with little or no real resolution (de Groot et al. 2008; Beaudry and Schiffauerova 2009). In contrast, empirical evidence now provides widespread support (Frenken et al. 2007; Boschma and Frenken 2011; Boschma and Iammarino 2009; Boschma et al. 2012; Neffke et al. 2011) for the argument that economies develop more successfully over the medium and long-term when they diversify into activities or areas which are close to their existing sets of activities, technologies and skills-sets in which the economy already exhibits experience, expertise and scale. Moreover, these features appear to be even more noticeable at the level of the region than at the level of the country (Boschma et al. 2012).

The final concept which is already well-rehearsed in the economic geography literature and which is required to translate the aspatial smart specialisation model into an explicitly spatial and regional framework is that of *connectivity*. Connectivity is a sociological concept which emerged in the 'global cities' literature and which reflects all of the flows passing through a specific locality and the market potential and accessibility properties of the flows. These flows include flows of knowledge, flows of money, flows of goods, flows of services, but also critically, the flows of decision-making power and the autonomy and ability to act on those decision by those people situated in flowing through the locality (McCann and Ortega-Argilés 2014). Connectivity is a broader concept than the concept of 'connectedness' as used in the original smart specialisation schema because not only does it include network interactions and face-to-face contact but also it embodies the ability to act on those interactions for one's own gainful advantage. One of the key insights derived from economic geography of connectivity is that there are significant imbalances between places - between cities, regions and localities – not only in terms of network accessibility and market potential but also in terms of the decision-making capability and autonomy to successfully influence and respond to those differences. Greater connectivity between regions may foster increased learning on the part of follower or more peripheral regions but at the same time also increasingly exposes these weaker regions to increased competition from stronger regions. Overall the effects on a follower or more peripheral region of increased connectivity depends on the balance between these two potentially opposing forces. In some extreme cases greater connectivity can lead to entirely adverse competition effects, a phenomenon known as the 'Krugman shadow' effect (McCann and Ortega-Argilés 2014).

From a local and regional perspective the smart specialisation logic argues that in order to best foster local development through technological upgrading, localities and regions should be encouraged to upgrade their skills, technology and activity bases by diversifying in a

strategic and specialised manner around those technologies, skills sets and activities which are already well embedded in the region and in which the region already potentially exhibits scale properties. This also implies the need for strengthening and widening existing local knowledge and institutional linkages and this latter point is extremely important for three main reasons. Firstly, the mis-alignment or lack of congruence in local knowledge and institutional linkages will inhibit efforts aimed at enhancing diversification or promoting scale efforts and these need to be rectified or re-defined in order for development to proceed. Secondly, the building up of local knowledge and institutional linkages is essential in order to protect a follower or weaker region from the agglomeration 'shadow' effect as it becomes increasingly engaged with the wider national and global economy. Thirdly, a regional smart specialisation strategy would also require that the strongest and deepest possible local knowledge networks are developed in order to build up local institutional capabilities from a bottom-up perspective. The quality and efficacy of a local policy schema can only be as good as the institutions designing and delivering the policy and therefore fostering the governance capability to deliver such policies is essential. However, the capabilities for delivering such policies can only be discovered (Haussmann and Rodrik 2003) and acquired via 'learning by doing' and therefore trialing and experimentation are an essential features of these policy approaches, not only in order to identify what works in each case (Hughes 2012), but also learning on the part of governance institutions how such a policy approach works. In particular, the emphasis on building up detailed evidence and data baselines within which initial policy prioritisation discussions can be framed, as well as the gathering of data to allow for the ongoing monitoring and ex post evaluation of the policies, are features which local government actors can only gain experience by actually doing.

In order to be able to develop such policies and policy-approaches it is essential also to develop cooperation and partnership amongst different local actors and this also requires the building up of trust. In reality, however, building up the types of deep and widespread knowledge networks between local actors can sometimes be more difficult than network-building between actors in different countries or regions. The reason is that local actors are often in competition with each other for local resources whereas distant actors are much less likely to be so. As such, the linking-up with actors in other countries or regions generally tends to avoid many of the aspects of rivalry which often operate locally, and as such often represent knowledge network-building on a somewhat easier and rather more superficial level than those which are required at the local level. The building up of local knowledge networks in reality requires a great deal of trust-building and in order to facilitate these processes non-political actors such as universities or civil society institutions can play a crucial role in helping to foster engagement and cooperation between local firms, government. Yet, engagement also has many dimensions to it. It can be largely passive and or active in nature, and engagement also varies between being facilitating or inhibiting in nature, and in each case the details depend on the systems of institutional incentives which are prevailing. Narratives around institutional thickness' largely fail to deal with the complexity of these issues and much more detailed analyses are required addressing the specific links in the regional innovation system chains.

The various projects undertaken as part of *Smartspec* Work Package 1 each aim to identify and evaluate the magnitude, the strengths and the weaknesses of each of the entrepreneurial search process, *relevant scale* and *connectivity* dimensions and mechanisms contained within the smart specialisation framework.

The dynamics of entrepreneurial search processes can be captures via related variety, firm demographic change and entrepreneurial 'churn'. As already mentioned above, in the

explicitly geographical version of the smart specialisation framework the concept of *relevant scale* embodies issues of both related variety and *embeddedness*, and related variety can be captured in various different ways, including in terms of new technologies, new products, or new skills distributions. *Embeddedness* can be captured according to various different dimensions including local income and expenditure multipliers, supply-chain linkages, longevity and stability of local relations, investment in local social capital, and joint-lobbying activities on the part of the regional or local actor. Each of these different aspects of embeddedness is captured by reflected by different forms of evidence, which can be either monetary, structural, social or institutional. Similarly, *connectivity* can be captured by trade-related linkages but also by the scale and diversity of research-related, commercial linkages between actors and institutions, both locally and outside of the region. In other words, connectivity can also be captures via monetary, structural, social or institutional measures.

The team from Groningen-Utrecht building the trade and demand-based datasets which allow us to identify and evaluate the *monetary* degrees of trade-related and demand related levels of embeddedness and connectivity exhibited by each region.

The team from Groningen-Utrecht-Lund are undertaking the analyses of the features of entrepreneurial search processes using econometric models of related variety, firm demographics, and entrepreneurial start-ups. The evidence here of entrepreneurial search processes is primarily *structural* in nature.

The team from Cardiff is analysing the research-related linkages and engagement activities between networks of universities and firms and the indicators of embeddedness and connectivity can be either monetary or structural in nature.

Meanwhile, the teams from Newcastle and the Basque Country are examining the potential role played by different governance systems and actors including universities as facilitators and mediators of regional knowledge networks. The indicators of connectivity and embeddedness uncovered here are primarily socio-structural in nature.

2. Related and unrelated variety in follower/leader regions in Europe

The institutional and policy reforms that are necessary for a smart specialisation policy agenda has to be proceeded by well-informed and identified smart specialisation opportunities and preconditions. One may argue that every European region inhibits entrepreneurial and innovative development opportunities and that unique and smart cases of such can be developed everywhere, as many examples in Foray's recent book *Smart Specialisation* (2014) in first instance suggest – even or especially in nowadays lagging regions in Eastern and Southern Europe. As Foray (2014, p.66) describes it: "smart specialisation is not only for the best regions; just the opposite. It is a unique stairway to excellence for the less developed and transition regions". This promises a lot and would indeed be a breakthrough in the current impasse of dominating local policies competing on the short term for scarce resources that occurs all over Europe. More precisely, Foray (p.65) states that "the smart specialisation strategy seeks to avoid hindering relative positions between followers and leaders with the less advanced regions being locked into the development of applications and incremental innovations. Of course smart specialization does not have magical properties to transform laggards into global leaders. However, at the very least, a smart specialisation strategy transforms less advanced regions into good followers: a region in transition that is building capabilities and agglomerating knowledge resources in a certain domain of application,

enabling to capture knowledge spillovers from the leaders, attracts further knowledge assets and develops an ecosystem of innovation with the prospect of becoming a leader – not in inventing the generic technology, but in co-inventing specific applications".

This part of WP1 activities tries to systematically identify possible opportunities and preconditions using (spatial) econometric research techniques and detailed quantitative data on entrepreneurship, start-ups and firm demographies as entrepreneurial ecosystems, diversification opportunities of regional industrial compositions and specialisations (related variety), leader versus followers identification, and the influence of institutional arrangement and factors on these issues. Bringing these building blocks of smart specialisation to light using their complementary relations in a pan-European perspective is a challenge for at least two reasons. First, it requires detailed regional and longitudinal data on these issues that was at the start of this project not systematically available. Much time was therefore devoted to collect, clean and combine appropriate firm-level micro-data. Second, systematically and consistently measuring of these themes over European regions still means that, despite detailed micro-data, not all regional level contingent and important (intangible asset) conditions for successful strategies can be measured identified. But for regional and European level policymakers, reliable information on exactly those issues is inevitable and necessary in order to construct and compare evidence-based strategies. It does require openness from policymakers to the way of thinking that is introduced, because it is not common yet to approach regional growth opportunities from institutional and evolutionary perspectives (instead, absolute competitive advantages, clusters and local agglomeration are more commonly used for policy purposes). In this section we present the outcomes of for this project conducted analyses concerning related and unrelated variety on a pan-European scale (to be published in Van Oort et al. 2015 and Cortinovis & Van Oort 2015), presenting important conclusions that fuel the study and governance of regional diversification opportunities, entrepreneurial ecosystems, the role of institutions, the simultaneous role of economic networks (taken up in the next section) and the important distinction in leader and follower regions in this WP1. We highlight at the end of this section how we proceed to unify the various dimensions of specialisation, entrepreneurial search, institutions and knowledge in coming analyses. As mentioned, all these analyses focus on the structural setup of regional economies.

2.1 From elusive to key – related and unrelated variety in the agglomeration debate

Agglomeration economies in relation to urban and regional growth are receiving attention in an ever-burgeoning literature on its causes, magnitude and (policy) consequences. This rise of agglomeration economies in economic and geographical studies has met much criticism (McCann and Van Oort 2009). Some observers have argued that the modern treatment of agglomeration economies and regional growth in fact represents a rediscovery by economists of well-rehearsed concepts and ideas with a long pedigree in economic geography. Several criticisms of the monopolistic modelling logic underpinning New Economic Geography have come from economic geography schools of thought and from both orthodox and heterodox schools of economics. Conversely, advocates of relatively new economic approaches, such as institutional economics and evolutionary economic geography, argue that their analyses do provide insights into spatial economic phenomena that were previously unattainable under existing analytical frameworks and toolkits. Smart specialisation as a conceptual framework strongly builds on exactly these toolkits.

A prime example of potential gains of different theories and conceptual frameworks is the specialisation-diversity debate in the urban economics and economic geography literatures.

Should regions and cities specialise in certain products or technologies to locally gain from economies of scale (in so-called clusters), shared labour markets and input-output relations, or should regions diversify over various products and industries and hence have both growth opportunities from inter-industry spill-overs as well as portfolio advantages that hedge a regional economy in times of economic turmoil? This question has captured the attention of many researchers over the last two decades. That the specialisation-diversity issue is not an "either-or" question has now been concluded by two meta-studies and an extensive overview of all published empirical analyses on this matter (De Groot et al. 2009, Melo et al. 2009, Beaudry and Schiffauerova 2009). From these three overviews, it becomes clear that the debate appears to become an unproductive line of argument in addressing the nature, magnitude and determinants of agglomeration externalities (see also Desrochers & Leppald 2011). The answer to the "either-or" diversity-specialisation question is at best inconclusive, with outcomes being dependent on measurement in many respects (e.g., scale, composition, context, period, type of performance indicators). Aside from these methodological issues, the many tests provided do not actually measure knowledge transfer or knowledge spill-overs (Van Oort & Lambooy 2014) – one of the main mechanisms supposingly driving agglomeration economies **and** smart specialisation opportunities.

The divergence observed in the literature concerning diversification and specialisation is most likely related to the weak conceptualisation and limited theoretical underpinning of the concepts. New theoretical developments in institutional and evolutionary economic geography have recently emerged, offering heterodox economic explanations for the regional economic development and the role of relatedness and diversification (Boschma and Martin 2010). For economic geographers, as well as institutional and evolutionary economists working in this tradition, cultural and cognitive proximity are deemed to be equally as important as geographical proximity in the transmission of ideas and knowledge (Boschma 2005). Boschma and Lambooy (1999) further argue that the generation of local externalities are also crucially linked to the importance of variety and selection in terms of the 'fitness' or embeddedness of a local milieu. The now-burgeoning tradition in evolutionary economic geography has prompted the question of whether concepts of diversification and specialisation may fully capture the complex role of variety within the capitalist economy. This development has led to a recent revival of interest in the role of specific forms of variety, specifically related and unrelated variety. 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 highly related when they are closer to each other within the SIC classification system, within value-chains with subcontracting relations, within skill-related labour markets, or in networks of co-invention – all important aspects of smart specialisation conditions (Foray 2014). Unrelated variety is not the reciprocal of related variety – it conceptualises the fact that regions specialised in various industries on a broad level have portfolio or resilience advantages in the sense that shocks in one industry have not immediate negative effects in other industries. Both related and unrelated variety in principle lead to positive outcomes for regional development opportunities. Most studies using this conceptualisation 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 by entrepreneurial search processes) in a first stage, and process innovation (and more

productivity growth) in a second stage of clusters and mature specialization, when the dominant technological model of an industry is fixed. 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. This literature thus provides us with a simultaneous framework of related variety (as innovative diversification opportunity), unrelated variety (as portfolio opportunity), life cycles of industries and economic growth. Prior to the WP1 analyses, these concepts have been tested only across regions within countries (there is a rapid growing number of studies, see Van Oort et al 2014) and no pan-European test was provided due to data limitations. This part of the research paper provides the conclusions and implications of first pan-European tests of these concepts carried out in WP1.

2.2 From micro-data to informative outcomes

The econometrical analyses in Van Oort et al (2015) and Cortinovis and Van Oort (2015) test the relationship of productivity growth, employment growth and unemployment growth between 2000 and 2010 in European regions with related and unrelated variety, controlling for other important factors, and varying over urban sizes as well as over leader versus follower regions. Measuring diversification over sectors in regional economies is sensitive to the indicator applied. We applied an entropy measure with the advantage that entropy can be decomposed at each sectoral digit level. The decomposable nature of entropy implies that variety at several digit levels can enter a regression analysis without causing collinearity. In the context of measuring regional variety to analyse the effects on growth, decomposition is informative, as one expects entropy/variety at a high level of sector aggregation to have the portfolio effect on the regional economy, protecting it from unemployment, whereas one expects entropy/variety at a low level of sector aggregation to generate crossovers, knowledge spill-overs and employment growth. Put differently, entropy at a high level of sector aggregation measures unrelated variety, whereas entropy at a low level of sector aggregation measures related variety. We use geo-coded AMADEUS micro-data (provided by Bureau van Dijk and checked and cleaned extensively) on European firms aggregated into European NUTS2 regions as a source for the calculation of related and unrelated variety. Because small firms are underrepresented in this database, firm level data are weighted by turnover and employment values. This approach allows us to best capture the large and sectorally heterogeneous regional economies in Europe. Van Oort et al. (2015) apply a cross-sectional model to these data, while Cortinovis and Van Oort (2015) exploit the longitudinal panel structure of the data. Maps of the variables show that related variety is more attached to highly urbanised regions than unrelated variety.

The analyses in Van Oort et al (2015) show that on a European scale:
  (a) Related variety and employment growth are positively correlated in all specifications, suggesting that innovative process in industry life cycles may open up new markets with new job opportunities;
  (b) This relation of related variety and employment growth is especially important for medium-sized urban regions ("second-tier cities") in Europe, stressing the polycentric character of Europe. Perhaps due to agglomeration disadvantages, the largest urban regions do not show the highest employment growth rates (compare Dijkstra et al. 2013);
  (c) This marked regional heterogeneity indicates that micro-economic processes play out differently in different types of regions, thereby confirming that European place-based

policy strategies may play an important role for regional development alongside place-neutral (people-based) policy strategies (compare Barca et al 2013);

(d) Mature industrial and business service specialization and productivity growth are positively related, confirming clustering and life-cycle theories;

(e) The hypothesised relationship between unemployment growth and unrelated variety is not confirmed in our first pan-European exercise. This finding suggests that national regulations and institutions in Europe cause the pan-European model to deviate from national models.

In addition, Cortinovis and Van Oort et al (2015) using panel data analyses show that on a European scale:

(f) Controlling for more unobserved heterogeneity exploiting the panel structure of the data confirms the most important conclusions on related variety;

(g) But related variety and employment growth are correlated **exclusively** in high- and medium-tech regions, so-called leader regions. This confirms the worries for the generative and absorptive innovative capacities of non-leader or follower regions expressed by Rodriguez-Pose et al (2013) and Foray (2014);

2.3 Integrating networks, entrepreneurial ecosystems and institutions

These analyses show that conceptual renewal in line with the smart-specialisation narrative may represent a fruitful and exciting way to advance the debate on agglomeration and spatial heterogeneity in light of European reforms and policy formulations. More detailed analyses on entrepreneurial search and the influence of institutions will be integrated in WP1 in the near future. The micro-data of the AMADEUS dataset used in the (un)related variety analyses are one longitudinal source of entrepreneurial dynamics that can fuel firm demography statistics, although smaller firms are underrepresented in these data. Therefore, data will be complemented with Eurostat ABS-data and possibly GEM-data (see Van Oort & Bosma 2013 for an application of aggregated GEM-data to European regions also using related and unrelated variety as variables). Because the entrepreneurial micro-level is obviously important for the entrepreneurial search theme, collecting, checking and cleaning these data take even more time than the data applied in the related and unrelated variety analyses. Integrating institutions in the analyses of relatedness will be done by exploiting the longitudinal character of the AMADEUS and PBL/WIO regional trade data (to be discussed in the next section) on regional branching of the economy into emerging, growing and dissolving industries (compare Neffke et al. 2011). This analysis will focus on the Varieties of Capitalism conceptualisation and apply this to regional industrial renewal and diversification in European regions. In a first paper, Boschma & Capone (2014) performed an European country-level analysis, explaining that the Varieties of Capitalism literature has drawn little attention to industrial renewal and diversification, while the related diversification literature (like the related and unrelated variety analyses performed for WP1) has neglected the institutional dimension of industrial change. Bringing together both literatures, the paper by Boschma & Capone (2014) proposes that institutions have an impact on the direction of the diversification process, in particular on whether countries gain a comparative advantage in new sectors that are close or far from what is already part of their existing industrial structure. They investigate the diversification process in 23 developed countries by means of detailed product trade data in the period 1995-2010. The results show that relatedness is a stronger driver of diversification into new products in coordinated market economies, while liberal market economies show a higher probability to move in more unrelated industries: their

overarching institutional framework gives countries more freedom to make a jump in their industrial evolution. In particular, it is found that the role of relatedness as driver of diversification into new sectors is stronger in the presence of institutions that focus more on 'non-market' coordination in the domains of labour relations, corporate governance relations, product market relations, and inter-firm relations. This analyses will be spread out to the regional level (including regions in less developed countries) comparable to the related and unrelated variety analyses and introducing a variety of institutional quality indicators on the regional level (compare Charron et al. 2014) by the UU researchers of WP1 early 2015.

3. The evaluation of regional strengths in embedded networks

The important issue of leader and follower (less developed) regions will simultaneously be taken up in the network analyses of WP1. As Foray (2014, p.66-67) rightly sates: "The most peripheral and less advanced regions will be in difficulty when it comes to developing a smart specialisation strategy. The lack of entrepreneurial capacities and the weakness of institutions will combine to make the process uncertain and almost impossible. However, it cannot be disputed that these regions, more so than others, need structural transformation of certain sectors towards new markets". These regions may be better off by connection to external knowledge reservoirs via networks. Roderiguez-Pose et al. (2013) argue that the pipeline option may indeed be preferred over the local buzz option. Foray (2014, p.67) on this argues that "the mobilisation of external resources is obviously a good idea and the logic of smart specialisation certainly does not reject it. Connections and pipelines are part of the panoply of instruments allowing the initiation and support of new activities in a particular region. However, the idea of local concentration of resources and skills remains valid and fundamental if we want there to be a receiver at the end of the pipeline. This is the absorptive capacity theory. This suggests that 'clusters versus pipeline' is not a debate. These options are complementary and must be mobilised simultaneously to allow the new speciality to develop". On order to identify pipeline opportunities though, economic and knowledge network connectivity of European regions had to be measured over time, and related to the interregional and international trade and value-chain impacts of the entrepreneurial and technological dynamics analysed in the other studies op WP1. By assessing inter-regional trade flows and value-chain feedbacks the study will examine the links between the embeddedness and connectivity on a region's activities and the real value return from different investment choices. Overall, the trade and demand-based datasets for embeddedness and connectivity provide intelligence on the smart specialisation options available to the regions of Europe.

To test network dependencies, a database is needed that adequately describes the regional monetary interactions between different economic agents such as firms, government and consumers in a framework consistent with the National Accounts. A vast amount of time in WP1 was used to develop such a database since it was not available at the start of the project. This new dataset is an integration of both the regional trade oriented PBL database (Thissen et al. 2013 and 2014) with the WIOD database, complemented with additional regional accounts data. The result of this large data research project is a database that consists of European regional (NUTS2) supply and use tables that are completely consistent with the WIOD database. The construction of the dataset implied a new approach to determine re-export flows that significantly affected the regional trade relatedness on the country level compared to not national account consistent and not re-export corrected trade data (Lankhuizen and Thissen, 2014).

At the end of 2014 the first version of the new dataset is available and a start is made to identify and evaluate the monetary degrees of trade-related and demand related (and in its slipstream, also knowledge related) levels of embeddedness and connectivity exhibited by each region. To properly evaluate the performance of different firms in European embedded regions a new approach was developed to decompose economic growth in a demand and a structural component (reported in detail in Thissen et al (2015). Economic growth is equivalent with producing and selling more or better products and services. This economic growth can be due to economic growth accompanied with increasing demand from other regions, or it can be due to region-internal factors raising productivity and a region's competitive position. As a result, a region may implement excellent regional policies and relatively outperform many other regions in this while having an overall negative growth rate caused by a collapse in demand from other regions. The economic crisis in Europe that started with the banking crisis in 2008 and still continues into 2014/2015 is an illustration of such negative interregional demand spillovers. We therefore have to distinguish between regional growth that is the result of an increase in demand in other parts of the world, and growth that is due to a change in local structural factors strengthening a region's competitiveness and increasing its productivity and market share. Only raising the competitiveness of a region can be influenced by regional economic policy and is therefore central in a regional economic smart specialization policy strategy. This is in clear logic with the smart specialisation conceptualisations.

The preliminary results of the interregional monetary trade network data show that the maximum effect of regional (structural) policy on economic growth is only 30 percent of total economic growth. In other words, 70 percent of local economic growth is beyond the control of the local policy maker and stems from interregional, global demand effects. The growth decomposition gives also very precise information on winning and losing competitors on the specific markets that a sector in a region is active. It shows us that the general picture is only of limited use giving policy advise. Winning regions may not be a good example for other regions since they may be active in very different markets. Detailed analysis shows that taking the market area into account is crucial for distinguishing among good and bad policy examples to learn form (Thissen et al. 2013).

This brings us to an important conclusion. The growth decomposition shows that with regard to policy only one size fits one. Although there are general economic processes, they operate in specific (geographical and product) markets that therefore require location specific policies. We find that regional economic development differs strongly among sectors and regions with a strong geographical component in the location of growth. Growth does not only take place in size-based classes of the largest conurbations or the medium-sized regions, but in regions that have specific characteristics or are imbedded in typical and unique networks. The specific characteristics of these regions depend on, for instance, the sector under investigation. These results support European place-based policy strategies more than place-neutral ones – based on the interplay of local and network advantages of regions simultaneously.

Growth of production may be may be not only the result of increased sales but also the result of an increase in the price of intermediate goods and thereby production costs. Moreover, large sales (or exports) of regions may result in large increases in intermediate demand leaking to other regions without much value added being earned in a region. As a consequence the growth in the value of production or demand is not representative for the actual growth of regional GDP. It is therefore important to calculate the associated value added and following the value added chains to adequately determine a regions economic most

important sectors. The analysis of value (added) chains is on the research agenda for Smartspec project in 2015.

4. Knowledge Networks and Smart Specialisation

An emerging stream of work from the study suggests that the relationship between entrepreneurship, innovation and regional economic growth is governed by a series of network dynamics relating to: (1) the nature of the firms established by entrepreneurs; (2) the nature of the knowledge accessed by firms; and (3) the spatial nature of the networks existing between those accessing and sourcing knowledge. In particular, early findings indicate that the nature of the knowledge networks held by firms is a key driver of regional rates of innovation and subsequently growth. Furthermore, preliminary evidence suggests that a key determinant of regional innovation and growth differentials is the capability and capacity of firms within regions to establish the *network capital* required to innovate in an increasingly open environment. In this case, network capital is defined as consisting of investments in strategic and calculative relations with other firms and organizations in order to gain access to knowledge to enhance expected economic returns, principally via innovation. In this sense, the term *network* covers a wide range of interactions, and may be either horizontal or vertical. Alongside customers, suppliers, and members of professional networks, other potential actors with which firms may engage in knowledge-related networks include rival firms, private and public sector knowledge providers, and universities.

Overall, the innovation performance of firms, and subsequently the innovation and growth performance of the regions in which they are located, appears to be significantly related to network capital investment in dynamically configured inter-organizational interactions and relationships. Furthermore, there are multiple mechanisms underlying the formation and development of inter-organizational networks by firms, and 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. Given this, regional innovation rates may be a function of the interaction between the rate of entrepreneurship and the rate of network capital accumulation by entrepreneurs and their firms, as manifested by the capability to access external knowledge. Furthermore, regional innovation rates are partly a function of the spatial configuration of the knowledge networks established by firms, with the innovation capability of firms being partly a function of their capacity to access superior, excludable and miscible forms of knowledge regardless of the geographic location of knowledge sources.

4.1 Network Structure and Regional Innovation
An empirical analysis of the structure of knowledge networks stemming from ties between universities and other actors, principally firms found that the most innovative and economically developed regions are more likely to be the location for actors holding highly central and influential positions within knowledge network architectures. Although much research has concentrated on the capitalisation aspects of networks with regard to the strength of ties, or relational embeddedness, of networks, the analysis undertaken here is concerned more with the structural embeddedness of ties and the advantages accrued based on the structural position of actors within a knowledge network, or what can be termed their *structural network capital*.

Within the configuration of university-industry tie networks it is found the large R&D-intensive firm, often multinationals, and research intensive universities act as key boundary spanners that bridge and connect flows of knowledge across regions. This suggests that those regions which are locations for these firms not only benefit from the innovation they generate, but also the flow of knowledge they are able to access to manage across other firms and universities. In particular, the analysis strongly indicates that more innovative and economically developed regions are more likely to have a higher proportion of actors holding highly central and influential positions within the knowledge network architecture. In other words, knowledge network structures are an important indicator of regional innovation capacity and capability.

This proposed link between network structure and regional innovation supports the work of others, as well as indicating that within the network capital conceptual framework the structural tie component of such capital is likely to be as, if not more, important than the tie strength component. Of course, the underlying question stemming from this is: what causes some regions to have a higher proportion of actors with central, rather than peripheral, positions within the network. From the perspective of firms, the analysis indicates that economic and industrial structure plays a leading role. It is clear that the majority of the central positions within the network are occupied by highly R&D-intensive establishments, especially multinational concerns. Similarly, those universities at the centre of the network tend to be leading research-facing institutions with a high propensity for external knowledge-based interaction. Therefore, the existing knowledge stock of firms and other organisations in a region is likely to be an important factor impacting upon the centrality that a region as whole holds within the network, i.e. the existing knowledge-base and economic structure of a region will be a key determinant of the centrality of the region as a whole within a knowledge network.

The analysis indicates that whilst local intra-regional interactions account for a significant proportion of links, it is the extent of the non-local inter-regional ties that appears to allow some actors to occupy more central positions than others. In general, actors with more inter-regional ties tend to be more centrally positioned. These actors often act as bridges between particular clusters within the network, and are well-positioned to manage and influence knowledge flows, and presumably to maintain high rates of innovation within their organisation. This suggests that network actors with a high propensity to engage in interactions with actors in other regions are more likely to hold central positions within a knowledge network.

From the perspective of regions and their performance, it appears to be the case that those regions with a high proportion of actors engaged in inter-regional interactions are likely to be significantly more innovation than those with a bias toward local level ties. This indicates the importance of these actors as boundary spanning and bridging agents, with them being at heart of a wide spatially configured network architecture. Therefore, those regions with open and porous regional innovation systems are significantly more likely to have higher rates of innovation capability and capacity. This is an important insight to the extent that it adds weight to the argument that spatially unbounded knowledge networks and innovation systems are an increasingly important element of routes to achieving regional competitive advantage, i.e. regions with a spatially open network architecture are likely to be more innovative.

Furthermore, the findings hint at the cumulative and agglomerative nature of regional innovation processes. In particular, as network structure influences rates of regional

innovation and economic development, this is likely to make a region a more or less attractive spatial location for firms and other organisations. This ability to attract, retain and grow new organisations will itself influence the regional knowledge base and stock. Complementing studies suggesting that the tie strength dimension of networks can be associated with innovative performance and development, the findings indicate the necessity to also consider more structural dimensions.

4.2 Networks and Entrepreneurial Search Dynamics

Given the focus of smart specialisation on entrepreneurial search dynamics, the analysis undertaken thus far suggests a number of implications for those entrepreneurs and their firms engaged in knowledge search dynamics. First off, it is clear that those entrepreneurs seeking to innovate are likely to benefit from the accumulation of network capital, which will facilitate better access to economically beneficial knowledge. However, entrepreneurs may need to be aware of the trade-offs that may exist between accessing knowledge that is relatively easy to source and absorb, and knowledge which may be more difficult to identify and integrate, but potentially offers far greater economic returns. Given this, and echoing the comments above, entrepreneurs should ensure that management systems are in place to effectively search, screen and select the most appropriate knowledge to flow in and out of their firms.

It is likely that in order to access the highest quality knowledge, entrepreneurs should seek to invest in a balanced portfolio of networks encompassing both local and more global geographic connections. However, this balance, and the success of firms in generating innovation, will be partly governed by the regional environment in which entrepreneurial firms are located. Similarly, the networks established by entrepreneurs are likely to impact upon the innovation capability and economic growth capacity not only of their home region, but also the performance of other regions where there are firms and organisations with which they network.

These practical implications for entrepreneurs raise a number of potential recommendations for future policy that can be said to operate at the nexus of regional innovation and entrepreneurship policymaking. It is clear that regional rates of innovation are likely to be relatively high in those regions where firms are able to establish networks facilitating access to a pool of high quality knowledge. In regions with lagging rates of innovation, firms are likely to face barriers in accessing such knowledge, especially through networks within their own region. This implies the need for policy intervention to be made available to firms in regions with low rates innovation. More generally, across regions of all types there is a need to ensure the necessary support to help firms develop their capability to establish effective networks. For example, if entrepreneurs within a region are unable to assimilate knowledge from their internal base with that accessible from other organizations, there is a potential role for intervention in the form of innovation policies that act as an 'emulsifier' allowing different types of knowledge to be more effectively combined.

Similarly, policy should support firms to ensure they are capable of accessing the most appropriate and suitable knowledge for their innovation needs. In particular, policymakers need to become increasingly aware of the need for firms to establish a portfolio of both sustained and more dynamic ephemeral knowledge sources. Without this balance, firms run the risk of becoming locked-in to using outdated knowledge that undermines their innovative capabilities. Alongside this, there is a clear and on-going requirement for regional policy to

ensure sufficient absorptive capacity and human capital within the regional base of firms. Therefore, regional innovation policies must be closely meshed with regional skills strategies to continue efforts to up-skill the workforces and human capital of entrepreneurial firms – particularly with regard to management development – ensuring they are able to identify, absorb and transform into innovation the wealth of knowledge potentially available to them.

4.3 Network Spatiality

The findings tend to suggest that policymakers need to be aware that firms make use of different forms of networks during different stages of the lifecycle, with the types of sources, forms of knowledge, and location of sources varying over time. In the past, most network initiatives aimed at entrepreneurial firms have supported firms in developing networks with local actors, particularly through the use of local cluster initiatives and the like. However, it is clear that whilst entrepreneurial firms do engage in local knowledge networks, they are also significantly involved in wider national and international networks.

More entrepreneurially-oriented firms are unlikely to be able to bear the cost of full-time knowledge gatekeepers, and more can be done to educate firms in the key principles of network management, as a feature of more general knowledge management practices. There are growing applied and professional disciplines related to the management of networks and knowledge flows, which should be supported through public policy. Firms should be further encouraged to source the most relevant knowledge wherever it is located.

For some years, regional innovation policy has focused on the cluster model of development, which has led to there being little concern from policymakers with supporting more global connections. Policy initiatives, therefore, should widen their regional focus and embrace more spatially open and connected network systems. Efforts to internationalise the trading activities of firms should be complemented by a greater effort to internationalise their knowledge and innovation networks. Support should also be made available for engagement with global communities of practice. Communities of practice are becoming ever more international in their dimensions, and to remain innovative entrepreneurial firms must become better integrated into their respective global villages.

Finally, regional policy can play a role in empowering entrepreneurial firms. Entrepreneurial firms are often fearful of engaging in knowledge exchange partnerships with larger firms, particularly multinationals, due to worries concerning the exploitation of their knowledge base without receiving appropriate levels of financial reward. Traditionally, the assertion of intellectual property has been seen as the key means by which entrepreneurial firms are able to protect their knowledge. However, due to increasing problems of asserting rights in many sectors (e.g. services) and the cost and time implications of patenting and licensing agreements, this is not an option for all entrepreneurial firms, especially as larger firms are adopting open innovation strategies. To an extent, the traditional intellectual property support available to entrepreneurial firms is likely to become less relevant as open innovation and open sourcing become ever more prevalent business practices, and new policy initiatives are required to support these firms in ensuring they are equitably treated when establishing joint knowledge-based venture and strategic alliances with larger firms.

4.4 Conclusions on Network Structures

Thus far, this stream of research has begun to tease out the association between geographically space-less network structures and spatially constructed outcome measures such as regional innovation and economic performance. Furthermore, it has, at least loosely, applied the 'capitalisation' theory of networks, whereby networks are considered to offer advantages in terms of resource access, in this case access to the knowledge afforded to actors by network capital. Complementing studies suggesting that the tie strength dimension of networks can be associated with innovative performance and development, the current study indicates the necessity to also consider more structural and spatial dimensions, suggesting a framework incorporating the *strength*, *structure* and *spatiality* of knowledge network ties.

Alongside the significant relationships found between network centrality and innovation at regional level, the research point to the relative thinness of network architectures in the majority of the lagging regions studied. As well as adding some explanatory value to discourses on the role of 'thickness' to such network architectures, it also raises some considerations for policymaking. As well as reinforcing existing messages regarding the importance regional innovation policymaking should give to network and interaction building that goes beyond the notion of 'regional' cluster and 'regional' innovation system formulation, the research suggests that regional policymakers would be well-served by having access to more intelligence as to which actors in their region occupy the most central and prominent structural position within knowledge networks. This may better facilitate the formulation of strategies that identify and utilise these actors as key network nodes in establishing more open regional innovation systems.

Furthermore, it draws attention to a range of issues relating to the role of universities in regional innovation and economic development strategies. In particular, it makes clear that many universities, especially research-leading institutions, are to a large extent geographically indiscriminate in terms of the actors with which they form networks. Also, a bias towards local ties appears to be an indicator of relatively weak regional innovation performance. Therefore, regionally policymakers should not blindly pursue the notion that regionally-based knowledge transfer programmes represent a desirable, or even an effective, means for matching the demand for and supply of knowledge for innovation.

5. Institutions and Institutional Factors in Smart Specialisation

The contribution by WP1 to the discussions on the role of institutions/institutional factors and is split into two distinct but related lines of enquiry: the interaction of different types of institutions/organisations in smart specialisation processes, and institutional barriers/bottlenecks to the effective development and implementation of smart specialisation strategies. Here we concentrate on the first of these lines of enquiry by briefly outlining some emerging findings from the two case study regions. Until now the work on the case studies has allowed us to discuss a potential conceptual framework that can be used to understand this material based broadly around the notion of the 'quadruple helix' embracing business, universities, public authorities and civil society. By assessing how civil society is incorporated into the regional innovation system we hope to shed new light on notions of embeddedness, particularly how a globally connected institution like a university through linking its community engagement to its research and teaching can become locally anchored; along the way we hope to illustrate some of the institutional tensions between global connectivity and local engagement. These lines of enquiry will lead to two separate final outputs, both of which will predominately draw their empirical material from research carried out as part of work package 5. The first of these papers (interaction of

institutions/organisations) will comprise case studies of developments in strategic areas in the Newcastle 'Living Lab' regions of Tampere and Northern Ireland. These have in common technological developments and their application which have a strong social as well as economic innovation dimension – respectively Smart City (Tampere) and Connected Health (Northern Ireland). The second of these papers (institutional bottlenecks/barriers and reform) will also include material from a wider range of Living Labs regions. A provisional conceptual/heuristic framework for the second of these lines of enquiry (institutional bottlenecks/barriers) was proposed in Newcastle University's contribution to the WP1 1 reflection paper last year (Goddard *et al.*, 2014).

5.1 Case Studies: Mapping the Institutional Landscapes

The two strategic priorities focused on here – Smart Cities in Tampere and Connected Health in Northern Ireland – are not unique to these regions, but emerging concepts or fields that are developing on at least a European scale. Indeed in both cases the regions are part of developing transnational networks around the area in question. The two areas – smart cities and connected health – also include elements, such as the centrality of user or citizen involvement and potential to contribute to 'societal challenges', that mean they can be understood as also representative of the wider 'social innovation' agenda being explored in WP2 (see Richardson *et al.*, 2014). The particular form they are taking as smart specialisation priorities in Tampere and Northern Ireland respectively is shaped by the specific institutional context of the region; including factors such as, its multi-level governance system, inherited policy and economic development paths, and mix of different organisational actors in the relevant regional innovation ecology and their patterns of systemic interaction. The rest of this section will briefly outline key elements of these contexts for the two regions based on our provisional fieldwork (reported in Vallance and Goddard, 2014; Vallance and Kempton, 2014). Further research will be carried out in the following year that will give more depth to these case studies based in-part on the issues identified in this working paper section.

Tampere: In Tampere 'smart mobility' and 'smart housing & infrastructure' are two of the four priorities for the region identified in the smart specialisation strategy (the other two are 'renewing industry' and 'advanced treatments and human spare parts'). These smart specialisation priorities are, however, derived from areas selected as part of the establishment of a new national innovation programme – Innovative Cities (INKA) – in which Tampere is the lead partner of the Smart City (as well as Renewing Industry) theme (for general discussion of the smart city concept see Hollands, 2008; Caragliu *et al.*, 2011). The other partners in this theme are the Finnish city-regions of Lahti, Oulu, Turku, and the Helsinki Metropolitan area (including Espoo and Vantaa). As the name suggests, the INKA programme is particularly focused on large cities or city-regions within Finland (mainly outside the core Helsinki metropolitan area) rather than wider regions. In particular, the City of Tampere municipality, a powerful local authority, will have significant direct control and funding for the national INKA programme. From the perspective of the Smart City theme, that the City municipality itself will lead, this holds the potential to link this innovation policy to other relevant urban development public functions such as housing, traffic, infrastructure, healthcare and social services. The INKA Smart City theme will also run in parallel to a related national project involving almost exactly the same set of the large cities: the Open and Agile Cities Strategy programme is part of the implementation of EU Cohesion Policy for 2014-2020 in Finland relating to investment in integrated sustainable urban development, and

it will have a focus on open innovation environments, open data and interfaces, and open inclusion (promoting inclusion through public/citizen services)[3].

This INKA programme (which only started operating in 2014) is the successor to the long-running national Centre of Expertise (OSKE) programme in Finland (1994-2013), in which Tampere was a participant throughout. This national programme included a strong focus on information and communication technology, reflecting the traditional expertise in this area within Finland based largely on the presence of the Nokia Corporation, which has a large R&D centre in Tampere. Under the third phase of the OSKE programme (2007-2013) Tampere was one of two coordinating cities for a national Competence Cluster in Ubiquitous Computing, which (anticipating the smart city agenda) supported the "development, commercialisation and capitalisation of embedded intelligence in human-centred, distributed, mobile and constructed environments"[4]. The priority areas for the new INKA programme, however, are intended to break with the previous technology or sector based innovation-policy based approach of the OSKE programme in being "demand-driven, solution-centred and multisectoral themes that combine several competence areas"[5] (also see Edquist *et al.*, 2009 on 'broad-based innovation policy' in Finland). Tampere itself had already started moving in this direction towards a more horizontal, cross-sectoral understanding of economic policy influenced by the principles of open innovation. This development was in-part a response to the recognition that the previous more sector-based cluster model was unsustainable. In the area of information and communication technologies particularly, overreliance on Nokia as an anchor firm for the cluster has been revealed as a weakness due to its declining global share of the mobile phone market during the 2010s, and consequent significant downsizing of its operations throughout Finland (although the R&D facility in Tampere has remained open).

Reflecting this new policy thinking, the smart specialisation priorities identified for Tampere have been framed as 'growth ecosystems' rather than industrial sectors. These growth ecosystems are supported by a series of what in the region are referred to as 'innovation platforms'. Several of these platforms are operated in the region by Hermia Group, which started as the Science Park organisation, but has now developed a wider innovation intermediary role. For instance, ITS Factory supports projects involving private and public sector organisations in the (smart city related) Intelligent Transport domain[6]. The first and still highest profile of these innovation platforms is Demola, which is a vehicle for projects in which teams of students from multiple higher education institutions work together with a private, public or third sector organisation on a real-life problem or goal provided by that partner. The success of Demola has meant that it has expanded from Tampere to a number of other locations throughout Europe, and this existing international innovation platform has recently been taken the opportunity to establish a joint Smart City Accelerator between Tampere and (the other Demola locations) Malmö and Lund in Sweden. This accelerator

---

[3] See http://www.forumvirium.fi/en/sixpackstrategy

[4] http://www.tampere-region.eu/in-english/excellence-in-tampere-region/key-clusters/ubiquitous-computing/
[5] https://www.tem.fi/en/innovations/strategic_centres_and_clusters/innovative_cities_programme_%28inka%29
[6] http://www.hermiagroup.fi/its-factory/

programme will help quickly generate numerous project activities in this field (under the themes smart mobility, citizen participation, and smart city ecosystems), with the best ideas and solutions intended to be implemented by the participating cities[7]. The Demola Smart City Accelerator is also part of a deeper partnership being developed between the Tampere and Skåne regions around Smart and Sustainable Cities (Vanguard Initiative, 2014).

Northern Ireland: In Northern Ireland the smart specialisation priorities are a series of 'marketplace opportunities' identified through the private sector-led regional Science Industry Panel (Matrix), which fall under five broader domains of technological capability: Agri-Food Technologies, Sustainable Energy, ICT, Advanced Manufacturing/Materials, and Life and Health Sciences. The one marketplace opportunity identified underneath the Life and Health Sciences domain (although it also has links to ICT and Advanced Manufacturing/Materials) is Connected Health & Stratified Medicine (DETINI, 2014). This in fact refers to two fields with overlapping applications: Connected Health is about the use of ICT to remotely monitor patient health and help deliver care; Stratified (or Personalised) Medicine, is about the use of "diagnostic tests to select the most appropriate treatment for individual patients"[8]. The development of capability in Connected Health (the main focus here) in Northern Ireland builds on a longer related tradition in the region that dates back to the invention of the portable defibrillator in the region during the 1960s. This led to the growth of an engineering (and more recently) computer science based research capability around these technology applications in the University of Ulster (one of the two universities in the region alongside the overall more research-intensive institution Queen's University Belfast). This capability and its market potential was recognised by Matrix in the initial round of 'horizon scanning' reports produced following its establishment in 2007, meaning that Connected Health has come to be recognised as a strategic opportunity by the Northern Ireland Assembly (a devolved administration within the UK state). This has translated into government commitment to support the agenda within the region as represented by the signing of a Memorandum of Understanding between the Northern Ireland Executive departments for the economy (DETI) and health and social services (DHSSPS). From here a formalised Northern Ireland Connected Health Ecosystem has emerged, which holds regular meetings of its partners from the public, private, and third/community sectors as well as academia (universities and higher/further education colleges). This regional ecosystem is also part of the European Connected Health Alliance (with partners from the Republic of Ireland, Catalonia, Greece,, Estonia, and Oulu), and plugged into the New Innovation in Medical Science and Connected Health Group partnership of Northern Ireland with Massachusetts and Finland.

Notably for a relatively small region, Northern Ireland has a handful of fairly large and established indigenous firms in the broad area of healthcare and pharmaceuticals, which are amongst its largest spenders on business R&D. In addition, a few important companies in this area have also emerged as spin-outs from the University of Ulster. More recently, the economic development agency Invest NI has sought to support the research capability of other mainly smaller private sector firms in this sector by setting up the Connected Health Innovation Centre (CHIC), which is organisationally based (as a virtual centre) in the University of Ulster. CHIC, one of five Competence Centres being set up in Northern Ireland around the Matrix areas described above, is focused on encouraging its private sector

---

[7] http://www.smartcityaccelerator.com/.
[8] https://www.catapult.org.uk/precision-medicine.

members to collaborate on 'pre-competitive' research projects that are facilitated by the University. The aim here is that the research projects will increase the knowledge of the participating companies and generate ideas for potential commercial products that they can take forward outside the centre.

The export potential of Connected Health is integral to its recognition as a potentially important economic development opportunity for Northern Ireland. However, the region also has a significant internal market for these products in the form of its own health and social care sector. These two sectors are, unlike the rest of the UK, integrated into one service with combined regional trusts in Northern Ireland. This institutional arrangement, along with the early introduction of electronic care record systems, means that Northern Ireland is potentially well positioned to act as a test-bed for the development of Connected Health applications through in-situ testing and trials with patient users in their homes. However, this will also require wider changes in the form of, for instance, social care workers being trained in the use of digital technologies as part of their work. The more general challenge that this links into is the cultural change involved in public sector innovation, which is one of the priority enabling themes identified in the region's recent innovation strategy (reflecting the aspiration to leverage the large public sector in the region as a source and facilitator of innovation) (DETINI, 2014).

Although these two examples come from very different technological domains, they have comparable features in terms of the range of institutional actors mobilised around them within the two regions, and a development and innovation process in which the effective incorporation of users (broadly defined) is a vital element. These features are central to the emerging conceptual framework of the 'quadruple helix', and the next section will discuss the potential of developing this framework in reference to the case study material.

5.2 The Quadruple Helix: Framing the Case Studies

The quadruple helix is an extension of the triple helix concept developed by Leydesdorff and Etzkowitz (1996; 2003; Etzkowitz and Leydesdorff, 2000). Where the triple helix refers to University-Industry-Government relations, the fourth helix of the new model is most commonly understood to be civil society, the community or the public. This notion has been promoted in relation to smart specialisation through several references in the formal Guide to RIS3 produced by Foray et al. (2012) on behalf of the European Commission (2012). However, the academic foundations of this concept are still at a relatively early stage of formulation. The highest profile attempt to advance the quadruple helix model has come from Carayannis and Campbell (2009; 2012) working in the fields of innovation studies and knowledge/technology management. This field defines the fourth helix as the 'media-based and culture-based public' and 'civil society', and offers an array of associated concepts, such as mode 3 knowledge production; Twenty-first Century Fractal Research, Education and Innovation Ecosystem; the academic firm; and the Quintuple Helix (extending the model further to include the natural environment) (Carayannis and Campbell, 2012). In a more recent paper this conceptual scheme has also been linked to smart specialisation and the wider

European Union agenda around 'smart, sustainable, and inclusive growth' (Carayannis and Rakhmatullin, 2014). However, the proliferation of new concepts in this work, many of them an iteration on existing ideas (e.g. the triple helix and mode 2 knowledge production), seems somewhat speculative and not clearly justified by evidence. As Leydesdorff (2012) argues, the analytical validity and usefulness of the quadruple helix concept should not in itself be assumed, but needs to be substantiated primarily through empirical studies. An alternative, more considered view of a quadruple helix model (cited in the RIS3 Guide) is provided by Arnkil *et al.* (2010) in the final report of the EU CLIQ (Creating Local Innovation through a Quadruple Helix) research project. This report is more informative in relation to our emerging understanding of the quadruple helix, and aspects from it will be drawn on and discussed below. Nevertheless there is scope for further development of the concept in relation to our focus on regional innovation systems.

The basic position taken here is that the triple helix concept is best understood as a variant of the wider innovation system approach as developed (in the form of national innovation systems) by Lundvall (1992) and Nelson (1993) (see Etzkowitz and Leydesdorff, 2000), and that the same perspective should be taken of the quadruple helix. This means that the task of extending the framework to include the components of civil society or the public can be based on the established theoretical principles of innovation systems more widely, such as the non-linear and interactive form of innovation, the importance of institutional arrangements and environments, and the evolutionary basis of change in the system (see Edquist, 1997). An additional benefit here is that this will allow the quadruple helix model to be brought closer to the regional version of the innovation system concept (e.g. Asheim *et al.*, 2011) in reference to which its more local territorial configurations (see below) can be explored. From this starting point, three potential novel implications of the quadruple helix, that are relevant to the development of our two case studies introduced above, can be briefly outlined.

First, the inclusion of civil society or the public as the fourth helix is closely associated with a greater emphasis on the role of the user in innovation. In fact this is proposed as the key defining characteristic of the quadruple helix by Arnkil *et al.* (2010). They argue:

> The Quadruple Helix (QH), with its emphasis on broad cooperation in innovation, represents a shift towards systemic, open and user-centric innovation policy. An era of linear, top-down, expert driven development, production and services is giving way to different forms and levels of coproduction with consumers, customers and citizens. This also sets a challenge for public authorities and the production of public services.
>
> (Arnkil *et al.*, 2010; executive summary)

However, while this emphasis on users may not have been an explicit focus in the arguably more science and technology focused triple helix model, it was recognised in the concept of non-linear and interactive learning processes in the original national innovation systems concept, referring particularly to user-producer (firm) relationships (Lundvall, 1992). Subsequently, a focus on users - whether firms, communities, or individual customers – has become a central concern in innovation studies (e.g. Franke and Shah, 2003; Von Hippel,

2005; Grabher *et al.*, 2008). However, the focus on the user alone is not a strong enough basis on which to differentiate the quadruple helix as a new model: instead it is necessary to specify the role of civil society organisations, community groups or individual citizens as users, and address the specific and distinctive challenges to more traditional understandings of innovation processes that this entails. The inclusion of these actors also reinforces the prospect that innovation in the quadruple helix can be towards social goals as compared to the economic goals when members of the public arte simply viewed as consumers helping firms to create new products. In our two case studies the users are residents of particular urban areas and users of public services (Tampere) and patients who are wearing or otherwise utilising the connected health devices (Northern Ireland). The technological focus of the two areas in question (smart cities and connected health) also shapes the form of social innovation these developments will take (as distinct from the vision of community development-based social innovation outlined by Moulaert and Nussbaumer, 2005). This will mean that the role in the innovation process of these users in relation to professional experts from the fields of academia, business, and government/public authorities will have to be identified and the applicability of ideas such as 'co-production' assessed accordingly. In this regard four variants of the quadruple helix are suggested by Arnkil *et al.* (2010) – the Triple Helix + users; the firm-centred 'living lab'; the public sector-centred 'living lab', and the citizen-centred quadruple helix. Each of these variants highlights differences in the role citizen can play as users in the innovation system and in the process can provide a useful conceptual reference point.

Second, the geography of the quadruple helix, and whether this varies from triple helix or other innovation system models, has yet to be explored in detail by the limited previous academic work on the concept. On the one hand, the 'open' nature of innovation processes implied by the quadruple helix would seem to align it with work in economic geography that has departed from previous regional-centred perspectives to emphasise the spatially non-bounded nature of innovation relations and the globally connected systems that they form (e.g. Oinas and Malecki, 2002; Fløysand and Jakobsen, 2010). A common feature of our two case studies, mentioned in the section above, is that, the development of the field in question is taking place in collaboration with other regions on an international scale (e.g. Northern Ireland membership of the European Connected Health Alliance, Tampere's partnership with Skåne around Smart and Sustainable Cities).. At the same time the quadruple helix has been associated by Arnkil *et al.* (2010, p.24) with the notion of 'living laboratories', which are understood as 'geographically bounded innovation environments' in which experimentation through in-situ interaction with users takes place. The living laboratory concept can be applied to spaces varying from households to neighbourhoods or whole cities depending on the scale of the technology or application in question (e.g. see Konig and Evans, 2013 on urban living labs for sustainable development). This broad notion can therefore, in theory be fitted to user involvement in both of our case studies: in Tampere, smart city experiments and large-scale demonstrator projects are planned to take place in certain suburbs of the city; in Northern Ireland, Connected Health has clear applications for people in homes or other places outside of clinical settings. The key issue for our research will be how these spaces are institutionally constructed in these specific regional contexts through the relationships between different quadruple helix actors (MacGregor *et al.*, 2010). These dynamics could also be a source of tension between the geographically situated nature of developments in living laboratories, which will be shaped particularly by distinctive national or regional systems of public service delivery, versus the need to develop more universally applicable and exportable

models of these technologies through which economic value and international market-share can be captured.

Third, one of the contributions of work on the triple helix has been to explore how the different institutional spheres (academia, business, government) are themselves transformed through interaction with each other (Etzkowitz and Leydesdorff, 2000; Etzkowitz *et al.*, 2000). The introduction of civil society or the public into the quadruple helix model, therefore, means it is important to consider the interface of this fourth sphere with academia, business, and government, and the co-evolution between the sets of pairs (e.g. society/business, academia/government, etc.) that results (Marcovich and Shinn, 2011). In the triple helix model, particular emphasis is put on the perceived transformation of the traditional university, through changing relationships with government and business, into the entrepreneurial university capable of playing a greater role in driving innovation (Etzkowitz *et al.*, 2000). By extension, this raises the question of the role of universities in a quadruple helix framework, in which their societal role should be brought more to the fore as a factor shaping innovation processes through interaction with the fourth sphere of civil society, the public or community. Higher education institutions are an important actor (although not necessarily the leaders of developments) in both of our regional case studies, and this may create an opportunity to further explore notions of the 'engaged' or 'civic' university as an alternative to the entrepreneurial university (Goddard, 2009; Goddard and Vallance, 2013). Another clearly important focus will be the modified role of government (at different levels and in different arrangements in the two regions) in promoting innovation policies that effectively integrate the social concerns that are reflected in the smart specialisation priorities. This takes us directly to another of the key lines of enquiry of WP1 research work.

6. Multilevel Governance and Smart Specialisation

Governance, understood as the processes surrounding the making of choices or decisions that orient strategy (Bailey *et al.*, 2006), is necessarily at the core of debates around smart specialisation strategies. Indeed, the current lack of understanding around how entrepreneurial discovery processes should take place in practice can be explained by the need for experimenting with fundamental changes in governance to move from concept to successful implementation. The centrality of entrepreneurial discovery processes to smart specialisation as a concept implies a strategy that is 'alive', constantly evolving, and constantly engaging a broad range of agents in its definition, implementation and evaluation. This requires new, dynamic and networked forms of decision-making that break with the more static and hierarchical governance forms that governments and other agents are used to when making strategic plans in relatively 'top-down' processes. Governance in this sense goes well beyond 'government' (Stoker, 1998; Sugden *et al.*, 2006), and refers to the engagement of a broad range of stakeholders from the quadruple helix of business, research, government and civil society in processes that ultimately lead to decisions with regards the activities that should be prioritised in the region and the ongoing coordination and evolution of these activities (Foray *et al.*, 2012).

The need to understand how these new governance processes can be nurtured in practice is complicated by the multi-level reality of territorial governance relationships. Yet a failure to

clearly recognise the different levels of analysis (and their articulation) required for a coherent regional strategy is contributing to the 'black boxing' of the practical aspects of entrepreneurial discovery process within many debates on smart specialisation strategies. From the regional priorities identified in strategy, 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 at different moments of decision-making processes, the level of analysis matters. Typically within a region, for example, 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, European and global governance dynamics.

Multilevel governance is hence one of the inter-related themes being explored in Work Package 1 of the Smartspec project. This is being advanced both conceptually and empirically: conceptually through an analysis of different literatures that have something to add to our understanding of the (formal and informal) structures, institutions and conditions underscoring the development of effective multi-level governance; and empirically though analysis of the regional 'living labs' that are a key feature of the Smartspec project (Work Package 5), alongside other regional case studies, the study of which are helping us to look inside the black box of the dynamic, evolving and ultimately human processes behind smart specialization strategies. Various specific themes are emerging and being explored through this mix of conceptual and empirical research, including: the distinction between multilevel governance in the government sphere and in other spheres (business, research, civil society); the relationship between multilevel governance and horizontal governance; the role of time, history and path dependence in governance relationships; the importance of the human element in governance relationships, in particular leadership. The remainder of this section discusses some of the advances being made and the key issues arising with regards these themes and in terms of the ongoing development of analysis of specific regional cases.


6.1 Multilevel governance and Policy Coordination

The development of our understanding of how innovation takes place in a systemic context has prompted the emergence of evolutionary alternatives to the linear, market failure rationales for policy intervention of neoclassical analysis (Metcalfe, 1995; Smith, 2000; Edquist, 2001; Laranja *et al.*, 2008). In turn a new set of policy interventions has evolved to respond to 'system problems' that inhibit the creation and transfer of knowledge within innovation systems. These don't replace neoclassical rationales based on market failures, but have emerged alongside them in a 'policy mix' (Flanagan *et al.*, 2011), and, together with the increasing significance of multiple geographical scales of policy governance and multiple operational layers of policy decision-making (Magro and Wilson, 2013; Magro *et al.*, 2014), they result in an innovation policy landscape characterised by significant complexity.

The government sphere is thus a natural starting point for exploring multilevel governance in the context of smart specialisation strategies; innovation policies themselves should support the emergence and evolution of regional smart specialisation strategies, but this requires an understanding of how policies from different levels interact. To advance conceptually on these questions insights from institutional and public policy theories alongside concepts from STI policy and regional innovation systems have been brought together in developing a framework that highlights different types of policy coordination (Magro *et al.*, 2014). As such, Figure 1 depicts a complex science, technology and innovation (STI) policy ecosystem

organized around multi-domain, multi-level, multi-instrument, multi-layer, and multi-actor dimensions.

Figure 1: Complexity in STI Policy
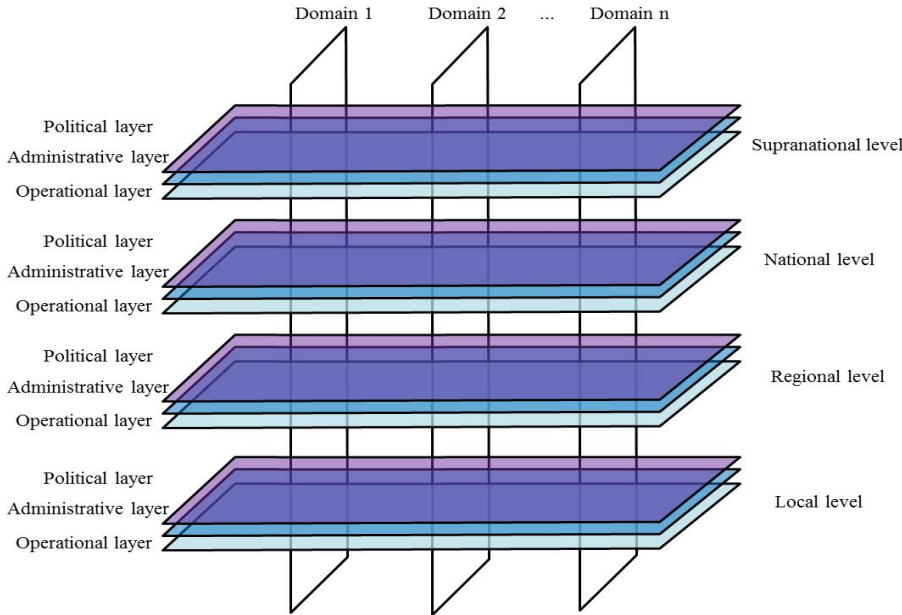
Source: Magro *et al.* (2014)

Managing this complexity calls for a diversity of vertical and horizontal modes of coordination and associated mechanisms. A distinction can be made between horizontal coordination as collaboration among a large variety of players and governmental agencies within a particular territory, and vertical coordination as coordination among units from different territories. Yet the two are likely to be related such that an improvement in one will affect the other: "fragmented decision making and management at the central level creates serious problems at the sub-national level. Thus, often the measures which promote vertical governance also facilitate horizontal governance at the central level, and vice versa" (OECD, 2010: 30). There are also a number of other specific issues arising from this conceptual analysis of policy coordination that warrant further research. For example, there is the question of where the balance lies between the costs of better coordination and the benefits obtained in terms of policy effectiveness. In turn this opens up an agenda around the appropriateness and effectiveness of different coordination mechanisms in different circumstances (Hessels, 2013), including the role that informal mechanisms (i.e., beliefs, routines, etc.) play alongside formal structures and mechanisms. A contextual approach is indeed particularly important when considering the multi-level dimension because the political, administrative and operational layers of decision-making tend to be developed in quite different ways at the sub-national, national and supra-national levels.

More generally there is a need to clarify the distinction between coordination and governance. While governance is studied in many disciplines and starts from a very broad premise – "any mode of coordination of interdependent activities" (Jessop, 1998) – the literature on coordination tends to be much more narrowly focused on policy. One approach, therefore, would be to refer to coordination in the policies that support smart specialisation strategies and to governance in the strategies themselves. Indeed the governance of territorial strategies necessarily goes beyond government to include the quadruple helix of agents, both within

territory and across different territorial levels. This is a particular challenge because much of the literature treating multi-level governance in reality treats multi-level government (for example, OECD, 2011).[9] A key issue arising therefore is how the interests, behaviours and decision-making processes of firms, universities and civil society groups, all of which typically operate in different ways at different territorial scales, can be set alongside the vertical policy coordination concerns highlighted by the conceptual analysis to date.

6.2 Historical Context and Path Dependence Affecting Governance Relationships

Path dependence is a concept that is widely recognised as important in economic development and economic development policy processes. While employed initially to account for lock-in situations whereby the territory remains specialised in old technologies or activities, unable to shift to more promising new ones (Grabher, 1993), its usage has broadened to account for both negative and positive effects on regional economic performance and to explain why change goes in a particular direction (Martin and Sunley, 2006; Boschma and Frenken, 2006; Lagerholm and Malmberg, 2009; Martin, 2010; Henning *et al.*, 2012). Path dependence occurs due to the quasi-irreversibility of investments and the existence of both network externalities (economies of scale from the supply and demand side, and effects stemming from technical complementarity and compatibility) and self-reinforcement effects (such as learning effects, coordination effects and self-reinforcing expectations) (Martin, 2010).

It follows that historical context and path dependence should be a central consideration in understanding the construction of smart specialisation strategies, the process of which will inevitably be shaped by pre-existing investments, strategies, policies and governance relationships. Yet analysis of STI policies from a path dependence perspective are scarce, and as some authors have pointed out the concept has been used more as a metaphor than as a proper theoretical explanation of change and evolution (Sydow *et al.*, 2009: 689). This lack of conceptual clarity makes very difficult to empirically test path dependence arguments (Dobusch and Kapeller, 2013). Moreover, and of particular relevance for our desire to understand the governance and multi-level governance of smart specialisation strategies, there has been a failure to consider the complexity of policy-making institutions and the role of agency and power in path dependence analysis (Mackinnon *et al.*, 2009; Campbell, 2010; Martin, 2010; Henning *et al.*, 2012).

A step in deepening understanding of these issues in the context of smart specialisation strategies has been taken through reflecting on the STI policy in the Basque Country region in historical context (Valdaliso *et al.*, 2014). By identifying specific phases where different types of processes have been present and distinguishing between different change mechanisms found in the literature (*layering, conversion, displacement, drift, exhaustion, recombination,* and *delayering*), such case analysis highlights the context in which governance relationships (including multi-level) have to develop around current smart specialisation strategies. Key next steps should include deepening in the multi-level dimension of these findings and drawing comparative analysis with other cases that help understand how different multi-level governance contexts and trajectories can shape current smart specialisation processes.

6.3 Leadership and the Human Element in Governance Relationships

---

[9] It is also revealing in this sense that while what is referred to as multi-level governance in Europe tends to be termed inter-governmental relationships in the US.

The entrepreneurial discovery processes central to smart specialization strategies are both complex and sensitive because they involve many different agents at many different levels, and ultimately they should determine important decisions around investment priorities. The change in approach required by smart specialization strategies requires the development of new capabilities among agents, and in particular it raises questions for the role of different types of leadership in these processes. It has been observed variously that private actors often lack the abilities or interest to lead the process (McCann and Ortega-Argiles, 2013), that it shouldn't be taken for granted that regional governments themselves possess the capacities to lead (Walendowski *et al.*, 2011), and that collaborative leadership is likely to be significant (Martinez and Palazuelos-Martinez, 2014). Yet leadership it is an aspect that has been little explored, despite Sotarauta's (2009) argument that as regional scenarios become more complex, regional development relies more heavily on leadership and network management.[10]

As remarked above, a region is a complex system and in a complex system the knowledge necessary to overcome challenges and take advantage of opportunities is distributed, and not only among different territorial actors, but at a global level. The strategy cannot be led by one individual, but must develop around a multiplicity of quadruple helix partnerships, themselves frequently spanning different territorial levels, that respond to different strategic challenges and/or opportunities. There are different roles to play within this. Leaders with a systemic vision are needed to create the interaction spaces and inspire involvement in those spaces; and leaders with an understanding of processes and with capabilities to nurture all important trust and reciprocity are needed to manage those spaces in ways that facilitate the emergence of opportunities and the generation of a shared vision. Leaders with knowledge of specific fields (sectors, technologies, scientific fields, product markets) are also needed to identify specific opportunities for smart specialisation, or perhaps better termed smart diversification, from combining regional capabilities, and to galvanise the right set of agents in developing them. On the one hand these different roles are similar to the distinction between 'policy generalists, persons of substance and persons of process understanding' identified by Sotarauta (2010), for example, or to Terry's (1993) distinction between 'content visionaries' and 'process visionaries' as cited by Mabey and Freeman (2010: 512). On the other hand their reliance on each other and their necessary configuration to generate an entrepreneurial discovery process points to the concept of shared leadership that has become popular in the leadership literature (Conger and Pearce, 2003; Fletcher and Kaufer, 2003; Pearce and Conger, 2003).

Building on literature on place leadership and territorial strategy, a number of considerations for the specific shared leadership or mix of leaderships likely to be required by entrepreneurial discovery processes can be highlighted (Aranguren *et al.*, 2015). Firstly, there is need for a *dualism in reference frame*. Public and private agents at different territorial levels must establish the region in question as a frame of reference for their thinking and their decisions, alongside an already existing frame of reference; their firm, university, government department, etc., and potentially the other territorial scale (city, nation, European or global context) in which they mainly operate. Secondly, the different competences required at different stages and in different components of the strategy are not typically held by the same actor, organization or territorial level, implying *a mix and rotation of leaderships*, with different agents playing different roles at different times. It is important therefore that each

---

[10] This is reflective of the widespread perception that the human element of how policies are designed, including the role of leadership, has been neglected in regional studies (Collinge and Gibney, 2010; Gibney, 2011; Sotarauta, 2005; Stimpson *et al.*, 2009).

actor identifies the moments when its role could be critical and assumes responsibility, and likewise identifies the moments where it should step back and let others with different competences lead. Thirdly, there is the important question of from where different leaderships emerge, or the *source of leaders*, given that different roles are likely to suit more or less different profiles from the quadruple helix and from different territorial levels, and the appropriate capacities will also be found in different places.

6.4 Insights on Governance and Coordination from Specific Regional Cases?

It is impossible to better understand the human factors that appear to be critical for entrepreneurial discovery processes without analyzing real live cases. Indeed the design of the Smartspec project is such that conceptual analysis of key questions proceeds in parallel with analysis in a series of living labs. The team at Orkestra working on the issues related to multilevel governance set out in the preceding sub-sections have been working on two regional living labs in Spain – Murcia and Navarre – alongside application to their own region of the Basque Country (as seen for example in the previously cited work of Magro *et al.*, 2014, Valdaliso *et al.*, 2014, Aranguren *et al.*, 2015).

Spanish regions or autonomous communities have among the highest levels of policy autonomy in Europe, and the processes of preparing Research and Innovation Strategies for Smart Specialisation (RIS3) for the European Commission have been led at the regional level (rather than at the national level, as is the case in some countries). The Basque Country and Navarre are neighbouring regions in the north of Spain that at first glance look very similar. They are both industrial regions, with relatively strong economic performance and relatively well-developed innovation systems, with their own unique (in Spain) tax-raising powers, and which are currently governed by regionalist/nationalist political parties in minority in the regional assembly. Yet the RIS3 process of each is taking shape quite differently. Murcia is a region in the south of Spain with quite different fundamental characteristics, in economic (a low presence of industry, less developed innovation system, and weaker economic performance), administrative (no tax-raising powers, which fall under the general Spanish regime), and political (the ruling political party is a national one, in a majority at the regional assembly) terms. All three regions also have quite different multi-level structures at sub-regional level, and different relationships with the national level. A comparative analysis of the RIS3 process in these three cases hence opens up learning with regards the specific issues that European regions are addressing in practice in seeking to develop appropriate governance relationships.

Data for analysis of the cases come from secondary sources surrounding their RIS3 alongside around a dozen in-depth interviews with key players in the RIS3 process of each region that were conducted during June/July 2014. Aranguren *et al.* (2015) organise their early reflections on these cases following the 'six-step' structure that was proposed by the European Commission for the development of RIS3 in their *Guide to Research and Innovation Strategies for Smart Specialisation* (Foray *et al.*, 2012), after first reflecting on the significance of differences in the broad regional context.

A clear conclusion emerges regarding the importance of regional context in influencing the development of the processes that underlie smart specialisation strategies. Regions are characterised by different types of complexity, made up of a multitude of geographical, structural and institutional factors that interact with one-another in different ways, and by

strong degrees of path dependence that mark the very vision of what a smart specialisation strategy means. This implies that there are no single recipes for developing the right processes that will set in motion entrepreneurial discovery and lead to the appropriate identification of priorities that are then supported by ideal policy mixes and bolstered by effective evaluations. Each region has to find its own way, based upon its own complexity in existing governance relationships and its own history of where it has come from. Yet there are nevertheless some general patterns and arguments that emerge from analysis of the pursuit of the six steps in these three cases.

Reflecting a more general perception of how European regions have approached meeting the European Commission's RIS3 requirements, there is a sense in which the first diagnostic step is the easy part and that for many regions the serious thought stops there. An analysis of the region's strengths, weaknesses and capabilities, combined with strategic intelligence on technological and market trends (step 1) can lead to a convincing justification of areas for prioritization (step 4), and there may be a temptation for regional governments to avoid becoming too deeply embroiled in the messy, uncertain processes of governance and development of shared vision that are critical for igniting entrepreneurial discovery processes (steps 2 and 3). Thus RIS3 might easily revert to a technocratic, intelligence-based plan rather than the emergent and living processes of experimentation and discovery that are necessary to make effective prioritization decisions. Indeed, the cases illustrate different difficulties in linking (explicitly-defined and implicit) wider governance processes to the government's plan-based perception of what a strategy should look like, and even where this link does appear to have been made with some success (in Navarre) it was temporary and has not continued in time.

The analysis also highlights the severe practical difficulties in setting actual priorities where there are always conflicting interests (step 4), in aligning policy mixes with those priorities in the face of existing policy inertias (step 5), and in establishing effective evaluation mechanisms (step 6). The challenges of steps 5 and 6 in particular have been accentuated by timing issues, in the sense that European regions have been under great pressure to present RIS3 in a short space of time. In such a context it is logical to move from diagnostic (step 1) to prioritisation (step 4) as these are the most tangible parts of what is typically understood by a strategic plan. While policy mix coordination (within territories and across territorial levels) and evaluation should be integral parts of a RIS3 from the very beginning, especially if existing inertias are to be overcome, in this context of time pressure it is tempting to leave them as after-thoughts to the more visible parts of the strategy.

7. Ongoing Research Developments

As is evident here, the various lines of research work in *Smartspec* Work Package 1 are progressing well and making headway of a range of different fronts at the same time. Demand linkages and technological profiles are also mediated at the regional level via institutional and governance systems. These linkages will be better positioned in the wider smart specialisation debates from the summer of 2015 onwards when a series of scientific papers will also be emerging from Work Package 1 as the building of the various datasets on entrepreneurial dynamics and trade-linkages are expected to completed by then. These data will then feed directly into the other lines of research on related and unrelated variety, as well as on institutional and on governance issues. These data will also help to better calibrate the

effectiveness of smart specialisation policy prioritisation processes and to better assist with the choice of smart specialisation monitoring and evaluation exercises.

REFERENCES

Aranguren, M-J., Navarro, M., and Wilson, J.R., (2015), "From plan to process: Exploring the leadership implications of RIS3", unpublished manuscript submitted for review.

Arnkil, R., Järvensivu, A., Koski, P., and Piirainen, T., (2010) "Exploring quadruple helix: outlining user-oriented innovation models", Final report on Quadruple Helix Research for the CLIQ project, *Työraportteja 85/2010 Working Papers.*

Asheim, B. T., Lawton Smith, H., and Oughton, C., (2011), "Regional innovation systems: theory, empirics and policy", *Regional Studies* 45 (7), 875-891.

Bailey, D., De Propris, L., Sugden, R., and Wilson, J.R., (2006). "Public Policy for European Economic Competitiveness: An Analytical Framework and a Research Agenda", *International Review of Applied Economics*, 20(5): 555-572.

Beaudry, C., and Shiffauerova, A., (2009), "Who's right, Marshall or Jacobs? The localization versus urbanization debate". *Research Policy*, 38:318–337.

Boschma, R., and Capone, G., (2014), Institutions and Diversification: Related versus Unrelated Diversification in a Varieties of Capitalism Framework", Paper in Evolutionary Economic Geography 14.21, Utrecht University.

Boschma, R. & J. Lambooy (1999), "Evolutionary Economics and Economic Geography". *Journal of Evolutionary Economics* 9: 411-429.

Boschma, R. and Martin, R., (2010), *The Handbook of Evolutionary Economic Geography*. Edward Elgar, Cheltenham.

Boschma, R.A., and Frenken, K., 2011, "Technological Relatedness and Regional Branching, in Bathelt, H., Feldman, M.P., and Kogler, D.F., (eds.), *Dynamic Geographies of Knowledge Creation and Innovation*, Taylor and Francis, Routledge, London, Forthcoming
Boschma, R.A., and Iammarino, S., 2009, "Related Variety, Trade Linkages and Regional Growth, *Economic Geography*, 85.3, 289–311
Boschma, R.A., Minondo, A., and Navarro, M., 2012, "Related Variety and Regional Grwoth in Spain", *Papers in Regional Science*, Forthcoming

Campbell, J.L., (2010), "Institutional reproduction and change". In Morgan, G., Campbell, J.L., Crouch, C., Pedersen, O.K., and Whitley, R. (eds.), *The Oxford handbook of Comparative Institutional Analysis*. Oxford, Oxford University Press, pp. 87-115.

Caragliu, A., Del Bo, C., and Nijkamp, P., (2011), "Smart Cities in Europe", *Journal of Urban Technology* 18, 65-82.

Carayannis, E.G., and Campbell, D.F.J., (2009), "'Mode 3' and 'Quadruple Helix': Towards a 21st Century Fractal Innovation Ecosystem", *International Journal of Technology Management* 46, 201-234.

Carayannis, E.G., and Campbell, D.F.J., (2012), *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems,* Springer, New York.

Carayannis, E.G., and Rakhmatullin, R., (2014), "The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and Beyond", *Journal of Knowledge Economy* 5, 212-239.

Charron, N., Dijkstra, L., and Lapuentea, V., (2014), "Regional Governance Matters: Quality of Government within European Union Member States", *Regional Studies*, 48:1, 68-90.

Cortinovis, N., and van Oort, F., (2015), "Variety, Economic Growth and Knowledge-Intensity of European Regions: A Spatial Panel Analysis", Utrecht University.

Collinge, C. and Gibney, J., (2010), "Connecting Place, Policy and Leadership", *Policy Studies*, 31(4), 379-391.

Conger, J.A., and Pearce, C.L., (2003), "A Landscape of Opportunities. Future Research on Shared Leadership", in Pearce, C.L, and Conger, J.A., (eds.), *Shared leadership: Reframing the Hows and Whys of Leadership*, Sage Publications, Thousand Oaks.

David, P., Foray, D., and Hall, B., 2009, *Measuring Smart Specialisation: The Concept and the Need for Indicators,* Knowledge for Growth Expert Group, See:
http://cemi.epfl.ch/files/content/sites/cemi/files/users/178044/public/Measuring%20smart%20specialisation.doc

De Groot, H.L.F., Poot, J., and Smit, M., 2009, "Agglomeration Externalities, Innovation and Regional Growth: Theoretical Perspectives and Meta-Analysis", in Cappello, R., and Nijkamp, P., *Handbook of Regional Growth and Development Theories*, Edward Elgar, Cheltenham

Desrochers, P., and Leppald, S (2011), "Opening up the 'Jacobs Spillovers' Black Box: Local Diversity, Creativity and the Processes Underlying New Combinations". *Journal of Economic Geography* 11, 843-863.

DETINI (2014), *Innovation Strategy for Northern Ireland – 2014-2025: Innovate NI*, DETI, Belfast. http://www.detini.gov.uk/innovationstrategyni

Dobusch, L., and Kapeller, J., (2013), "Breaking New Paths: Theory and Method in Path Dependence Research", *Schmalenbach Business Review*, 65, 288-311.

Edquist, C., (1997), "Systems of Innovation Approaches – Their Emergence and Characteristics", in Edquist, C (ed.), *Systems of Innovation: Technologies, Institutions and Organizations*, Pinter, London, pp.1-35.

Edquist, C., (2001), "Innovation Policy – A Systemic Approach", in Archibugi, D., and Lundvall, A.A, (eds.), *The Globalizing Learning Economy*, Oxford: Oxford University Press.

Edquist, C., Luukkonen, T., and Sotarauta, M., (2009) *Broad-based innovation policy. In Evaluation of the Finnish National Innovation System – Full Report*, Ministry of Education and Ministry of Employment and the Economy, pp.11-70.

Etzkowitz, H., and Leydesdorff, L., (2000), "The Dynamics of Innovation: From National Systems and Mode 2 to a Triple Helix of University-Industry-Government Relations", *Research Policy*, 29, 313-330.

Etzkowitz, H., Webster, A., Gebhardt, C., and Terra, B.R.C., (2000), "The Future of the University and the University of the Future: Evolution of Ivory Tower to Entrepreneurial Paradigm", *Research Policy* 29, 313-330.

Flanagan, K., Uyarra, E., and Laranja, M., (2011), "Reconceptualising the 'Policy Mix' for Innovation", *Research Policy*, 40, 702-713.

Fletcher, J.K., and Kaufer, K., (2003), "Shared Leadership. Paradox and Possibility", in Pearce, C.L., and Conger, J.A., (eds.), *Shared Leadership: Reframing the Hows and Whys of Leadership*, Sage Publications, Thousand Oaks.

Fløysand, A., and Jakobsen, S-E, (2010), "The Complexity of Innovation: A Relational Turn", *Progress in Human Geography*, 35, 328-344.

Foray, D., (2014), *Smart specialization. Opportunities and challenges for regional innovation policy*. London: Routledge.

Foray, D.; David, P., and Hall, B., 2009, "Smart Specialisation – The Concept" Knowledge Economists Policy Brief No 9, June 2009

Foray, D., David, P., and Hall, B., 2011, "Smart specialization: From academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation", MTEI Working Paper, École Polytechnique Fédérale de Lausanne

Foray, D., Goddard, J., Goenaga Beldarrain, X., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C., and Ortega-Argilés, R., (2012), *Guide to Research and Innovation Strategies for Smart Specialisations*, Brussels: European Commission.

Franke, N., and Shah, S., (2003), How Communities Support Innovative Activities: An Exploration of Assistance and Sharing Among End-Users", *Research Policy*, 32, 157-178.

Frenken, K., Van Oort, F., and Verburg, T., (2007), "Related Variety, Unrelated Variety and Regional Economic Growth", *Regional Studies* 41: 685–697.

Gibney, J., (2011), 'Knowledge in a "Shared and Interdependent World": Implications for a Progressive Leadership of Cities and Regions', *European Planning Studies*, 19.4, 613-627.

Goddard, J., Healy, A., Huggins, R., McCann, P., van Oort, F., Thissen, M., Vallance, P. and Wilson, J. (2014) Entrepreneurial Search Dynamics, *SmartSpec WP1 Reflection Paper*, http://www.cardiff.ac.uk/cplan/sites/default/files/Entrepreneurial%20Search%20Dynamics.pdf.

Goddard, J., (2009), *Re-Inventing the Civic University*, London: NESTA

Goddard, J., and Vallance, P., (2013), *The University and the City*, Routledge, London.

Grabher, G., (1993), "The Weakness of Strong Ties: the Lock-in of Regional Development in the Ruhr Area". In Grabher, G. (ed.), *The Embedded Firm: On the Socioeconomics of Industrial Networks*, Routledge, London, pp. 255-277.

Grabher, G., Ibert, O., and Flohr, S., (2008), "The Neglected King: The Customer in the New Knowledge Ecology of Innovation", *Economic Geography* 84, 253-280.

Hausmann, R., and Rodrik, D., 2003, "Economic Development as Self-Discovery," *Journal of Development Economics*, 72.2, 603- 633

Henning, M., Stam, E., and Wenting, R., (2012), "Path Dependence Research in Regional Economic Development: Cacophony or Knowledge Accumulation?", *Regional Studies* 47.8, 1348-1362.

Hessels, L.K., (2013), "Coordination in the Science System: Theoretical Framework and a Case Study of An Intermediary Organization", *Minerva*, 51.3, 317–339.

Hollands, R.G., (2008), "Will the Real Smart City Please Stand Up? Intelligent, Progressive or Entrepreneurial?", *City*, 12, 303-320.

Hughes, A., 2012, "Choosing Races and Placing Bets: UK National Innovation Policy and the Globalisation of Innovation Systems", in Greenaway, D., (ed.), *The UK in a Global World. How can the UK focus on steps in Global Value Chains that Really Add Value?*, BIS e-book, CEPR and Department for Business, Innovation and Skills See: http://www.cepr.org/pubs/books/cepr/BIS_eBook.pdf

Jessop, B., (1998), 'The Rise of Governance and the Risks of Failure: The Case of Economic Development', *International Social Science Journal*, 50(155), 29-45.

Konig, A., and Evans, J., (2013), "Introduction: Experimenting for Sustainable Development? Living Laboratories, Social Learning, and the Role of the University", In Konig, A. (ed.), *Regenerative Sustainable Development of Universities and Cities: The Role of Living Laboratories*, Edward Elgar, Cheltenham, pp.1-24.

Lagerholm, M., and Malmberg, A., (2009), "Path Dependence in Economic Geography", in Magnusson, L., and Ottosson, J., (eds.), *The Evolution of Path Dependence*, Edward Elgar, Cheltenham, pp. 87-107.

Laranja, M., Uyarra, E., and Flanagan, K., (2008), "Policies for Science, Technology and Innovation: Translating Rational into Regional Policies in a Multi-Level Setting", *Research Policy*, 37.5, 823-835.

Lankhuizen M., and Thissen, M., (2014), *Identifying True Trade Patterns: Correcting Bilateral Trade Flows for Re-Exports*, Paper presented at the IIOA conference in Lisbon.

Leydesdorff, L., (2012), "The Triple Helix, Quadruple Helix, ..., and an *n*-Tuple of Helices: Explanatory Models for Analyzing the Knowledge-Based Economy?", *Journal of Knowledge Economy* 3, 25-35.

Leydesdorff, L., and Etzkowitz, H., (1996), "Emergence of a Triple Helix of University-Industry-Government Relations", *Science and Public Policy*, 23, 279-286.

Leydesdorff, L., and Etzkowitz, H., (2003), "Can 'the public' be Considered as a Fourth Helix in University-Industry-Government Relations?", Report on the Fourth Triple Helix Conference, 2002. *Science and Public Policy*, 30, 55-61.

Lundvall, B-Å., (1992), (ed.), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

MacGregor, S. P., Marques-Gou, P., and Simon-Villar, A., (2010), "Gauging Readiness for the Quadruple Helix: A Study of 16 European Organizations", *Journal of Knowledge Economy*, 1, 173-190.

Mackinnon, D., Cumbers, A., Pike, A., Birch, K., and McMaster, R., (2009), "Evolution in Economic Geography: Institutions, Political Economy, and Adaptation", *Economic Geography*, 85, 2, 129-150.

Magro, E., Navarro, M., and Zabala-Iturriagagoitia, J.M., (2014), "Coordination-Mix: The Hidden Face of STI Policy", *Review of Policy Research*, 31.5, 367-389.

Magro, E., and Wilson, J.R., (2013), "Complex Innovation Policy Systems: Towards an Evaluation Mix, *Research Policy*, 42, 1647-1656.

Marcovich, A., and Shinn, T., (2011), "From the Triple Helix to a Quadruple Helix? The Case of Dip-Pen Nanolithography", *Minerva*, 49, 175-190.

Martin, R., (2010), "Rethking Regional Path Dependence: Beyond Lock-In to Evolution", *Economic Geography*, 86.1, 1-27.

Martin, R., and Sunley, P., (2006), "Path Dependence and Regional Economic Evolution", *Journal of Economic Geography*, 6, 395-417.

Martinez, D., and Palazuelos-Martinez, M., (2014), "Breaking with the Past in Smart Specialisation: A New Model of Selection of Business Stakeholders within the

Entrepreneurial Process of Discovery, *S3 Working Paper Series*, No. 04/2014, IPTS, Seville.

McCann, P., 2015, *The Regional and Urban Policy of the European Union: Cohesion, Results-Orientation and Smart Specialisation*, Edward Elgar. Cheltenham

McCann, P. and Ortega-Argilés, R. (2014) Smart Specialisation, Regional Growth and Applications to EU Cohesion Policy, *Regional Studies*, doi: 10.1080/00343404.2013.799769.

McCann, P., and Van Oort, (2009), "Theories of Agglomeration and Regional Economic Growth: a Historical Review, in Capello, R., and Nijkamp, P., (eds.), *Handbook of Regional Growth and Development Theories*, Cheltenham, Edward Elgar: 19-32.

Melo, P., Graham, D, and Noland, R., (2009), "A Meta-Analysis of Estimates of Agglomeration Economies", *Regional Science and Urban Economics* 39, 332–342.

Metcalfe, J.S., (1995), "Technology Systems and Technology Policy in an Evolutionary Framework, *Cambridge Journal of Economics*, 19.1, 25–46.

Moretti, E., 2012, *The New Geography of Jobs*, Houghton Mifflin Harcourt, New York

Moulaert, F., and Nussbaurner, J., (2005), "The Social Region: Beyond the Territorial Dynamics of the Learning Economy", *European Urban and Regional Studies*, 12, 45-64.

Neffke, F., Henning, M., and Boschma, R., 2011, "How do Regions Diversify over Time? Industry Relatedness and the Development of New Growth Paths in Regions", Economic Geography, *Economic Geography*, 87.3, 237–265,

Nelson, R.R., (1993) (ed.), *National Innovation Systems: A Comparative Analysis*, Oxford: Oxford University Press.

Oinas, P. and Malecki, E. J., (2002), The Ëvolution of Technologies in Time and Space: From National and Regional to Spatial Innovation Systems", *International Regional Science Review* 25, 102-131.

OECD, (2010), *Regional development policies in OECD countries*. Paris, France: OECD Publishing.

OECD, (2011), *Regions and Innovation Policy, OECD Reviews of Regional Innovation*, Paris: OECD Publishing.

Pearce, C.L., and Conger, J.A., (2003), *All Those Years Ago. The Historical Underpinnings of Shared Leadership*, in Pearce, C.L, and Conger, J.A., (eds.), *Shared Leadership: Reframing the Hows and Whys of Leadership*, Sage Publications, Thousand Oaks.

Rodriguez-Pose, A., and Dahl Fitjar, R., "Buzz, Archipelago Economies and The Future of Intermediate and Peripheral Areas in a Spiky World", *European Planning Studies*, 21, 355-372.

Richardson, R., Healy, A., and Morgan, K., (2014), "Embracing Social Innovation", *SmartSpec WP3 Reflection Paper*,

http://www.cardiff.ac.uk/cplan/sites/default/files/Embracing%20Social%20Innovation.pdf

Rodrik, D., 2014, "When Ideas Trump Interests: Preferences, Worldviews, and Policy Innovations", *Journal of Economic Perspectives*, 28.1, 189-208

Smith, K., (2000), "Innovation as a Systemic Phenomenon: Rethinking the Role of Policy", *Enterprise and Innovation Management Studies*, 1.1, 73-102.

Sotatauta, M., (2005), "Shared Leadership and Dynamic Capabilities in Regional Development", in Sagan, I. and Haikier, H. (Eds.) *Regionalism contested: Institutions, Society and Governance*, Cornwall: Ashgate.

Sotarauta, M., (2009), "Power and Influence Tactics in the Promotion of Regional Development: An Empirical Analysis of the Work of Finnish Regional Development Officers, *Geoforum*, 40, 895-905.

Sotarauta, M., (2010), "Leadership and Governance in Regional Innovation Systems", in Eriksson, A., (ed.), *The Matrix – Post Cluster Innovation Policy*, Vinnova Report VR 2010:10, Vinnova, Stockholm.

Stimson, R., Stough, R.R., and Salazar, M., (2009), *Leadership and Institutions in Regional Endogenous Development*, Cheltenham: Edward Elgar.

Stoker, G., (1998), 'Governance as Theory: Five Propositions', *International Social Science Journal*, 50(155), 17-28.

Sugden, R., Wei, P., Wilson, J.R., (2006), "Clusters, Governance and the Development of Economies: A Framework for Case Studies", in Pitelis. C., et al. (eds.), *Clusters and Globalisation: The Development of Urban and Regional Economies*, Cheltenham: Edward Elgar.

Sydow, J., Schreyögg, G., and Koch, J., (2009), "Organizational Path Dependence: Opening the Black Box", *Academy of Management Review*, 34, 4, 689-709.

Terry, R.W., (1993), "Authentic Leadership: Courage in Action", Jossey-Bass, San Francisco.

Thissen, M., Van Oort, F., Diodato, D., and Ruijs, A., (2013), *Regional competitiveness and smart specialization in Europe. Place-based development in international economic networks*. Cheltenham: Edward Elgar.

Thissen, M., Diodato, D., and Van Oort, F., (2014), "Integrated Regional Europe: European Regional Trade Flows in 2000", The Hague: Netherlands Environmental Assessment Agency (PBL).

Thissen, M., de Graaff, T., and Van Oort, F., (2015), *Structural determinants and interregional demand effects in regional economic growth: a decomposition method*. Heidelberg: Springer, forthcoming.

Vallance, P., and Goddard, J., (2014), *Smart Specialisation for Regional Innovation (WP5): Regional Report on Pirkanmaa (Tampere), Finland*.

Vallance, P., and Kempton, L., (2014), *Smart Specialisation for Regional Innovation (WP5): Regional Report on Northern Ireland, UK*.

Vanguard Initiative, (2014), *New Growth through Smart Specialisation: Engagement for a European Industrial Renaissance*.

Von Hippel, E., (2005), *Democratizing Innovation*, Cambridge, MA: MIT Press.

Valdaliso, J-M., Magro, E., Navarro, M., Aranguren, M-J, and Wilson, J.R., (2014), "Path Dependence in Policies Supporting Smart Specialisation Strategies: Insights from the Basque Case", *European Journal of Innovation*, Management, 17.4, 390-408.

Van Oort, F., and Bosma, N., (2013), "Agglomeration Economies, Inventors and Entrepreneurs as Engines of European Regional Productivity", *Annals of Regional Science*,

51, 213-244.

Van Oort, F., de Geus, S., and Dogaru, T., (2015), "Related Variety and Economic Growth in a Cross-Section of European Urban Regions". *European Planning Studies* (forthcoming). DOI: 10.1080/09654313.2014.905003.

Van Oort, F., and. Lambooy, J., (2014), "Cities, Knowledge and Innovation". In: Fischer M., and Nijkamp, P., (eds.), *Handbook of Regional Science*. Berlin, Springer: 475-488.

Walendowski, J., Kroll, H., Wintjes, R. and Hollanders, H., (2011), *Innovation Patterns and Innovation Policy in European Regions – Trends, Challenges and Perspectives*, Regional Innovation Monitor 2010 Annual Report, available at:
http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/

World Bank, 2010, *Innovation Policy: A Guide for Developing Countries*, World Bank, Washington DC