Paper to be presented at the DRUID Academy conference in Rebild, Aalborg, Denmark on January

15-17, 2014

Problematising the ?Regional System of Innovation? Approach; Lessons from a Weaker Region

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Abstract

Innovation studies have increasingly moved towards a systemic approach that understands innovation as interactive, evolutionary, and context specific. Both in the academic and policy spheres the ?systems of innovation? approach has gained currency over the last twenty or so years, and has become the dominant lens through which we view and understand innovation dynamics. Within the systems of innovation literature, there have been divergent ideas and bodies of research, arguing for the use of different systemic frameworks of analysis including national, regional, local, sectoral, and technological.

This paper takes the Regional Innovation Systems (RIS) approach and questions how useful it is as a tool for examining and understanding innovation dynamics at the regional level, and as a framework for better designing regional innovation policy. Specifically, it tests the applicability and appropriateness of the RIS approach in a weaker region (Wales, UK), in order to answer the key question of the author?s PhD thesis:

?Which innovation ?theories? are more suited to weaker, more peripheral regions??

The rationale behind this research is that our knowledge and understanding of innovation in weaker regions is limited, and ideas formulated in stronger regions are often transplanted wholesale, usually failing to reproduce the successful outcomes. By interrogating the RIS concept in the weaker region context, this paper fundamentally questions whether our pre- existing models and theories are appropriate or useful. The data presented in this paper was collected as part of a case study on innovation and the role of government as a driver of economic growth in Wales. Empirical research consisted of an in-depth policy review of the last 15 years of innovation policy, and 58 interviews with key stakeholders in the Welsh innovation system from government, academia, business, intermediary and third sector organisations.

This paper finds three main problems with the RIS approach as a framework for analysing innovation policy and understanding innovation dynamics in Wales. It finds the geographical delineation of ?the region? as problematic in this context, which impedes the usefulness of the RIS concept as both an analytical tool and policy ?best practice? model. Secondly, it finds that RIS approaches have been popular in Wales in the past but have fallen out of favour more recently, being replaced by cluster based policies predicated on the smart specialisation concept gaining currency across Europe at the current time. And thirdly, it finds practical difficulties in utilising the concept to design innovation policies and programmes due to problems of concept ?fuzziness? and intangibility. This paper suggests that, whilst the

RIS concept is theoretically and practically useful and has proven to be an important idea that has translated from academic to policy (and vice versa), there are some problems encountered when it is applied to the Welsh case that cause us to question the applicability and usefulness of the concept in the context of a weaker region.

Jelcodes:R58,-

Problematising the "Regional Innovation Systems" Approach; Lessons from a Weaker Region

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Abstract

This paper draws together two bodies of literature (regional geography and innovation studies) in order to fundamentally question our conceptualisation of innovation and economic development at the regional level. First, it justifies why the regional level of analysis is useful and appropriate, and then problematises the Regional Innovation System (RIS) both as an analytical framework and a best-practice tool for policymakers. This paper will argue that the RIS approach is no longer suitable for territories such as Wales, which correspond to neither our traditional understandings of a region nor of a nation. It argues that the contested nature of "the region" and the problems in its definition and recognition undermine the validity of the RIS approach. The connotations of the term "region" render it untenable as a tool for policymakers in contested territories. It may seen contradictory to firstly defend and justify a regional approach only to tear it apart and fundamentally question its relevance but the premise of this paper is that the regional approach to understanding innovation and economic development is the best framework we have for improving the fates of the poorest parts of Europe, but in order for policymakers to implement and appreciate the RIS framework some serious strengthening and re-packaging of the concept is required. The academic study of innovation should not be conducted in a vacuum, isolated from the political contexts and sensitivities within which innovation policy is practiced and implemented.

Introduction and Theoretical Background

This paper aims to make a theoretical contribution to the disciplines of economic geography and innovation studies; specifically to advance the regional innovation systems theory through critical insights gained from an empirical case study. Firstly, an overview of the academic literature will be provided, in particular the systems of innovation body of work and in particular the regional variants of the approach. Then, the case study of Wales will be introduced, together with methodology. The majority of the paper presents the insights learnt about the RIS approach through practical application. In particular, the problems with the approach are examined, raising fundamental questions about the applicability of the RIS approach to present-day Wales. Finally some suggestions are made for dealing with moving the theory forward; a re-packaging of the RIS concept is suggested to make it more applicable and tenable as an approach for policymakers in weaker regions, such as Wales, to implement.

There are two distinct yet interwoven strands of literature that this papers draws heavily upon: the first is the IS body of literature, which has grown in importance over the last thirty years gaining currency in both the academic and policy spheres and changing the way we conceptualise and study innovation dynamics towards a more interactive and evolutionary approach; the second is the new-regionalist school of work, which sees the region as the locus of economic activity in the modern

world and also a growing focus politically, socially and culturally. This paper views regional and innovation studies as intermeshed and interdependent, as expressed through the RIS approach, to the extent that it does not make sense to study them separately. The inter-disciplinary bonds will be strengthened and the assumptions present within each approach will be interrogated; ultimately our understanding of regional innovation systems will be enhanced through a comprehensive problematising and unpacking process.

Over the past three decades the Systems of Innovation or Innovation Systems (IS) approach to innovation and economic development has gained prominence in both the academic and policy spheres so that it is now a dominant lens through which we examine innovation processes and dynamics, and is an influential best practice framework for innovation policy (Lundvall, 2007; Edquist, 2005). The approach first emerged in the academic literature with work on National Systems of Innovation (NSI) (Lundvall, 1988, 1992; Nelson, 1993), and has since evolved into several variations all with the underlying conception of innovation as interactive and evolutionary. The systems approach was developed to challenge mainstream economics and prevailing economic policy practice (Lundvall, 2007) and it is important to recognise the role of the concept in driving shifts in our understanding of innovation and economic development towards a more evolutionary and interactive approach, influencing economic and innovation policy at various levels.[1]

Lundvall (2007) provides a comprehensive overview of the variations present within the systems of innovation literature, and Edquist (2005) refers to a "family" of SI concepts underpinned by common understandings of the innovation process as evolutionary and interactive. The key variants that have evolved from the original NSI concept are: regional systems of innovation (Cooke, 1996; Maskell & Malmberg, 1997); technological systems (Carlsson & Stankiewitz, 1991); and sectoral systems of innovation (Breschi & Malerba, 1997). The geographical variants of the SI approach are of particular interest to this study, which investigates the Welsh innovation system. SI sits alongside approaches developed both as analytical tools for studying innovation and as best practice or ideal types for places to aspire towards. The most influential approaches as identified through academic, grey and policy literature reviews are the Triple Helix (Etzkowitz & Leydesdorff, 1997), the Learning Region (Florida, 1995; Morgan, 1997; Rutten & Boekema, 2007), and Clusters (Porter, 1990; Baptista, 1998) with other approaches such as innovative milieux (Breschi & Lissoni, 2001) and open innovation (Chesborough, 2003) also having an important impact. The analysis conducted in this paper, which uses empirical observations from a real world case study to reflect on theory, could be repeated using any of these theoretical frameworks, but for the purposes of this paper the SI approach has been chosen; specifically the RIS variant.

Edquist identifies the key elements that underpin the SI approach: firms do not innovate in isolation but in collaboration and interdependence with other organisations; these organisations can be other firms, public bodies, schools, universities; the behaviours of these institutions are shaped by institutions – the laws, rules, norms and routines that constitute incentives and obstacles for innovation (2005, p.182), or what North refers to as the rules of the game (1990). Lundvall explains how there are differing interpretations of the IS; it can be interpreted in a broad or narrow fashion, and often has been interpreted overly narrowly by policymakers leading to a "distortion" of the

[1] Lundvall (2007) and Edquist (2005) give examples of systems influenced regional, national, and international innovation policy: OECD, UNCTAD and UNIDO, VINNOVA (the Swedish Agency for Innovation Systems).

concept and "innovation paradoxes, which leave significant elements of innovation-based economic performance unexplained." (2007, p.1). The SI concept is employed as a label, an analytical tool, and to derive policy implications, but by far the most common usage is the former (Edquist, 2005, p.192). The value of the SI theory lies in its broad understanding of innovation as interactive and evolutionary; it does not condense the complexity of innovation into a simple checklist for policymakers to follow in the manner of the Triple Helix or Cluster approaches.

The strengths and weaknesses of the IS approach have been much discussed in the literature, and so will be briefly reviewed here. Edquist provides an overview of the strengths and weaknesses of the IS approach garnered from his own research and also through assimilating other authors' perspectives. He finds the strengths of the IS to be: the holistic and interdisciplinary perspective; the historical and evolutionary perspectives it encompasses; the interdependence and non-linearity of the approach; and the central role of institutions in explaining the innovation process (2005, p.185). The weaknesses identified revolve around the "fuzziness" of the approach (Markusen, 2003); for example the lack of a definition for an institution, and the lack of specification over what should be included or excluded from the system and where the system boundaries are (Edquist, 2005, p.186). There is fundamental disagreement in the literature over how well-defined and theorised the systems concept should be. Some authors believe that its openness and flexibility are central strengths of the systems approach (Lundvall, 1992, p.13; Nelson & Rosenberg, 1993, p.5-6) so that it can be usefully applied in a variety of contexts with a range of variables considered (Edquist, 2005, p.186). Others see the approach as undertheorised and needing to become more "theory-like" (Lundvall 2002, 2003; Fischer, 2001).

Having provided an overview of the ideas surrounding the IS approach this paper will now consider its empirical application to a real world case study and the lessons that can be incorporated into the theory. Before presenting the findings, some background of methodology and the case study in question is given.

Methodology and Case Study

This paper presents the findings of a case study conducted on innovation policy and economic development in Wales, UK. The empirical research consisted of an in-depth review of innovation and related policy and programmes (from 1999 to the present day), and 58 in-depth semi-structured interviews with key stakeholders in the Welsh innovation system. The motivating research question was: "Which theories are most appropriate to the study of innovation in a weaker region?". It uses insights gained from the case study, particularly from the perspective of the role of government within it, to fundamentally question the suitability of territorialised innovation theories both as a lens for examining weaker regions and as a tool for creating a best practice plan for innovation policymakers.

The overarching methodology of the case study approach will be briefly explained, followed by the specific methods employed. This study takes a broadly constructionist approach to conducting qualitative research following the research design explained by Denzin & Lincoln:

> "The gendered multiculturally situated researcher approaches the world with a set of ideas, a framework (theory, ontology) that specifies a set of questions (epistemology) that he or she then examines in specific ways (methodology, analysis)." (2005, p.21).

The case study approach was chosen as the most appropriate for this study because "the case study is used in many situations to contribute to our knowledge of individual, group, organisational, social, political and related phenomena" (Yin, 2009, p.4). The primary aim of this paper is to enhance and increase our understanding of the particular Wales case, but also to provide some insights into innovation and economic development theory that could be of broader relevance to weaker regions elsewhere. Within the broad case study framework a mixed methods approach can be used to "collect a richer and stronger array of evidence" and allows one to address broader and more complicated research questions (Yin, 2009, p.63).

The specific methods selected for this study are policy review and stakeholder interviews. The rationale is to draw a detailed picture of the Welsh innovation system, in particular the role of government within it, from the perspectives of the government but also key stakeholders from the business, university, intermediary, and third sector spheres. Semi-structured interviews were conducted because "qualitative interviews are especially good at describing social and political processes, that is how and why things change" (Rubin & Rubin, 2005). Interviews "enable [the researcher] to get to core issues in the case more quickly and in greater depth", to probe motivations and ask follow up questions, and to facilitate individuals telling their stories (Simons, 2009, p.43). As a result of the combination of these two methods, a rich analysis could be built up of the Welsh innovation system and the interventions implemented over the last fifteen years, from the perspective of a wide range of stakeholders. The data gathered was analysed through the lens of the RIS approach, eliciting some interesting findings about the Wales case. The practical application of the RIS also revealed some issues or problems with the theory itself.

Before the findings of this research are presented it is important to provide an overview of the Wales case study; Wales can be understood as a small, economically weak, and peripheral region within the EU that is distinct politically and culturally from the rest of the UK. The population of Wales is 3,006,430 (StatsWales, 2010), and this population is concentrated primarily in the South with 1.4 million people living in the city region surrounding Cardiff (Barry, 2011), with a smaller population concentration in the North-East. The West, Central, and North-West areas of Wales are rural and sparsely populated. There are two official languages in Wales- Welsh and English, and whilst the issue of the Welsh language is not central to this study it is important to highlight the cultural differences between Wales and the UK as a whole. Wales is a post-industrial region with a struggling economy, has a certain degree of political devolution from the rest of the UK, and culturally can be considered a nation with various tensions arising between the Welsh and UK levels as a result.

To deal with the first assertion, that Wales is an economically weaker region suffering from the problems of post-industrial regions, allow us to consider some figures on the Welsh economy. Wales languishes at the bottom of UK GDP growth and competitiveness tables (Huggins & Thompson 2010, 2013) and has a level of economic inactivity 4% above the UK average. Low economic activity rates and GDP per capita figures are a result of past generations of deindustrialisation, according to Cooke (2003, p.15) and we can see related problems with skills and qualification levels (13.7% of the Welsh population have no qualifications compared to 11.4% of the UK) (Economic Research Programme, 2011). There are entrenched problems with the structure of the regional economy, in particular the lack of private sector dynamism and an overreliance on the public sector for employment (Ball, 2008; Cooke & Clifton, 2006). There are too few innovative and R&D performing firms in Wales, and

Welsh SMEs are usually involved in the low value aspects; however there are some strengths in aerospace, opto-electronics, and bio-sciences (Thomas & Henderson, 2011). The general business culture is seen to be weak, and a culture of entrepreneurship and innovation is lacking across the Welsh SME base; this can be attributed to the over-reliance on branch plants and FDI rather than building up indigenous capacity and capabilities. Much of Wales qualifies for Convergence funding, the highest level of support for economic development activities from the European Commission, managed and distributed in Wales by the Welsh European Funding Office (WEFO). Aside from these economic factors, the rurality and peripheraility of most of the country outside the Southern coastal belt has implications for the functioning and structure of the innovation system.

The political situation in the UK is somewhat complex because of the devolution process which has been gradually evolving and intensifying since beginning in 1997. In brief, the "home nations" of Scotland, Wales, and Northern Ireland all have separate executives and legislatures that function alongside the central UK Government (Whitehall) and Parliament (Westminster).[2] In each country the situation is slightly different but in Wales there is a conferred powers model, which means that certain areas of responsibility have been devolved from the UK to Welsh level of government; innovation and economic development are an example of such an area alongside others including health, education and the environment. However, there are policy areas which have an important bearing on innovation and economic development that are still controlled by the UK government such as foreign policy, defence, tax and regulation. Alongside and intersecting with this interesting and slightly messy political situation is the cultural context; Wales is technically a principality and part of the United Kingdom. However, it is often referred to both within and outside Wales as a "country", has its own language and distinctive heritage, and a proud and distinct identity from that of England, Ireland, or Scotland. This complicated situation makes it very difficult to know whether Wales should be considered a nation or a region for the purposes of analysing the innovation system; this question is something of a sensitive subject within Wales and the UK, particularly in light of the impending referendum on Scottish independence.

Problematising the RIS Approach Using Theory and Empirical Observations

Having introduced the case study and the methodology employed, this paper will now present the problems encountered when applying the RIS in the context of a weaker region; problems were encountered at each stage of this process.

1) Selecting the Most Appropriate Geographical Level or Scale of Analysis

Theoretical Debates

After a thorough review of the literature on innovation and economic development and consideration of the various approaches proposed, the systems of innovation framework was selected because of its interactive and evolutionary nature. The next decision was which (geographical) variation of the systems framework to apply to Wales: regional or national. The theoretical debate between the two approaches was considered with wider debates about the role and importance of the region, before choosing the RIS variant for this study. This decision will be justified, highlighting some fundamental problems with the systems approach, in particular the

[2] In the UK, the various Governments and Parliaments are referred to by their geographical location. In the case of Wales this could be Cardiff (the capital), Cardiff Bay (the location of the National Assembly) or Cathays Park (location of the Welsh Government).

problem of categorising real-world territories as either the “regions” or “nations” that the SI framework proposes.

Authors from different disciplines have presented arguments as to why the region is becoming increasingly important as the focus of economic growth and innovation processes; the RIS body of work sits at the confluence between the economic geography and innovation systems (sub-) disciplines. To briefly summarise the regionalist argument: literature within economic geography tells us that changes observed in the global economy have altered patterns of economic growth and development, and also brought on societal changes resulting in prosperity for some parts of the world but decline for others. Many authors have emphasised the importance of regions within this new economic geography, as explained by Uyarra:

“One key rationale underpinning regionalist thinking is that global economic restructuring is reinforcing *the region* as a fundamental locus of economic governance.” (2007, p.244, emphasis added).

Florida also sees the importance of the region growing as globalism and regionalism evolve as part of the same process of economic transformation, and regions function as effective points of entry into the global economy (1995). Agreeing with this viewpoint, Scott and Storper explain how regions are crucial due to the importance of agglomeration in the globalized world: “Large scale agglomeration and its counterpart, regional economic specialisation, is a worldwide and historically persistent phenomenon that is intensifying greatly at the present time by forces unleashed by globalization.” (2003, p.588).

It is not only academics from the economic and innovation traditions that emphasise the role of the region; there is a similar body of work in the political geography arena which sees the region growing in importance politically and culturally. Several authors have highlighted the shifting power dynamics at a geographical level, finding power increasingly transferred to the regional level, especially in the EU. For example, evidence from the UK, Norway and Denmark presented by Asheim and Gertler finds authority increasingly transferred to the region through national and EU level policies (2005). In the UK, a “hollowing out” process has been observed whereby the power of sub- and supra-national actors has increased, thus decreasing the power and influence of the nation state (Holiday, 2000; Bache & Flinders, 2004; Hooghe & Marks, 2001). Paasi highlights the role of the EU in strengthening and re-defining the role of regions across Europe and elevating them to important actors:

“Regions are highly significant in the EU, where both the political making of the Union itself and the “Europe of the regions” are examples of the re-scaling of state spaces and of the new meanings being assigned to territories” (2009, p.145).

The RIS literature focuses on the innovation-specific aspects of this debate and argues that a regional framework is most appropriate due to the fact that learning and knowledge have a specifically regional context. Asheim and Gertler, for example, see a distinctive “regional culture” that can influence practices of firms, and shapes the way they interact with one another (2005). Knowledge is hard to exchange over long distances, being heavily imbued with meaning arising from the social and institutional context in which it is produced; regions have individual knowledge capabilities and resources (Cooke et. al. 1997; Asheim & Gertler, 2005; Cooke et. al., 2007, p.199;

Morgan, 1997; Nauwelaers & Wintjes, 2003). Paasi links up the increasing political influence of regions with regional identity and economic development (2009, p. 139), explaining how EU cohesion policy, which is concerned with a just redistribution of opportunities in space, was developed to motivate regions to exploit their cultural characteristics, skills, and social capital for ultimately economic goals (Faludi, 2007).

Although there is a convincing body of evidence presented by these authors amongst others, there are many who question the centrality of the region and instead argue that other territorial levels and geographical scales of analysis are equally or more important, or that knowledge and innovation are not spatially bounded rendering a geographically based view fundamentally problematic (Lovering, 1999; MacLeod, 2001; Hadjimichalis, 2006; Harrison, 2006, 2013). Lovering (1999) is especially critical of the "new-regionalism" and uses insights from his study of Wales to contest the two key ideas underpinning the new-regionalist school of thought: that the region has become the "crucible of economic development"; and the normative basis that "the region" should be the prime focus of economic policy (1999, p. 380). Instead of empowering regions and their citizens, Lovering sees the new-regionalist discourse obscuring and diverting attention away from the fact that national systems of regional redistribution have "withered" and resources for investment in regions have declined; the Welsh economy is in fact being supported and driven by the activities of the national (British) state (1999, p. 382; Martin and Sunley, 1997).

Much of the debate about whether or not the regional perspective is most appropriate revolves around a binary choice between conceptualising the main driver of economic growth and innovation, and the geographical scale at which institutions and organisations operate, as the region or nation. In essence, this debate sees the new-regionalists (e.g. Cooke, Morgan, Asheim, Paasi) on one side, and those who see the national level as most important on the other (e.g. Lundvall, Nelson, Edquist, Lovering). This binary dynamic is strongly visible in the IS literature, which is split into the regional (RIS) and national (NSI) variants; the interconnected and overlapping nature of these two approaches is often recognised but there are limited attempts to integrate the two. Other geographical variants do exist within the systems literature (e.g. local and supranational), but most dominant in literature and policy spheres, at least in the European context, are the national and regional variants.

The NSI and RIS approaches are in fact very similar; Lundvall sees the RIS variant as the perspective most resembling the original NSI because both are based on the understanding of knowledge as local and tacit, view innovation systems as localised, and attempt to explain economic performance in geographical terms (2007, p.4). Several authors see the national level as the most useful or appropriate for examining and trying to understand innovation processes and performance (Lundvall, 1988; Edquist, 1997) because: different countries have different knowledge stocks due to levels of inputs devoted to innovation (Furman, Porter, & Stern, 2002); interactions take place within specific national contexts of shared norms, routines, and established practices (Isaksen, 2003); and the innovation process is organised according to the national level of governance (Ronde & Hussler, 2005). National innovation cultures are seen to exist, and the regional level is not seen to be sufficient for firms to stay competitive (Isaksen, 2003; Asheim & Coenen, 2005).

The RIS school of thought is premised on the understanding that the regional level is most important in understanding processes of economic growth and development in the globalised knowledge

economy. It was established as an alternative to counterbalance and highlights the limits of the original NSI approach. For example, Dodgson et. al. see the NSI variant as problematic because of the relevance of global, regional, sectoral, and technological influences on innovation performance (2011, p.1). The key argument underpinning the RIS approach is that learning has a specifically regional context; knowledge is hard to exchange over long distances being heavily imbued with meaning arising from the social and institutional context in which it is produced, and regions have individual knowledge capabilities and resources (Cooke et. al. 1997; Asheim & Gertler, 2005; Cooke, 2007, p.199; Morgan, 1997; Nauwelaers & Wintjes, 2003). Both approaches have their advocates and detractors. For example, Bellini & Landabaso criticise the regional approach because they see innovation policy as too small in resources to tackle the macro dimensions of innovation (2007).

Practical Considerations of the Case Study

There are convincing theoretical arguments made in favour of each approach, but the important factor to take into account is the context of the study being undertaken so that the most appropriate framework can be applied (Edquist, 2005). The original work on RIS was conducted by Cardiff based academics Phil Cooke and Kevin Morgan, amongst others. This sets the RIS approach apart from other territorialised innovation theories such as the other systems variants, clusters, the learning region, and innovative milieux, because it was developed from empirical observations of a weaker peripheral region: Wales (Cooke, 2008, 2003, 1998; Cooke & Morgan, 1998). Following their lead, this paper continues the rich tradition of conducting research into the RIS in Wales but takes a balanced view, also drawing on the work of critical commentators from the wider academic community (discussed above) and those working in Wales, such as Lovering (1999) and Bristow (2005), who resist some of the new-regionalist and RIS advocate's core arguments.

As discussed above, the IS framework presents the empirical researcher with an overwhelmingly binary choice between the national and regional approaches. For this study the RIS was considered the most appropriate framework partly because of precedent and partly as a result of a detailed consideration of the empirical evidence gathered. Difficulties were encountered when trying to decide upon the geographical framework; this was not a clear cut process because there are elements of both regional and national approaches that could provide a useful framework for Wales depending on which elements of the IS are being examined. For example, should one consider purely economic factors, or also social, cultural and political factors? And should a broad or narrow conceptualisation of the IS be used? This study takes a broad and evolutionary approach as advocated by Lundvall (2007), a key originator of the concept, which includes the range of economic, social, cultural, and political factors. Also, from the regional studies discipline, Keating (1998) finds that regions take various forms – administrative, cultural, economic, governmental, and historical; these various dimensions could all have different implications for the applicability of the NSI and RIS models, depending on which of these we include in our analysis and upon which we allocate the most weight.

Considering the governance of innovation and innovation policy, the Welsh situation is complicated because, whilst economic development and innovation are devolved matters, many important economic levers are retained at the UK level and the Welsh government does not have the ability to borrow or raise its own revenue. This paper argues that these restrictions make the NSI problematic as a framework for analysing the Welsh IS. However, the RIS is hardly an ideal framework because

politically and culturally Wales is more than a region as it is understood in the British context. The English regions (excluding Northern Ireland and Scotland) do not have their own government level as is the case in some other European countries. Politically, the concept of a region is not particularly appropriate in the UK setting, but the framework provided by the RIS is potentially most useful and practical considering the important limits to the Welsh Government's powers. It is important to highlight the nation building and independence agenda present in Wales, as with other regions across Europe. Many see Wales as a nation, including academics (Morgan, 1981; Jenkins, 2007) and referring to it as a region could be problematic. Economic and political factors get interwoven with arguments over identity, language, history, and tradition (Paasi, 2009) and are hard to disentangle. In line with Paasi (2009) this paper argues that issues of regional culture, identity, and institutions all have profound influence on economic development and innovation, and should be seriously considered in any discussion of the innovation system. Economically, Wales and England are highly connected; there are significant flows of capital, people, and trade running east-west between the two territories. One could argue that economically, Wales is a region of the UK, with strong intra-regional inks and networks but significant cross-border relations and flows.

Deciding between the NSI and RIS frameworks based on these observations is problematic because neither framework is entirely appropriate; arguments could be made for either. Interviews with stakeholders from the university, government, business, and intermediary spheres investigated the interactions and networks between actors and organisations to establish whether these were mainly internal to Wales, or cross-border. Respondents were also asked which geographical levels of government and governance are most important to the IS. The responses were fairly conclusive that the Welsh and European levels of support are more important than the national (UK) level because the influence of UK innovation policy is weaker and most of the supports available are provided by the Welsh or European levels. Economic links between Wales and England were seen as important, especially links along the M4 corridor running East-West between London and Swansea.[3] These insights were decisive: because of the influence of the Welsh and European levels of government in the governance of the innovation system it does not make sense to analyse Wales embedded within the wider UK NSI, but because of the important powers reserved at the UK level an NSI perspective on the Welsh innovation system is similarly unsuitable. Considering the various factors and empirical observations, as well as the precedent set by Cooke and Morgan, the RIS was chosen as the best framework for analysing the Welsh innovation system. It is important to emphasise the government focus of this study, which prioritises governance and organisational aspects of the innovation system.

2) Moving from Theory to Application

Fundamental Issues in Conceptualising "The Region"

Having decided that a regional framework is most appropriate for analysing the Welsh innovation system, the next stage is to move from a theoretical consideration towards applying the framework. There are problems encountered when making this journey from theory to real world application,

[3] The "M4 corridor" is the term used to describe the band along the motorway running from London to Swansea, which includes many of the UK's important settlements and economic drivers such as Oxford, Reading, Bristol, Cardiff.

one of which is applying the theoretical concept of "the region" on the ground. This is not a problem exclusive to the RIS, but stems from more fundamental issues with the new-regionalist approach: the lack of definition and empirical explanation of what a region actually is and what it looks like in reality. Real world territories or places do not necessarily fit into our theoretical constructs. Several academics have highlighted underlying problems with the concept of "the region": the region, as it is presented in the literature, is "conceptually vague" (Lovering, 1999), and "object of mystery" (Harrison, 2006), or an "enigmatic concept" (MacLeaod & Jones, 2007) (Harrison, 2013). Doloroux & Parto see the fundamental problem with the RIS theory that we cannot determine what exactly a region is, how it looks, and how much and what type of innovation must occur within a region for it to be considered a RIS (2005). There are also fundamental questions asked about the validity of the geographical approach by those studying innovation who do not see knowledge flows conforming to national or regional boundaries. For example, Oerlemans et. al. argue against regionalised innovation theories because they see organisational proximity as more important than spatial proximity (2007, p.168). Nevertheless, this paper is grounded in the academic traditions of economic geography, which sees knowledge and innovation as geographically contextualised and dependent.

Conducting an empirical case study using the SI approach is problematic when considering a place that does not fit into either the regional or national frameworks provided, such as Wales. The discussion above has highlighted the problems in choosing between the two pre-existing frameworks, and how complex the choice is. Of course, we could not reasonably expect a theory to be perfectly applicable to every circumstance, and the process of theorising will always call for compromise and adaptation. But this paper argues that the SI approach as it stands is inadequate because it does not provide a framework for conceptualising and analysing territories that fall in between the definition of a nation or a region. Cooke has made attempts to address the normative and dogmatic nature of the RIS approach and recognises that "very few regions have all the attributes of an RIS" (2008, p.17). He identifies 6 different varieties of RIS: grassroots, network, dirigiste, localist, interactive, and globalised (1998, pp.20-23) thus allowing for a variety of regions but they all still fit within a hierarchical framework below the national level. The NSI and RIS approaches both have aspects and elements that could fit the Wales case well, but neither is appropriate in its entirety; the choice of one or another is a compromise and could lead to obscuring or misinterpreting important elements.

The SI approach provides little scope for understanding the changing and evolving nature of regions, this paper argues. The economic, political, social, and cultural aspects of regions change over time (Paasi, 2009) and correspondingly, our theorisation of them needs to account for this evolution. The binary SI framework does not account for the fact that a nation or region can shift across these category boundaries. For example, in the Wales case this could be a result of the changing political situation; as the identity and powers of Wales get stronger a "regional" conceptualisation becomes more problematic. At present a RIS approach is slightly more appropriate and practical than a national one, based on the governance of the innovation system still residing to a large extent at the UK level and the Welsh economy being so interlinked with that of England, but this could quickly change with evolving circumstances. Another example is the Scottish case, where a referendum on independence will be held in a year's time potentially shifting the innovation system further towards the NSI. In its current format the IS theory does not account for innovation system evolution between the different types, despite its proclamations of being an evolutionary and interactive approach.

Boundaries

Another problem identified through the application of the RIS framework is defining the system boundaries; this is a contested issue in the literature. For Edquist we must be able to define the boundaries of the system in order to study it empirically; "it must be possible to discriminate between the system and the rest of the world" (2005, p.187).There is an inherent assumption in the RIS approach that the boundaries of the "region" and the "innovation system" will be the same. If we assume that the boundaries of the innovation system and the region are the same, which may not be the case, there are some fundamental problems with the concept of regional boundaries. Paasi finds the concept of regional boundaries problematic, asserting that "we shouldn't necessarily understand regions as bounded unique units" and that the making and deducing of regional boundaries is a contested process (2009, p.132/134). However, he recognises that "borders do exist" (2009, p.137), but the boundaries of a region can range from "hard" to "soft" (p.134), from administrative boundaries to social practices and norms (p.136). The difficulty of recognising the hard borders of a region varies, in the case of Wales it is relatively easy, but defining and delimiting soft boundaries is another matter. Garcia-Álvarez & Trillo-Santamaria consider "cross-border regions" that are located on borders between different states (2013).

The problem of boundary definition is not only pertinent to the regional variation of the SI, but emerges whichever geographical scale one chooses to analyse. At the national level Lundvall finds that the boundaries of an NSI cannot be sharply determined and might be impossible to define (Edquist, 2005). Regions can be harder to define than nations because they may not have such sharply defined and enforced state borders (Paasi, 2009); they can be more fuzzy and contested entities. Clear administrative boundaries exist separating Wales from England, but these are not enforced or regulated in the way that national boundaries often are; one is not required to show a passport to pass between the two. As a result, people and goods flow freely, and significant economic and social linkages and interdependencies exist. Interviews with stakeholders, especially from the business sphere, revealed how important flows of goods and people between Wales and England are to the Welsh economy. A commonly cited barrier to innovation and economic growth is the fairly poor infrastructure links between the two. An example often provided is the bridge that links South Wales and South-West England, which many stakeholders see as particularly problematic because the cost of crossing (around 10 Euros) is seen as preventing economic activity between the two territories. This underlines the importance of borders to the functioning of the innovation system, and that physical borders (either natural or created) can be important as well as administrative boundaries.

The RIS approach envisages the region as a defined entity that can be approached and studied as a coherent whole and policy recommendations provided on that basis. However this study has found that we cannot necessary consider a region as homogenous and the RIS framework can obscure inter-regional differences. As Uyarra explains: an important problem with the RIS approach is that it assumes the region is a coherent whole, whereas in fact regions are usually characterised by a strong internal industrial/spatial diversity and uneven geography of development (2007, p.251). Interviews with stakeholders found inter-regional difference within Wales to be a pertinent issue for the Welsh economy and innovation system. For example, respondents from the rural North West felt that the issues affecting their economy and society were different compared to the rich urban area around Cardiff, in the South. They also felt that because the seat of political and administrative

(and indeed economic) power is in Cardiff the needs and priorities of the North are being sidelined. Furthermore, innovation support provision is spatially differentiated across Wales due to the allocation of funding from Europe: half of Wales qualifies for Convergence funding, so some policies and programmes address the Convergence area exclusively; the innovation system is different in these two sub-regions.

3) Policy Relevance and Implications

This section discusses the findings of the review of Welsh innovation policy, and supporting interviews with policymakers, implementers, and end users relating to the RIS as it has been applied in Welsh policy. Through analysing the evolution of innovation policy in Wales it was possible to trace which approaches were more or less popular at different times, and to find out why by questioning past and present policymakers. From this analysis insights can be garnered about the applicability and relevance of the RIS as a policy framework. The preceding sections discussed its merits and shortcomings as a theoretical approach to analysing innovation, and this section considers its validity and usefulness to policymakers as a practical tool. To remind the reader of the assertion made in the introduction, the SI approach is both an analytical framework and a best practice model for innovation and economic development and so is examined as both in this paper.

The RIS approach was found to feature in Welsh innovation policy, especially in the early years of the study period (late 1990s-early 2000s) when it was explicitly employed as a framework for policymaking as part of a drive across Europe for region to create their own innovation policies. However, the RIS was not used after 2002 and other theoretical approaches, in particular the Triple Helix and cluster-based approaches, became more popular in Wales. Both policy analysis and discussion with policymakers revealed the decline in the popularity of the RIS approach and the increasing importance of the Smart Specialisation agenda being driven from Europe at the current time (see Foray & Hall 2009, 2011). Respondents were asked to comment on which policies and programmes they see as being good or bad/useful or not and the early programmes that took an RIS approach generally received positive reviews from policymakers and academics. In fact, some called for a return to the systems approach because it is seen as a good framework for devising and structuring innovation policy in Wales. When asked about why the RIS approach fell out of favour in Wales, respondents felt that the priority shifted within innovation and economic policy towards a more higher-education based model that draws heavily on the Triple Helix approach; universities have been heavily relied upon to drive the Welsh innovation system. However, these approaches have proved to be generally unsuccessful, yet costly, both in formal evaluations conducted and in the eyes of stakeholders interviewed. The systems approach, whilst being perceived as a good framework, was seen by some stakeholders as overly complex and taking too long to deliver results; because it focuses on wider innovation factors and more cultural elements it is not perceived to be an approach that delivers the quick and demonstrable sought by policymakers.

The most recent Welsh innovation policy sees a return to the systems approach, in the national rather than regional format. Policymakers spoke of the Welsh "innovation ecosystem" idea, which when asked for clarification was shown to be very similar to the original NSI approach as proposed by Lundvall with an emphasis on the various organisations and institutions that compromise the Welsh IS. For example, stakeholders referred to creating and linking up networks of actors, addressing wider cultural factors to innovation and taking a holistic approach to supporting innovation and economic development. The terms of reference were very much internally focussed

on Wales and externally on Europe; there was little mention of the wider UK innovation system. Analysing the policy documents and the rhetoric contained within them shows an increasingly national discourse emerging within Wales. This is true in the economic and innovation spheres, but also in other policymaking spheres where the Welsh Government is increasingly differentiating and distancing itself from UK policy. This is partly driven by political factors because there are two opposing parties in power in Cardiff and London, and partly due to the increasing nation building agenda visible in Wales.

This paper argues that a theoretical framework that conceptualises a territory as a "region", subordinate to the nation, is becoming increasingly problematic considering the political situation in many European regions. It is hard to imagine a Welsh politician or policymaker today advocating an approach that labels Wales as a region, with lesser status than a nation and the discourse visible in Welsh policy documents at the current time is one of Wales as a nation in its own right rather than a region within the UK. A good example is a policy entitled *Wales; The Learning* Country. This paper finds that over time the Welsh discourse in innovation policy has shifted from a regional approach in the early years towards a national one today. For policymakers in Wales the term "nation" is much more attractive and popular; policy documents increasingly refer to Wales as a nation and talk about a national innovation system or "ecosystem". However, this paper argues that the NSI approach is unsuitable for Wales at the current time because of the important and fundamental restrictions to the governance of the Welsh innovation system within Wales; the UK still holds too much power to consider a Welsh NSI.

The RIS approach is to a certain extent a "home-grown" theory, developed using empirical observation from Wales by Welsh academics. However, it was born in a different time, pre-devolution and self-governance, when Wales was governed from London and innovation was governed and supported by a `Regional Development Agency'. Today, Wales has its own executive and legislature, a seat at the European table, and an actively pursued nation building agenda. Building a "regional" innovation system is no longer an appropriate discourse to be pursuing in Wales, and to remain relevant and useful in the policy sphere the IS theory needs to evolve with the changing political, economic, social, and cultural circumstances of European regions (Paasi, 2009). The RIS emerged in a different time and in light of the increasing influence of regional governance within the EU, the emergence of the region as the locus of economic development in the globalised world, the growth in independence politics in the UK and other European countries, and the "hollowing out of the nation" state the RIS is in danger of being rendered irrelevant and outdated.

Advancing the Theory

A key rationale behind the study of innovation and innovation policy is to improve the economic performance of weaker regions, ultimately leading to an improvement in the standard of living and quality of life for their residents. It is vitally important that policymakers in weaker regions are given the right tools and frameworks to design and implement the best possible innovation policies. This paper has argued that the wider systems of innovation approach, and the RIS variant in particular, has the potential to assist regional policymakers in this pursuit, and also provides an appropriate analytical framework for researchers.

This paper has argued that the discourse of the "region" (in the sub-state sense it is usually employed in economic geography) is untenable and unattractive for regions with a strong identity,

especially for those pursuing a separatist or nation building agenda, because of the connotations of subordinance and deference to the nation state. Wales is a good example of a territory with a strong identity manifested in the political sphere as a nation-building agenda. The "region" label is unpalatable to policymakers in territories such as Wales.

Within the European context, regional identity has been found to be stronger in economically weaker regions, of which Wales is one:

"A recent survey of Euro-regions found that strong identities are associated with peripheral location, economically weak areas, low level education, and high relative levels of primary employment" (Millard & Christensen, 2004, cited by Paasi, 2009, p.140).

Herein lies the paradox: weaker regions need sound innovation policy frameworks the most; the RIS is a sound innovation framework but the vocabulary of "the region" is unpalatable to policymakers pursuing a separatist or nation-building agenda, associated with strong identities; weaker regions are those that tend to have stronger identities. The regions most in need of the RIS framework are those least likely to find it tenable or acceptable.

The RIS requires a re-packaging to make it tenable and attractive as an approach for policymakers in territories such as Wales. It is important that, as academics, we evolve and advance our theories to ensure that they are practical and tenable for policymakers. If the SI community fails to do this, other more attractive theories such as the Triple Helix and Clusters, which reduce innovation and economic development to a very limited checklist of factors and have developed out of best case scenarios in leading regions, will win pride of place in the regional policy-makers' toolbox. The RIS approach has a number of useful ideas and suggestions to help regional policymakers, especially those in less favoured regions but it needs to be packaged and marketed appropriately. Theory must be able to adapt alongside political, economic, and social change taking place; if the RIS fails to do this it risks becoming a relic found only in the history books of innovation and economic development. A re-packaging of the RIS approach is suggested to render it more appropriate and tenable, so it can once again provide a useful tool for policymakers who are trying to build their regions economically without requiring them to compromise on their regional culture and identity or nation-building agendas through the use of outdated and inappropriate language.

Great weight has been placed on the linguistic and rhetorical elements of innovation theory in this paper, and so any useful proposition for advancing the field must take due consideration of this. In terms of the correct re-packaging term for the RIS approach, this paper makes three suggestions. One is the "Region-State Innovation System" (R-SIS), which draws upon the term introduced by Ohmae (1995) and utilised by Paasi (2009), which elevates the region alongside the nation-state as a central and important economic and political actor. Another suggestion is the "Autonomous-Community Innovation System" (ACIS), borrowing the Spanish term for such regions (Garcia-Álvarez & Trillo-Santamaria, 2013), which perhaps more respectful and tactful regarding the identity politics surrounding these debates. The final suggestion is the "Sub-State Innovation System" (S-SIS), which is more general and all encompassing of any geographical scale below the nation-state. These three options are suggested as terms that are more respectful of the culture and importance of sub-state territories and escape some of the negative connotations associated, for some, with the term region. Of course, these are all in turn loaded terms with different connotations and associations for

different people and organisations; a better alternative is needed and this paper is a first step in trying to establish what that might be.

Conclusion

This paper has thoroughly problematised the RIS approach to the study of innovation. It has found some serious shortcomings and has attempted to address and resolve these in order to advance the discipline and re-state the relevance of the RIS as an option for innovation policymakers. The problems with defining and recognising regions and how they should be studied have already been highlighted by numerous researchers; this study adds to the body of empirical attempts to study and define regions "on the ground" through the application of the RIS framework and finds this to be an inherently problematic task due in a large part to the fuzziness and contested nature of the region. This paper calls for further empirical observation and theorising to tighten up our definitions and understandings of what regions are and how they should be studied, but still holds that the practice of regional study and economic geography is a valid pursuit in order to help enhance our understanding of how and why some regions thrive whilst others falter. It adds to the small but growing body of work on weaker regions, and re-iterates the importance of understanding innovation dynamics and processes in the places that need it the most.

The central problem this paper encounters when applying the IS approach to an empirical case study is the necessity to make a binary decision between a national or regional frame of analysis, which proved to be problematic for territories displaying elements of both. In this case the RIS approach was found to be the most appropriate, but concerns are raised about limitations to our understanding of the Welsh innovation system caused by taking an exclusively regional viewpoint. Some territories are in limbo; they are not nations in the sense that they have sovereignty and governance over all aspects of their innovation system, but nor are they merely regions within a dominant and more powerful nation state. Indeed, referring to such territories as regions is at best overly simplistic and at worst offensive or incendiary. The SI approach as it stands has no framework for such territories; territories that do not fit the "nation" box are necessarily shoe-horned into the regional perspective. As the role and importance of regions within the EU grows it seems increasingly untenable to study them separately to nations within a straight geo-political hierarchy moving downwards from nations to regions to localities. Some suggestions have been made of alternative terminology that can be used to escape some of the problems with the term "region" within the RIS framework but these are stop-gap measures. Ultimately we need to have a serious re-consideration of the IS approach as a whole and decide whether or not a geographical delimitation and a binary choice between different levels of analysis is appropriate or useful at all. Perhaps we should dispense entirely with the geographical variants, or perhaps we should integrate the IS and multi-level governance frameworks, conducting all geographical research at multiple and interconnected levels. Either way, a serious reconsideration of the RIS is required lest it be relegated to the dusty bookshelf of territorialised innovation theories of time gone by.

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