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Research orientation and agglomeration: Can every region become a Silicon Valley?

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ABSTRACT

Not only success stories, such as Silicon Valley, but also non-success stories can inform regional innovation policy. In order to provide a benchmark for regional innovation systems we compare both success and non-success stories. Regional innovation systems differ in structural and functional requirements, because development processes are path dependent. We suggest that regions' development paths emerge from agglomeration patterns and research orientation. Accordingly, we have developed a typology of regions including (1) their agglomeration patterns (either MAR or Jacobs' type) and (2) the degree to which their research is predominantly oriented towards obtaining fundamental understanding or addressing considerations of use. We combine qualitative and quantitative data on thirty-six European regions to categorize them according to research orientation and agglomeration, thereby developing a typology. We use this typology and some basic quantitative economic data to see how success and non-success regions are distributed. Our results indicate that a better understanding of how to combine agglomeration patterns with research orientation can guide context-sensitive policy.

1. Introduction

Success stories, such as the tale of ever-vibrant Silicon Valley (Saxenian, 2006, 1990), appeal to practitioners and scientists alike, because these examples allow us to envision desired successes. Despite the growing interest of policy makers and scientists in regional learning and innovation, an increasing ambiguity exists in the evidence base (Morgan, 2004). Our understanding of the processes of innovation and learning at the regional level still has many blind spots. At the core of this ambiguity and lack of knowledge is our inherent favouring of success stories, thereby neglecting lessons to be learned from less successful but possibly more relevant endeavours.

During the early 2000s, policy for regional innovation systems stimulated linkages between university and industry as well as 'institutional thickness' (Morgan, 2004; Werker and Athreye, 2004). However, although important, neither can substitute for a strong local corporate sector or a strong scientific system (Dosi et al., 2006; Morgan, 2004). Therefore, there is no "ideal model" of policy regarding regional innovation (Tödtling and Trippl, 2005). By creating suitable conditions policy interventions can induce further development of regions to some extent. However, they never suffice to initiate or sustain innovation and technological change in regional innovation systems.

Recent innovation policy has been criticized for its tendency towards 'copy-and-paste' policy following successful examples of innovative regions, regardless of its fit with the specific regional innovation system at hand (e.g. Boschma, 2004; Hospers and Beugelsdijk, 2002; Tödtling and Trippl, 2005). There are a few examples of more sophisticated forms of regional benchmarking. Those benchmarks study various types of regional innovation systems and can be useful tools for regional policy makers (Huggins, 2010). Particularly, studying less successful regions – i.e. dysfunctional or failing regional innovation systems – would contribute to understanding regional innovation systems (Asheim et al., 2011a), and to improving regional benchmarking practices. Moreover, while policy and academic interest are often directed towards high-tech sectors, innovation policy should also stimulate regions endowed with low and medium tech, i.e. more traditional, industries (Tödtling et al., 2009).

Regional innovation systems with different contextual characteristics have different structural and functional requirements as research processes driving them are path-dependent (Malmberg

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and Maskell, 1997). Instead of continuously analysing success stories, such as the Silicon Valley, it is crucial to recognize different contexts of regions and to also analyse non-success stories. To this end, a framework distinguishing three distinct types of regions, i.e. peripheral regions, old industrial regions, and metropolitan regions, provides insights into problems and suggests suitable interventions associated with failures in innovation systems (Tödtling and Trippl, 2005). The framework has been applied to case studies of specific industries or regions (e.g. Isaksen and Karlsen, 2013; Tödtling et al., 2011; Trippl and Otto, 2009) and is an important complement of the success-oriented stories in the literature, because it focuses on the non-success regions.

Following the suggestions of a number of recent influential papers (e.g. Arencegui et al., 2012; Bergek et al., 2008; Edquist, 2011), in this paper, we compare success and non-success regions. To do so we make use of two mechanisms that capture sources and evolution of success within regional innovation systems, i.e. research orientation and agglomeration patterns. In essence, regional learning and innovation are organic and self-activating processes based on local circumstances and development paths (Morgan, 2004). Regional *research orientation* constitutes local circumstances of regional innovation processes. At the same time *agglomeration patterns* point to the development paths. Both research orientation and agglomeration patterns are given in the short run but can be adapted in the middle and long run, thereby lending themselves for policy measures. Although there have been suggestions that agglomeration and research orientation may interact and affect economic success of regions (e.g. Feldman, 1994; Varga et al., 2012), our study connects the two concepts and studies their co-evolution.

Knowledge generation and diffusion affects many structural and functional elements in the regional innovation system, e.g. innovation activities by regional firms and other stakeholders such as academia and governmental agencies (Asheim et al., 2011a). For knowledge to diffuse, interactions between innovative agents in different subsystems of regional innovation systems are necessary. While innovative agents generate and diffuse specific types of knowledge they influence regional innovation systems' *research orientation*, i.e. the quest for fundamental understanding or attention for considerations of use (for details see Section 2.2). *Agglomeration patterns* materialize as a result of dynamic externalities, which have been identified as the source of innovation and economic growth (e.g. Glaeser et al., 1992; Jacobs, 1969; Romer, 1986). There are two kinds of agglomeration patterns, namely: MAR and Jacobs' externalities (for details see Section 2.3). While MAR externalities emerge from knowledge spillovers between innovative agents belonging to specialised and related industries (e.g. Glaeser et al., 1992), Jacobs' externalities result from knowledge spillovers between innovative agents belonging to various industries (Jacobs, 1969).

The paper is organized as follows: We start by introducing the idea of context-specific policy as well as investigating the co-evolution between research orientation and agglomeration patterns (Section 2). Subsequently, we introduce the data on thirty-six European Union (EU) regions we use as well as our research design and analysis (Section 3). After having typified all regions according to research orientation, agglomeration pattern and a number of basic economic indicators, such as regional GDP per capita and unemployment rates (Section 3.3) we analyse the success and non-success regions (Section 4.1). Our findings lead to theoretical propositions and we provide a revised version of Stokes (1997) quadrants with which one can theoretically assess regions (Section 4.2) as well as draft context-sensitive policy (Section 4.3). We conclude with a brief summary of our contribution to theory and practice and add suggestions for further research (Section 5).

2. Research orientation and agglomeration patterns guiding context-specific policy making in regional innovation systems

2.1. Context-sensitive policy making for regional innovation systems

Innovation has drawn academic and societal interest ever since works of Schumpeter (1934,1942) spurred its introduction. Traditionally, a linear perspective of the innovation process dominated the innovation studies literature, implying innovation to follow distinct stages starting at research and leading to eventual commercialization, without any feedback between those stages (Edquist and Hommen, 1999). This step-by-step thinking proved to oversimplify and misrepresent real-life innovation. Rather, innovation processes are iterative in nature, and characterized by trial-and-error and continuous incremental progress (Malmberg and Maskell, 1997). Consequently, scholars in innovation have diverged from the original perspective to develop evolutionary approaches (Kline and Rosenberg, 1986), system-based approaches (Edquist and Hommen, 1999) and, more recently, open up the innovation process (Chesbrough, 2006).

Our analysis adopts the regional innovation system approach acknowledging the evolutionary nature of innovation processes which are characterized by inherent uncertainty regarding successful routes and outcomes. The structural elements of regional innovation systems are the institutional framework, such as laws and codes of conducts, and the interlinked innovative agents, such as firms, universities and public research organizations (Autio, 1998; Tödtling and Trippl, 2005). Additionally, external conditions, such as national innovation system policies or neighbouring regional innovation systems, can have considerable impact on the regional innovation system (Fritsch and Graf, 2011).

While most analyses of regional innovation systems focus on success stories (e.g. Saxenian, 1990, 2006) context-specific policy benefits from a differentiated policy approach which is sensitive to different contexts and adheres to an evolutionary, non-linear view of the innovation process (Tödtling and Trippl, 2005). Different types of regions – i.e. metropolitan, old industrial and peripheral regions – face generic sets of problems. They benefit from policy measures aiming at the specific regional innovation system elements that can alleviate their particular barriers to regional innovation and learning. In each context regions face different problems: while metropolitan regions might suffer from fragmentation, which is characterized by a lack of networks, interactive learning, regional cooperation and mutual trust (Isaksen, 2001; Tödtling and Trippl, 2005), old industrialized regions might face lock-in, often expressed by strong regional clustering in mature and obsolete industries (Boschma, 2005; Isaksen, 2001; Tödtling and Trippl, 2004), and peripheral regions often suffer from organizational thinness, which is the case when a region lacks sufficient agents to form a functioning system (Isaksen, 2001).

In recent decades regional innovation policy has progressed and although still somewhat biased towards knowledge-based industries and technology transfer, it is less oriented towards solely spin-offs and attraction of global companies (Tödtling and Trippl, 2005). Similarly, there have been attempts to improve policies' sensitivity to the specificities of technologies (Dolfsma and Seo, 2013). Current innovation policy has become more sensitive to regions' specific conditions and contextual factors, which is exemplified in European Union policy initiatives and their uptake by regions. The smart specialization strategies are an example of more context-specific policy with potential for application in many different types of regions (e.g. Foray et al., 2009; McCann and Ortega-Argilés, 2013). This development in policy making has been fuelled by academic interest in the concept of 'related variety' (Asheim et al., 2011b; Boschma et al., 2012). Additionally, there have been studies looking into other difficulties. For example, Isaksen and Karlsen (2013) studied how one might construct regional advantages for small regions. Furthermore, Uyarra (2010a) sets out the various dilemmas facing regional policy makers when it comes to applying insights from the regional innovation systems literature to actual regions given their high complexity. A central dilemma is the regions' specific contexts affecting the suitability of policies aimed at developing the regional innovation system. Notions of 'ideal' types of regional innovation systems lead policy makers to confusion and draw their attention away from devising policies that can enhance innovation in the context of their particular region (Iammarino, 2005; Uyarra, 2010a).

The targets of policy for regional innovation are primarily of an economic nature (Verspagen, 2006; Clarysse et al., 2009). However, innovation policy objectives increasingly diverge from this narrow perspective to include wider societal benefits as well (De la Mothe, 2004), such as improvement of general health and welfare, environment, social inclusion and education (e.g. Tödtling and Trippl, 2005; Pol and Ville, 2009).

2.2. Research orientation: Basic and applied research versus Pasteur's quadrant

The basic-applied spectrum of research is one widely adopted way to understand research orientations (e.g. Bush, 1945; Balconi et al., 2010). On the one extreme of the spectrum "*basic* research leads to new knowledge" (Bush, 1945, p. 241). On the other end of the spectrum *applied* research provides an answer to a specific practical problem (Bush, 1945). The notion of basic versus applied research is associated with the linear model of innovation, where the process from research to commercialization follows subsequent, separate steps including applied research and eventually leading to innovation (Balconi et al., 2010). Along these lines, at the industry level one may distinguish science-based from development-based industries (Gilsing et al., 2011). In this view, basic and applied research are worlds apart.

An alternative view of research orientation combines the the two worlds of basic and applied research in the so-called Pasteur's Quadrant (Stokes, 1997). Instead of a spectrum of basic towards applied research on one axis, Stokes puts 'considerations of use' on the x-axis and 'quest for fundamental understanding' on the y-axis. So, rather than using a one-dimensional continuum, the typology by Stokes is based on a two-dimensional matrix composed of four quadrants, as depicted in Fig. 1. In particular, in Pasteur's quadrant research can be inspired by fundamental interests and practical problems simultaneously.

In the following, based on Stokes (1997), we use these three types of research orientation:

(1) *Bohr*-type: This is basic or fundamental scientific research, which might – but not necessarily does – result in sizeable new-to-the-world discoveries. An example of this is the research conducted by physicist Niels Bohr. Although potentially valuable to scientific discourse, such quests are never directly relevant to societal problems, let alone inspired by real-world practical problems and questions.
(2) *Edison*-type: Research of this sort is primarily motivated by market needs and the pursuit of profits. A good example of this type is the research conducted by Thomas Edison, one of the first industrial R&D scientists.
(3) *Pasteur*-type: This is research driven by science, but with underlying considerations for its practical use. This is the quadrant where the worlds of basic and applied research unite. It is named after Louis Pasteur, who made a significant scientific contribution to the foundations of microbiology and who was able to reduce deaths by preventing diseases, such as rabies, in doing so.

The fourth quadrant denotes low or no research, because the activities are neither inspired by considerations of use nor by a quest for fundamental understanding. To create context, we interpret the above three types of research as *research orientations* of regional innovation systems. Note that only Pasteur-type and Edison-type knowledge can realistically be expected to be of practical use within the regional innovation system. Pure Bohr-type research can surely affect innovation processes, but at what point in time, and whether it will benefit the region of origination, is at best uncertain.

Regional innovation systems with different (dominant) types of research orientation are likely to require distinct policy interventions. Path (inter)dependence is likely to affect possible developmental trajectories of regional innovation systems (Cooke, 2012; Martin and Sunley, 2006). It is unlikely that systems with a weak overall research orientation will benefit from policy interventions derived from regions that are originally very strong at Pasteur-type research (which implies both a strong market-oriented and science-driven focus in research). Lambooy and Boschma (2001, p.113) state that "adaptation to change is largely constrained by the spatial system laid down in the past." Similarly, Iammarino

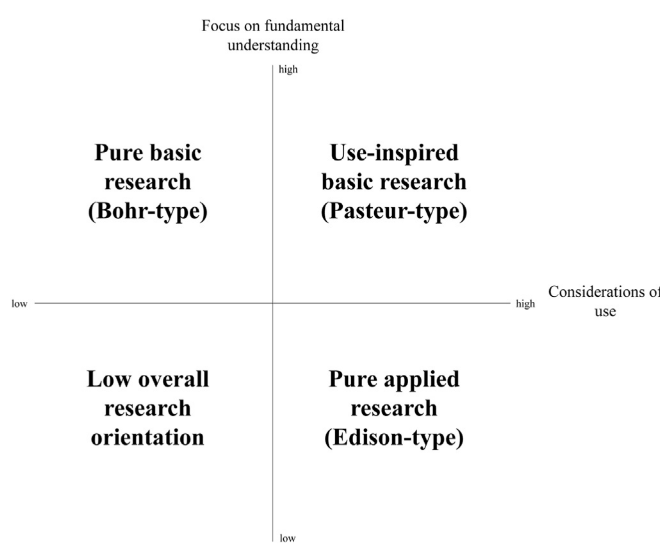

Fig. 1. Quadrant model of research orientation (adapted from Stokes, 1997).

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(2005, p.498) claims it is "unavoidable" that history of the regional innovation system affects "future opportunities for regional development". Therefore, policy would have to match the regional context in order to be effective. It is more likely for a regional innovation system to develop into a well-performing system within its own context, or – at best – progress into an adjacent type, than to one that is more distant in terms of the research orientation the system is historically suited for.

2.3. Agglomeration effects

Different types of geographical agglomerations cause different types of externalities, such as knowledge spillovers and labour market pooling (Beaudry and Schiffauerova, 2009) and affect dynamics of regional innovator networks (Cantner et al., 2010). Two dominant concepts of dynamic externalities are the Marshall-Arrow-Romer (MAR) theory and Jacobs' theory of agglomeration externalities. Agglomeration patterns and externalities are an important element of the regional innovation system context. By nature, dynamic externalities are the result of unique locally accumulated interactions and long-term relationships over time (Henderson et al., 1995) and affect future opportunities for development.

The two dominant concepts differ in terms of the source of externalities (e.g. Beaudry and Schiffauerova, 2009; Glaeser et al., 1992). In the MAR model the externalities are the result of local specialization, which leads to intra-industry knowledge spillovers (Glaeser et al., 1992). Specialized firms dominate the region, making way for knowledge to spill over vertically within the value chain between firms and their specialized suppliers. Firms from the same value chain are able to conduct cooperative innovation efforts more easily in locally specialized regions (Neffke et al., 2011). Moreover, firms are likely able to draw from specialized labour pools. For the sake of our argument, we suggest a minor reinterpretation of the MAR model of externalities. One important assumption of this model is the existence of monopolistic competition. Introduction of property rights and monopolistic competition is believed to reduce risks associated with innovation and, thus, to enable innovators to use knowledge spillovers to their benefit (Glaeser et al., 1992; Romer, 1990). However, monopolistic competition may also lead to negative MAR externalities (Beaudry and Schiffauerova, 2009), such as situations of lock-in (Asheim and Isaksen, 1997; Tödtling and Trippl, 2005). Therefore, we suggest to slightly relax the assumptions of the MAR model. We suggest that regions experiencing positive MAR externalities will – more so than other regions – be characterized by institutions of (social) security, trust, and regional cooperation; basically specific informal and formal constraints like norms, rules, conventions, and codes-of-conduct that are regionally prevalent and shared (North, 1994). An example of such institutions, which lower risks and provide certainty to regional firms, is the case of Northeast-Central Italy (Storper, 2007). In that highly competitive environment small firms are still able to innovate because institutions of loyalty, trust and security alleviate the effects of competition.

By contrast, in Jacobs' agglomeration externalities theory (Jacobs, 1969), knowledge spillovers occur between industries in diversified regions with an urban character. Industrial variety induces "cross-fertilization" amongst different industries (Glaeser et al., 1992, p. 1131). Cross-fertilization can occur in dense agglomerations where information and labour flow easily within the region and between industries (Glaeser and Gottlieb, 2009), such as regions with substantial urbanization or city regions. As such, regions with a diversified industrial structure could benefit from agglomeration externalities such as horizontal knowledge spillovers. True metropolitan Jacobs' type agglomerations are often very dynamic environments able to uphold local 'buzz' and global 'pipeline' interactions simultaneously (Rodríguez-Pose and Fitjar, 2013). In this respect, Feldman and Audretsch (1999) illustrate how diversity – given the existence of a common knowledge base – is conducive to innovation in regions. Contrary to the MAR-model, the Jacobs' type of agglomerations are characterized by local competition which requires firms to innovate, especially in urban agglomerations.

3. Thirty-six regions from EU-15 countries: Analysing the data

Regional innovation systems combining a specific type of research orientation with a particular agglomeration pattern differ in structural and functional requirements. For example, a region where market-oriented research is prevalent, is likely to benefit from regional agglomeration, whilst a region with more science-driven research is likely to profit from research networking across regional boundaries (Varga et al., 2012). In the following, we will empirically analyse research orientation and agglomeration patterns of thirty-six EU regions. In Section 3.1 we introduce the qualitative and quantitative data we use. Then, we discuss our research design (Section 3.2) and present the results of our analysis (Section 3.3).

3.1. Research design and data collection

We have used a qualitative research synthesis design. This design involves an aggregation of rich cases and integration of findings, enabling the development of higher order insights. Such higher order insights are needed to understand the interaction between research orientation and agglomeration. Qualitative research syntheses help to inform policy debates and are able to advance theory, whereas individual qualitative studies can do so only limitedly (Major and Savin-Baden, 2010). We explored the research orientation and the agglomeration patterns of regions by analysing thirty-six EU studies and consequently interpreted basic quantitative indicators of economic performance of each region. Through our analyses we arrive at theoretical propositions about the interaction between research orientation, agglomeration and regions' economic performance (inspired by Haefliger et al., 2010). Our method can therefore be regarded as a predominantly qualitative mixed-methods approach.

The primary data collection method consisted of desk research into available documentation on the various regions, where thirty-six studies (Table 1) of the EU Regional Innovation Monitor

Table 1
Overview of regions in analysis.

Country	Region
Austria	Styria (AT22), Tyrol (AT31), Upper Austria (AT33).
Belgium	Flanders (BE2).
Denmark	Danish Capital Region (DK01).
Finland	Pohjois-Suomi (FI1A), Itä-Suomi (FI13).
France	Picardy (FR22), Nord-Pas de Calais (FR30), Alsace (FR42), Brittany (FR52), Rhône-Alpes (FR71).
Germany	Bavaria (DE2), Berlin (DE3), Lower Saxony (DE9), Saxony (DED).
Ireland	Border, Midland and Western Region (IE01).
Italy	Lombardy (ITC4), Trento (ITD2), Lazio (ITE4), Puglia (ITF4).
Netherlands	Groningen (NL11), Gelderland (NL22), Noord-Brabant (NL41).
Portugal	Algarve (PT15), Lisbon (PT17).
Spain	Navarre (ES22), Catalonia (ES51), Valencian Community (ES52), Andalusia (ES61).
Sweden	Stockholm (SE11), Northern Central Sweden (SE31).
United Kingdom	West Midlands (UKG), London (UKI), South East England (UKJ), Wales (UKL).

Reports used are available from http://www.rim-europa.eu/website.

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(Regional Innovation Monitor Plus, 2013; hereafter referred to as RIM reports) served as the main source. The RIM reports cover thirty-six regions from 13 European Union member states (as reports for Greece and Luxembourg are unavailable). We limited our analysis to EU-15 regions, as the phase of development of innovation systems substantially affects their performance (Bergek et al., 2008). Arguably, it can take decades for regional innovation systems in the Eastern and South Eastern parts of the EU-27 to develop into a comparable state with the EU-15 member states.

For the purpose of triangulation, we added data from online sources when deemed necessary. The use of different data sources is important in order to prevent privileging of similarity in data, which would limit our openness to other challenging evidence (Major and Savin-Baden, 2011). The additional online sources were government websites and alternative policy studies. The use of quantitative data and data from online sources on top of the RIM reports ensured triangulation of data sources.

3.2. *Research design for identifying success and non-success stories*

In order to identify success and non-success stories we used the NUTS (nomenclature of territorial units for statistics) system of classification. This system hierarchically orders different economic territories of the EU along three levels from large to small scale (Eurostat, 2014). The NUTS territories are used as units of analysis in regional statistics, in socio-economic analyses of regions, and for framing and directing the regional policy programs of the EU. The unit of analysis for this study is NUTS 1 for United Kingdom and Germany and NUTS 2 for all other regions. The reason is twofold. First, conform Bergek et al. (2008), we opt for a broad approach, rather than an in-depth analysis. The data sources cover regional innovation systems in breadth and our exploration of the proposed typology benefits from a system comparison covering all elements of these regional innovation systems. In-depth analysis would be suitable when exploring the applicability of the typology in more detail and when the available data would offer insights directly inspired by our research questions. Second, geographical delineation of our unit of analysis allows for comparing specific *regional* innovation systems. Note that, as regional innovation systems are likely to exhibit multiple knowledge fields and generate a variety of products, as opposed to the *technological* innovation systems studied in Bergek et al. (2008) and Markard and Truffer (2008), the issue of choosing either a knowledge field or a product as a focusing device is not considered in our study.

We adopted the iterative data analysis procedure suggested by Major and Savin-Baden (2010) involving three phases, namely those of analysis, synthesis and interpretation. First, we have coded the thirty-six regions with aspects related to the degree of “focus on fundamental understanding” and the degree of inspiration by “considerations of use”, thereby capturing Stokes' (1997) quadrants of research orientation. We also identified the agglomeration patterns of regions in terms of Jacobs’ and MAR-type externalities through a coding procedure. The aspects used in our coding scheme were derived from a bottom-up process, which was characterized by going back and forth between theoretical contributions on research orientation as well as agglomeration and our initial readings of the reports. The codes used to categorize data for research orientation and agglomeration are listed and defined in Appendix A. Coded segments were summarized for each case per code to enable qualitative interpretation. Additionally, a count of segments at each code and an extensive weighting procedure were applied, assigning coded segments weights ranging from 1 (low; implying evidence contradicting the code) to 3 (high; implying evidence confirming the code). The counts and average weights for each code served as a double-check of our qualitative interpretations. Consequently, the assessment of each region its research orientation and agglomeration patterns was based on three sources of information: case summaries of the qualitative data, reaffirmed by a count of the number of coded segments, and the average scores of a weighting procedure of all coded segments as low (1), medium (2) or high (3). This information was studied for each code in all cases. Second, to synthesize data across studies we have integrated the findings in order to assess whether regions of similar research orientation show parallel agglomeration externalities. The resulting typology enables the comparison of regional innovation systems. Third, as a final interpretive step, quantitative evidence on the regions’ economic performance is studied to assess whether the typology has meaningful implications. In other words, do regions that exhibit specific combinations of research orientation and agglomeration patterns outperform other regions?

The qualitative evidence for each step is documented in a case study database using the MaxQDA 11 software tool. We ensured construct validity by establishing a clear chain of evidence (Gibbert and Ruigrok, 2010). To that end, the procedures for data analysis were logged and memos were kept during the coding process. We conducted peer examination of analytical decisions in various stages of the data analysis to establish a form of inter-rater reliability whilst at the same time upholding the interpretive character of qualitative research syntheses. Authors of the primary studies used in our analysis were consulted, i.e. member checks were performed, in order to understand and retain original interpretations.

3.3. *Analysis: Regions’ research orientation, agglomeration pattern and performance*

Below, we will map the thirty-six regions of our sample by (1) research orientation, (2) agglomeration pattern, and (3) economic profile. The research orientation is identified by fundamental understanding and considerations of use. High considerations of use combined with a low focus on fundamental understanding represents regions with a predominantly Edison-type research orientation. In contrast to this market-oriented position, regions with low considerations of use but high focus on fundamental understanding have a Bohr-type research orientation, with a strong tendency to pursue purely basic research interests. Pasteur-type research orientation implies both high considerations of use and high focus on fundamental understanding. The empirical evidence shows regions in our sample to be spread rather evenly over the various types of research orientations.

Indicators also focus on evidence of the existence of actual agglomeration externalities. We included three particular types of agglomeration patterns. First, regions that are characterized by a high degree of urbanization as well as diversification, and show signs of Jacobs’ type of agglomeration externalities, were assigned to the category “Jacobs’ type”. Second, regions were labelled “MAR-type” when they showed a considerable degree of both localization and specialization, or showed actual aspects of MAR-type agglomeration externalities, such as intra-industry knowledge spillovers. Third, the last category captures those regions that either (1) did not clearly fit in the MAR-type or Jacobs’ type categories or (2) did not display any aspects of these forms of agglomeration at all.

This exercise resulted in a visual representation of regions given in Fig. 2, for which Table 1 provides an overview of regions corresponding with particular NUTS codes. Fig. 2 shows that the majority of regions show signs of MAR-type agglomeration (fifteen in total), nine regions are of the Jacobs’ type and twelve regions appear to show no apparent agglomeration patterns and effects.

Fig. 3 incorporates data about the basic economic profile of all regions in our sample. With this profile we appraise the region's

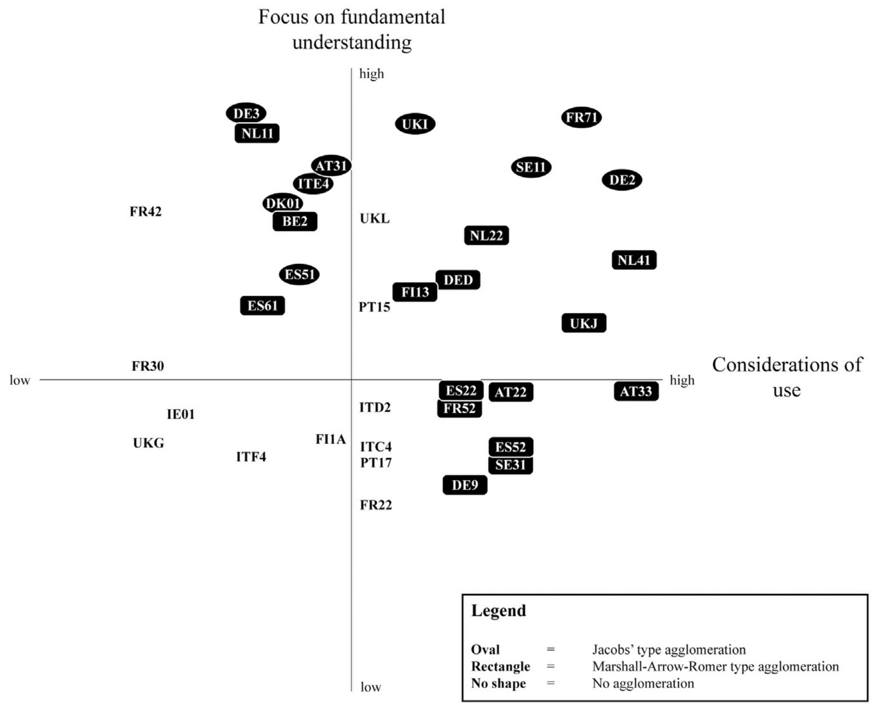

Fig. 2. Mapping of regions' research orientations and agglomeration patterns.

economic performance and analyse whether certain configurations of research orientation and agglomeration patterns are associated with better economic performance. Hence, it enables us to expose success stories and non-success stories.

Eurostat data (Eurostat, 2013; own calculations) on regional GDP per capita and regional unemployment rates averaged over the 2005–2010 period were compared to the national average for the same period (Table 2). Performance was regarded positive when regional GDP per capita was at least 84% of the national average, or unemployment rates were below 117% of the national average. These thresholds correspond with respectively the 25th and 75th percentile values for the variables. This rationale for selection of the cut-off point is also applied in qualitative comparative analysis (e.g. Fiss, 2011). Regions regarded as low performers are the regions in our sample with poor performance on both regional GDP per capita and unemployment rates. Regions regarded as moderate performers are in a position of concern in one respect, but still perform sufficiently well in the other. Well-performing regions score well on both indicators. The thresholds enable us to identify not only the poorest regions in the European

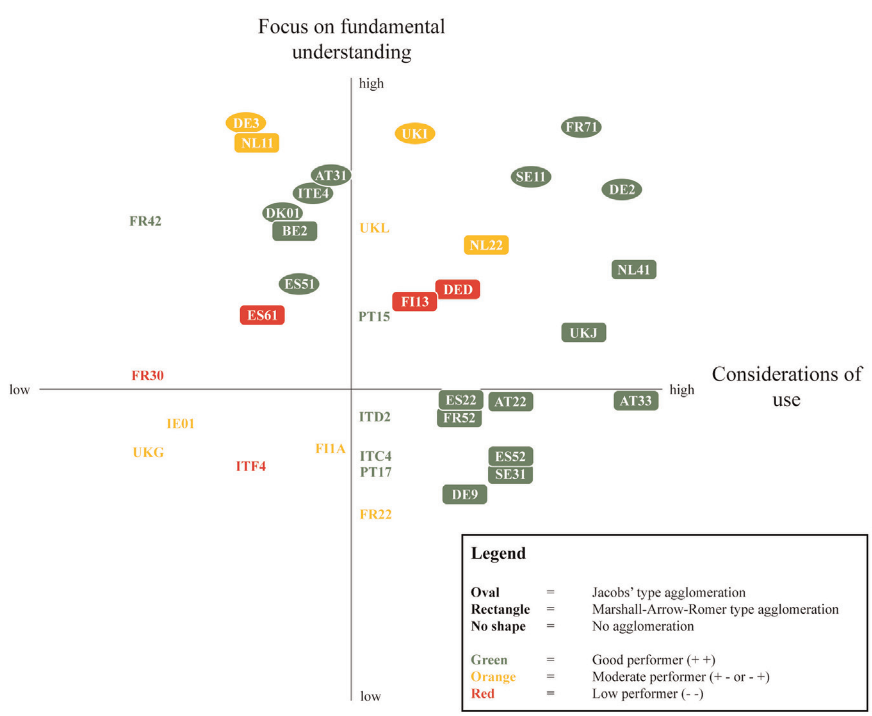

Fig. 3. Success and non-success stories.

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Table 2
Regional GDP per capita and unemployment relative to national GDP per capita and unemployment.

Region	GDP and unemployment	Region	GDP and unemployment
AT22–Styria	++	FR52–Brittany	++
AT31–Tyrol	++	FR71–Rhône-Alpes	++
AT33–Upper Austria	++	IE01–Border, Midland, and Western Region	−+
BE2–Flanders	++	ITC4–Lombardy	++
DE2–Bavaria	++	ITD2–Trento	++
DE3–Berlin	+−	ITE4–Lazio	++
DE9–Lower Saxony	++	ITF4–Puglia	−−
DED–Saxony	−−	NL11–Groningen	+−
DK01–Danish Capital Region	++	NL22–Gelderland	−+
ES22–Navarre	++	NL41–North-Brabant	++
ES51–Catalonia	++	PT15–Algarve	++
ES52–Valencian Community	++	PT17–Lisbon	++
ES61–Andalusia	−−	SE11–Stockholm	++
FI13–Itä-Suomi	−−	SE31–Northern Central Sweden	++
FI1A–Pohjois-Suomi	+−	ÙKG–West Midlands	−+
FR22–Picardy	−+	UKI–London	+−
FR30–Nord-Pas de Calais	−−	UKJ–South East England	++
FR42–Alsace	++	UKL–Wales	−+

Data: 2005–2010 averages adapted from Eurostat.
GDP (per capita): Minus (−) represents scores below 84% of the national average, plus (+) represents scores above 84% of the national average. The 84% threshold represents 25th percentile value for this variable.
Unemployment: Minus (−) represents scores above 117% of the national average, plus (+) represents scores below 117% of the national average. The 117% threshold represents the 75th percentile value for this variable.

Union, but also to capture high technology regions that are at risk of economic decline. The results show that 22 out of thirty-six regions score well on both indicators. Pronounced low economic performance is observed in five out of thirty-six regions, where both indicators show values far below (GDP per capita) or above (unemployment rate) the national average. Nine out of thirty-six regions have a modest economic performance, which means that for one of two variables their score is negative relative to the national average.

In Pasteur's Quadrant, Jacobs' type and MAR-type agglomerations cluster. A good example of a *region in Pasteur's Quadrant with strong Jacobs' externalities* is the French region of Rhône-Alpes (FR71). It has a strong university and public research landscape with good scientific output, but also a very sector-oriented focus – around "competitive poles" – in its research. Moreover, Rhône-Alpes brings forth a considerable amount of patents, usually connoted by considerations of use. A strong scientific community is combined with use-inspired output and research. Rhône-Alpes is urban and diverse in nature. Core activities are hosted in the two largest cities of the region (Lyon and Grenoble), each with their own industrial base. Lyon is more service-oriented, while Grenoble is focused on manufacturing in medium- and high-tech sectors. The primary study identifies 40 different industries in the region. Cross-fertilization is argued to take place between heterogeneous agents from various sectors and of different types (firms, universities, and governments). Hence, Rhône-Alpes is positioned in the top-right corner of Pasteur's Quadrant and regarded as Jacobs' type agglomeration (urban and industrially varied). Other examples of a combination of Pasteur's Quadrant with Jacobs' externalities are London (United Kingdom, UKI) and Bavaria (Germany, DE2). More so than Rhône-Alpes, London its cross-fertilization crosses regional boundaries. For example, many of the 40 higher education and research institutions are linked globally rather than regionally. Although Bavaria (Germany, DE2) is a large (NUTS 1 level) region with variation in agglomeration patterns within the region, the evidence shows that economic activity takes place in urbanizations (specifically München and Nuremberg) with great industrial variety (e.g. financial and insurance services, automotive, military industries, media, and ICT).

An example of a region positioned in *Pasteur's Quadrant but characterized by MAR-type agglomeration patterns*, is Itä-Suomi (FI13) in Finland. Unlike Rhône-Alpes and London, where patent output shows use-inspiration in research, the use-inspired character of Itä-Suomi is based on the large degree of science and education with clear considerations of use. This is illustrated neatly by Viljamaa and Lahtinen (2011, p.i): "The higher education Eastern Finland University (formed from a merger of two universities) provides a mix of education in several fields, many of which are relevant to the regional economy. The university is supported by four polytechnics, which are relatively tightly connected to the region in terms of focus and various forms of interaction with the government and the private sector." Despite its low 'hard' output of pure applied research (patents), the region is endowed with innovative, market-oriented SMEs linked to other regional SMEs and universities. Saxony (Germany, DED) and South East England (United Kingdom, UKJ) are other distinctive Pasteur-type regions displaying characteristics associated with MAR-type agglomeration. They host somewhat geographically concentrated industries, which – although diverse in nature – are few in number. Regions of the MAR-type mapped in Pasteur's Quadrant can be rather different even when located in the same country, as is demonstrated by two Dutch regions. The North-Brabant region (NL41) is highly reliant upon a number of large private firms and their R&D departments to drive research. In contrast, the Gelderland region (NL22) is more science-driven by its two universities (in particular one with regionally relevant specializations) instead of agents from industry.

The Portuguese Algarve region (PT15) and Wales (United Kingdom, UKL) are positioned in Pasteur's Quadrant but are atypical. For the Algarve region the primary study provides mixed evidence for MAR-type and Jacobs' type agglomeration. Algarve is a tourist region, but is described as specialized in diverse sectors such as agriculture, maritime industries, renewable energy, and creative industries. Additionally, there is no evidence for agglomeration externalities, leading us to assign the region to the "no agglomeration" category. In Wales, intra-industry knowledge spillovers occur between various agents, but there is no apparent MAR-type agglomeration pattern to underlie this, which explains its "no agglomeration" classification.

In the Edison Quadrant, MAR-type agglomerations dominate. A good example of this is the Valencian Community (ES52) in Spain. Innovation and research concentrates in low- and medium-tech, established, and – sometimes – traditional industries. While patent output is rather low, the private agents in the region are inspired by considerations of use, even though they have a tendency not to engage in the more explorative avenues of inquiry and innovation. The empirical evidence provides no indication of dominance of higher education institutions or sector-oriented public research institutes in the region. With regard to agglomeration patterns, the primary study on the Valencian Community lists how specific industries concentrate in different regional districts: shoe industry concentrates in Elda, Villena, and Elche (the Alicante district), automotive and furniture can be found in or near Valencia, while Alcoy and Ontinyent specialize in textiles, and so on (Etxaleku and Girbés, 2011). This pattern of local specialization indicates that the Valencian Community is a MAR-type agglomeration. Other examples are Brittany (France, FR52) and Northern Central Sweden (Sweden, SE31). In the French region of Brittany one finds four "heavyweight" (Lacave, 2012, p. i) industries: "agriculture and agro food, ICT and electronics, automotive, and shipbuilding." Empirical evidence illustrates that social cohesion and a shared identity are typical to the region, possibly providing a basis for intra-industry knowledge spillovers and acting as institutions to limit the risks of innovation. Northern Central Sweden is also regarded to be oriented towards Edison-type research with MAR-type agglomeration, as it generates a substantial number of market-oriented and use-inspired patents in specific sectors, but has little university research and lags behind in terms of higher education attainment.

In this quadrant we also find a few atypical cases. Although market-oriented research is dominant (e.g., high patent output and high private expenditure on R&D) in Upper Austria (Austria, AT33), its public research organizations and universities are also strong. Hence, Upper Austria is positioned on the borderline between Edison- and Pasteur-type research orientations. In the Italian region of Trento (ITD2), in-house innovation by SMEs is reported to occur; yet "hard" output of use-inspired research (such as patents) is lacking. Expenditure targets mostly public research organizations. In contrast, there is a relative lack of expenditure on higher education research. Trento is positioned near the average values on both dimensions. There are no clear patterns of agglomeration nor signs of agglomeration externalities in Trento.

Jacobs' type agglomerations are common to Bohr's Quadrant. Lazio (Italy, ITE4), the Danish Capital Region (Denmark, DK01), and Flanders (Belgium, BE2) display similar tendencies that appear typical to regions assigned to Bohr's Quadrant. Although somewhat oriented to considerations of use, the strength of these regions is principally in their public and university research. The empirical evidence shows that in each of the three regions higher education research is of good quality and regions are endowed with a number of university and public research institutes. In neither of the regions the public and university research is inspired by market needs particularly. Lazio (ITE4) is Italy's administrative centre. It is an urban region and hosts a variety of sectors. Analysis shows that the regional innovation system is somewhat fragmented, composed of sectors that do not approach large size and where firms have relatively low propensity to network. The latter could hinder inter-industry spillovers and cross-fertilization. As such, Lazio shows Jacobs' type agglomeration patterns, but arguably it is subject to the more negative type of Jacobs' externalities as well. Evidence for the Danish Capital Region (DK01) holds the same as for Lazio. A minor exception in terms of research orientation might be Flanders, where dedicated public research organizations feed private-side research. However, Flanders' universities are argued to be particularly indifferent when it comes to taking account of considerations of use in their research and education (Van Til, 2012, p.5): "Flemish universities have high autonomy and have relatively low incentives to work towards valorisation and commercialisation of their knowledge." Flemish firms are found least likely to cooperate with universities relative to other types of partners (such as their suppliers, other firms, or consultants). Flanders differs further from Lazio and the Danish Capital Region in that MAR-type agglomeration patterns are identified, with local concentrations of economic activity.

There are a number of other interesting examples. In different ways both the Berlin (DE3) region in Germany and the Groningen (NL11) region in the Netherlands are strongly oriented towards Bohr-type research. Where private R&D lags behind in both regions, Berlin hosts a large variety of research organizations that bring forth high quality fundamental research. Berlin is an urban and diversified region and is, therefore, mapped as a Jacobs' type of agglomeration. Groningen is less endowed with research organizations. The majority of its research is conducted by one university not particularly concerned with contributing to any industries. Groningen is locally specialized, with a large concentration of natural gas extraction firms, leading it to be mapped as a MAR-type region. Nord-Pas de Calais (France, FR30) formerly was a geographic concentration of mining and textile industries. However, the industries have declined long ago and apparently no new specializations arose. There is an average focus on basic research and market-oriented research hardly takes place. For these reasons, Nord-Pas de Calais is positioned in the lower left area of Bohr's Quadrant and with no apparent agglomeration pattern. In Andalusia (Spain, ES61), we find MAR-type patterns of local specialization similar to the ones observed in the Valencian Community (Spain, ES52). However, unlike the Valencian Community, which is characterized by an Edison-type research orientation, research in Andalusia is not driven by private agents or inspired by market needs but is of Bohr-type as it focuses mainly on obtaining a fundamental understanding.

There are also *regions lacking research orientation and agglomeration*. For all these regions, basic economic performance is low or modest. Pohjois-Suomi (Finland, FI1A) generates little market-oriented research despite of its high R&D expenditure. Although there is some industrial specialization in its higher education, science nor private R&D seems prominent. Granting that innovation activities in Puglia (Italy, ITF4) are increasing, its 'under-industrialized' regional agents are typically not concerned with market-oriented or scientific research. Puglia has elements indicating MAR-type agglomeration patterns, but lacks mass and actual externalities. The Border, Midland, and Western Region (IE01) of Ireland has little expenditure on, and output of, research in both the private and public sphere. Finally, relative to the other regions in the United Kingdom and in Europe the expenditure on research in West Midlands (UKG) lags far behind on all aspects, indicating a general lack of orientation towards research.

4. A theoretical framework guiding context-sensitive policy for regional innovation systems

4.1. Success and non-success stories

Specific combinations of research orientation and agglomeration associate with different levels of performance of regions (see Section 2). Here, we integrate the qualitative results on research orientation and agglomeration with the quantitative results on performance. In Table 2 you find the basic economic profile for all regions. Fig. 3 visualizes the results in one conceptual matrix (see Appendix B for a table integrating the results displayed in Fig. 3).

MAR-type regions perform relatively well under the conditions of both Pasteur- and Edison-type research orientations (see Fig. 3). Jacobs' type regions perform well under the conditions of both Bohr- and Pasteur-type research orientations (see Fig. 3). Well-performing Jacobs’ type agglomerations are found not only in Pasteur's Quadrant, but also in Bohr's Quadrant. Thus, the relationship between research orientation and agglomeration is different from our theoretical considerations in Section 2 in two ways: One, MAR-type regions perform best when they are oriented towards considerations of use. Cases such as Eindhoven (NL41), Upper Austria (AT33), South East England (UKJ), Navarre (ES22), and the Valencian Community (ES52) perform close to or above the national average on both GDP per capita and unemployment rate. All conduct predominantly use-inspired research, but some show substantial fundamental research orientations as well. Cases that are even more dominantly oriented towards considerations of use – like Styria (AT22), Brittany (FR52) and Northern Central Sweden (SE31) – also display good economic performance. The only well-performing MAR-type agglomeration that is not predominantly oriented towards considerations of use is Flanders (BE2). Flanders is rather heterogeneous and accordingly does not have an agglomeration pattern that holds for the region as a whole. The large city of Antwerp contrasts with its environment. When studying the city in isolation of its surroundings we find Jacobs’ type agglomerations that better fit with Flanders’ research orientation. A similar observation holds for Milan in Lombardy (ITC4). Hence, our typology would better fit if the large cities and their surroundings were analysed separately. For Itä-Suomi (FI13), Saxony (DED) and Gelderland (NL22) the focus on fundamental understanding is only slightly more important than use-inspiration, nevertheless, these MAR-type regions perform less well. Two, Jacobs’ type regions are where the focus lies on fundamental understanding. Moreover, the majority of the Jacobs’ type regions with a dominant focus on fundamental understanding show good economic performance: Tyrol (AT31), Lazio (ITE4), Danish Capital Region (DK01), Catalonia (ES51), Stockholm (SE11), and Rhône-Alpes (FR71). Bavaria (DE2) has a profile that closely resembles these regions, only slightly more driven by use-inspired research, and also performs well. Two cases characterized by Jacobs’ type agglomeration and a focus on fundamental understanding do less well: Berlin (DE3) and London (UKI). Our qualitative research synthesis revealed how the Jacobs’ type region of Berlin is fragmented in nature and, particularly, lacks substantial industrial agents. This deficiency together with Berlin's recent history of economically catching up after the fall of the Iron Curtain might explain its relatively high unemployment rate. The large variety of higher educational institutions, globally leading firms, and its banking sector clarify London's high GDP per capita. However, there seems to be a void in the labour market demand for lower-skilled workers, leading to high unemployment amongst part of the region's population. London's prosperity and its cosmopolitan character attract a variety of fortune seekers. Still, London's unemployment rate relative to the average EU-15 unemployment rate is positive (91.2% compared to the EU-15 average; data: 2005–2010 averages adapted from Eurostat). Generally spoken, our typology based on the core elements of research orientation and agglomeration does not seem to fully hold for metropolitan Jacobs' type agglomerations of an extremely high density. In such cases, elements external to our typology have an effect.

Two well-performing regions lack agglomeration patterns. These regions are Trento (ITD2) and Alsace (FR42), which have respectively an Edison-type and Bohr-type research orientation. This can be explained by their strong endowment with public or governmental institutions as a consequence of their multi-cultural European background and position on national borders. In Italy, Trento is originally more autonomous than most other regions, explaining the large share of public bodies and also relatively high government expenditure on public research. Alsace harbours the city of Strasbourg, where a significant amount of EU government bodies are located. Even though Trento lacks industrial activity and the Alsace population crosses the border into Germany to work, the existence of a large public sector enables both regions to prosper although they do not benefit from agglomeration effects, such as MAR or Jacobs' externalities.

Not surprisingly, regions that lack a research orientation on one or both dimensions often also lack agglomeration patterns and perform poorly. This holds particularly for regions in the quadrant of low overall research orientation (Pohjois-Suomi, FI1A; Puglia, ITF4; Border, Midland, and Western Region, IE01; West Midlands, UKG). A similar observation can be made for regions with low focus on fundamental understanding or attention for considerations of use (e.g. Andalusia, ES61 and Picardy, FR22). It also applies to Wales (UKL), which lacks any agglomeration pattern. Notable exceptions are two Portuguese regions (Algarve, PT15; Lisbon, PT17) that perform well compared to the Portuguese averages. Comparison to the EU-15 averages sheds a different light, for example, GDP per capita values would be resp. 61.1% and 77.1% (data: 2005–2010 averages adapted from Eurostat). This makes both regions moderate performers, whilst in almost all other cases the comparison to the EU-15 average further confirms the pattern observed.

4.2. Revising Stokes’ quadrants to identify success and non-success regions

Here, we depart from our theoretical discussion regarding research orientation and agglomeration patterns in Section 2. Generally spoken, one could conclude that positive MAR-type of agglomeration externalities arise when a region is locally specialized and there is either monopolistic competition or there are institutions that provide security. Edison-type research orientations allow regional innovation systems to specialize in distinct markets or industries, as this type of research spills over easily within industries. It appears reasonable to expect regions strong in market-oriented Edison-type research to be the ones to benefit from this MAR-type of agglomeration effect. Along the same line of reasoning, Jacobs’ type of agglomeration externalities associate with Pasteur-type research orientations. Jacobs’ type of agglomerations are urbanized and industrially diversified regions, where positive externalities are derived from knowledge spillovers between industries. As Pasteur-type research is both fundamental and inspired by considerations of use, it is likely to be applicable across different industries (as opposed to Edison-type research which is oriented toward specific technological applications and markets). Hence, Pasteur-type research is likely to be conducive to cross-fertilization and, thus, regions performing Pasteur-type research might be expected to benefit from Jacobs’ type of agglomeration patterns.

Our qualitative research synthesis together with quantitative data lead to a different theoretical framework that can identify not only success and non-success regions but also inform context-sensitive regional innovation policy to turn non-success regions into successful ones. We find that regions with Edison-type and Pasteur-type orientations or Bohr-type and Pasteur-type orientations can often be found similar regarding agglomeration patterns. Hence, rather than clustering in specific theoretically delineated Bohr's, Edison's, and Pasteur's Quadrants, specific types of well-performing agglomerations group at the far extremes on either the dimension of degree of focus on fundamental understanding or the dimension of degree of use-inspiration. As such, the interaction between research orientation and agglomeration is particularly apparent when studying the trade-off between the two dimensions in the model by Stokes (1997). Urbanized and industrially diverse regions perform best when research is oriented to obtaining fundamental understanding. Alternatively, regions

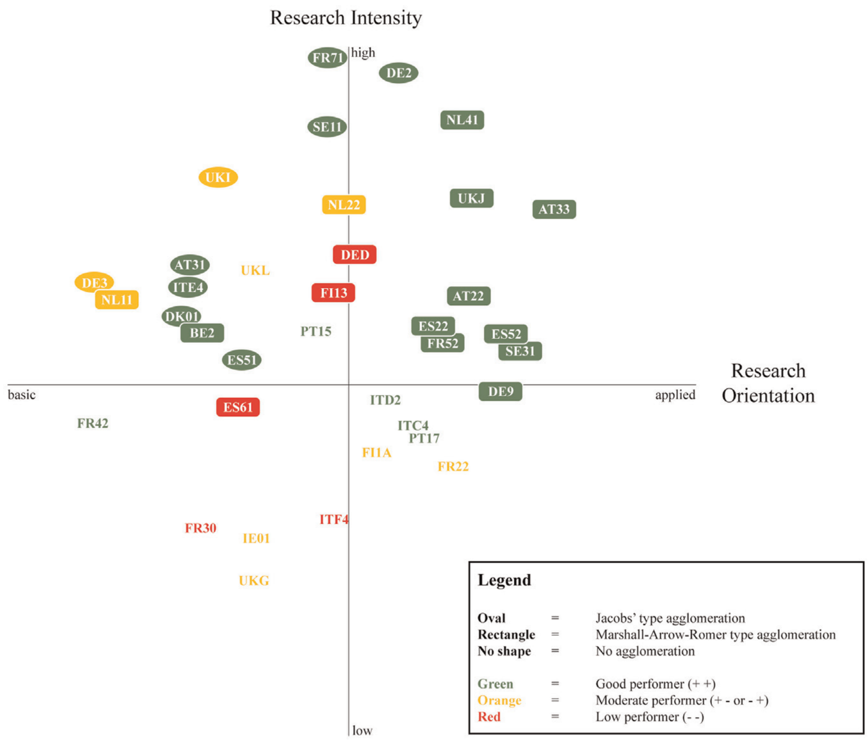

Fig. 4. Reinterpreting the relationship between research orientation and agglomeration.

that are locally specialized perform best when research is fed predominantly by considerations of use.

As our findings show that the quadrants of Stokes' model do not meaningfully categorise regions into groups of similar agglomeration patterns and research orientations, we reinterpret the conceptual plane by Stokes. In particular, we rotate the results counter-clockwise at a 45-degree angle and redefine the axes of the plot, creating Fig. 4. The horizontal axis may now be interpreted as similar to the original basic-applied spectrum of research orientation, whereas the vertical axis represents the 'research intensity' in regions. The concept of research intensity differs from research orientation as it does not capture the nature of research conducted but represents the amount of research conducted. It has been studied at various levels of analysis. For example, at the national level scholars analysed the percentage of R&D expenditure to gross national product (Co, 2004) and the quantity of peer-reviewed publications per one million inhabitants (Hien, 2010), at the firm level researchers studied total expenditure or sales from innovation (Belderbos et al., 2004), and research intensity of universities was captured by multiple measures of research output of academic staff (Hewitt-Dundas, 2012; Bonaccorsi and Daraio, 2008). The higher regions in our study score on the dimensions of 'considerations of use' and 'focus on fundamental understanding', the higher their overall research input and output is. This implies a high research intensity. Low scores on both dimensions imply a low research intensity. Hence, we align with previous studies and define research intensity to capture the relative amount of research input and output irrespective of its orientation. In the alternative view of our conceptual plane the Jacobs' type agglomerations are concerned mainly with basic research and the MAR-type regions cluster towards the applied end of the one-dimensional spectrum. The axis for research orientation shows the trade-off between the original two dimensions used in Stokes' model. That is, regions predominantly driven by the desire to obtain a fundamental understanding are regarded as basic in their research orientation and those mainly driven by considerations of use are regarded as applied in their research orientation. With each type of research orientation dominant in this trade-off we identify a distinct agglomeration pattern. The following propositions seem appropriate:

Proposition 1. *Well-performing MAR-type regions (specialization/localization agglomeration patterns) usually have a regional innovation system that is strongly oriented towards research inspired by considerations of use.*

Proposition 2. *Well-performing Jacobs' type regions (diversification/urbanization agglomeration patterns) usually have a regional innovation system that is strongly oriented towards research aiming at fundamental understanding.*

The trade-off mechanism we propose implies that ratio of research orientation, rather than the absolute amount of either basic or applied research orientation, is associated with a difference in economic performance for various types of agglomerations. This proposition is inspired by the results regarding regions FI13, DED, NL22 and ES61. These MAR-type agglomerations either underperform or perform moderately and are all characterized by a predominantly basic research orientation. Only the MAR-type region of Flanders (BE2) performs well with a predominantly basic research orientation. An explanation for this deviation may be found in Section 4.1 where we discuss the analytical difficulties encountered when determining Flanders' dominant agglomeration pattern. In contrast, all MAR-type regions with a predominantly applied research orientation perform well.

Considering previous empirical and theoretical contributions, the trade-off mechanism and particularly the limited importance of basic research to MAR-type regions may seem counterintuitive. In general, it is widely recognized that basic research yields substantial economic benefits (e.g. Salter and Martin, 2001; Toole, 2012). However, although well-performing MAR-type regions are strongly oriented towards research inspired by considerations of use, one may observe that most of these regions still maintain a modest focus on basic research when revisiting Fig. 3. Hence, we propose that a dominant orientation towards use-inspired research works well for MAR-type regions, but do not suggest that basic research should be discarded. At the same time, our empirical findings show that MAR-type regions should not scale up basic research as it may harm their economic performance.

Despite the rediscovered relevance of the simple basic-applied spectrum of research orientation for regions that perform well, the two-dimensional typology by Stokes is still very helpful in mapping the potential of low performers. Regions lacking research intensity would not appear on the one-dimensional spectrum, as they are neither basic, nor applied, nor something in between. It is important to know where, on the two-dimensional spectrum, such regions are located in order to determine their potential to develop a research intensity with an orientation that suits them. The most troublesome regions are those positioned as predominantly basic in research orientation yet characterized by MAR-type agglomeration patterns. In those cases, the agglomeration pattern does not match the neighbouring research orientation. This is presumably a more complex type of situation to deal with than those where the region is blank in terms of research orientation and agglomeration, as it implies a far-reaching change of agglomeration or research orientation. In fact, such cases may use the insights obtained from the anomalies discussed above, that lack research intensity and/or agglomeration, but still function well for different reasons, such as the regions of Trento (ITD2) or Alsace (FR42). One might also perform comparative analyses to identify similar – well-functioning – regions in order to determine suitable development trajectories away from a position of low research intensity and/or lack of agglomeration. The following proposition seems appropriate:

Proposition 3. *Underperforming regions usually have a regional innovation system that lacks research intensity or that is misconfigured in terms of agglomeration patterns and research orientation*.

Interestingly, the reinterpreted two-dimensional model indicates what aspects need most effort for desirable development: should most attention be directed to building intensity in a given research orientation or to developing agglomeration patterns? Low performers often lack research intensity (and thus research orientation) and agglomeration externalities, and their potential for development cannot be understood using the one-dimensional spectrum. Analysing the exact position of low performers in our reinterpreted two-dimensional model shows the specificities of a region's problems (either lack of research intensity and thus orientation, agglomeration, or both) and hints at evidently promising development trajectories.

Our theoretical findings are based on qualitative and quantitative data of thirty-six regional innovation systems in the EU-15. They come with the following four caveats: One, our analysis shows that our insights hold for most of the EU-15 regions we investigate. Although our sample of regions includes only European Union regions, with some caution the findings might be applied to other Western industrialized countries as well. However, in order to say something reasonable about regional innovation systems in emerging or developing countries further research would be necessary in order to account for specific problems and bottlenecks in these systems. Two, whilst the primary studies used in this paper form a unique data source, the RIM database provided us with data on the NUTS 1 and NUTS 2 level. Positioning of regions, in terms of agglomeration patterns in particular, is increasingly complex at the higher level of analysis, as these larger geographic areas often display more within-region disparities. Future research should focus on breaking down the NUTS 1 level cases in order to find whether the proposed configurations become further apparent. Three, our data did not include Jacobs' type regions with an applied research orientation showing moderate or low performance. Hence, we cannot apply the third proposition regarding misconfiguration for that specific type of region nor make strong inferences about non-success in Jacobs' type regions. Future research should seek to analyse whether or not Jacobs' type regions with an applied orientation are associated with non-success. Four, a common issue of using existing reports is their lack of completeness (Major and Savin-Baden, 2011). In our case, the primary studies only provided limited information on the methods used and the position of the original authors. However, they did list contact details for interviewees and authors and provided background information used in the studies. Where necessary, we made an effort to check for the existence of conflicting evidence.

4.3. Implications for context-sensitive policy making

At the outset we emphasized our ambition to better inform policy makers. By synthesizing, aggregating, and interpreting empirical evidence from thirty-six individual qualitative reports through a unique conceptual lens this paper provides relevant insights as to how the interplay between research orientation and agglomeration patterns affects potential regional development trajectories. We propose some broad implications for policy debate regarding regional innovation.

Recently, the European Union has put effort in shaping more differentiated policy approaches, such as the "smart specialization strategies" (e.g. Foray et al., 2009; McCann and Ortega-Argilés, 2013). However, the assumption that (smart) specialization is the key to development and innovation conflicts with our findings, which illustrate how specialization fits only in specific contexts. Our conceptual framework indicates that local specialization fits best in regional innovation systems geared at applied research. Diversification might be a preferable option taking into consideration a region's previous path, i.e., when a region is inherently oriented towards the conduct of basic research. Hence, the first question policy makers should be concerned with is not which sectors to specialize in, but at what end of the spectrum of specialization to diversification they should aim to be.

Those whose task it is to manoeuvre a region away from the bottom quadrants of low overall research intensity and lack of agglomeration can diagnose their innovation system to assess the potential for development of intensity in terms of specific research orientations and agglomeration patterns. Such diagnostic analyses (Arencegui et al., 2012; Bergek et al., 2008; Edquist, 2011) can reveal potential candidate regions for comparison. For example, one primary study on Puglia (ITF4) hinted at policies encouraging local concentration of specific specializations in its rather traditional industries, much like those observed in the Valencian Community (ES52) and those in Andalusia (ES61). In the latter case, one should note that a mismatch between the research orientation (focused on fundamental understanding) and agglomeration patterns (MAR-type) as well as low research intensity causes low performance, as a more applied research orientation is preferable under those circumstances.

Our suggestions for policy should be interpreted with care for two reasons: one, it is important to stress that, for those striving to create well-performing market-oriented regions with local concentrations of specialized industries, our research does not – in any way whatsoever – wish to advocate that these regions should decrease their basic research efforts or are to function in isolation. While limiting basic research would realize a trade-off in research orientation that favours applied research, a modest basic research orientation is instrumental to a region's capacity to effectively absorb and translate outside knowledge relevant to the technological problems facing the region's specialized industries (Salter and Martin, 2001). In turn, absorption of such innovative fundamental knowledge requires links to other regions, for example, Rodríguez-Pose and Fitjar (2013) show that in certain cases it is essential for the success of such regions to be part of larger “archipelago economies” of related specialized regions. Two, while our synthesis provides a number of grips that intervening policy makers may use, its main contribution lies in pointing to the relevant dynamics of existing regional contexts, thereby showing how research orientation, agglomeration and research intensity influence prospects for regional development. We claim that awareness of the impact of (mis)matching research orientation with agglomeration patterns is valuable to policy makers.

5. Conclusions

In our analysis we go beyond either analysing successful regions (such as Silicon Valley in Saxenian, 2006, 1990) or failing regions (such as in Tödtling and Trippl, 2005). Based on our comparison of thirty-six regions we could identify regional patterns that are associated with success or non-success of regional development. Our findings do not only inform context-specific policy but also offer an interesting new theoretical perspective. Returning to the question in the title of our paper, whether every region can become a Silicon Valley, we should of course answer negatively. More importantly, our findings illustrate that it is simply not in every region's interest to aspire to be like Silicon Valley. In particular, our results show that success cases, such as the Silicon Valley, combining positioning in the Pasteur Quadrant with Jacobs' urbanization externalities, are suitable benchmarks only for regions that may have potential in this respect but perform relatively poorly, such as Saxony (DED). For regions characterized by MAR-type localization externalities and oriented towards pure applied research using a benchmark, such as Silicon Valley, would be counterproductive. These regional innovation systems should rather look at well-performing MAR-type regions, such as Navarre (ES22) or Upper Austria (AT33).

Our findings illustrate how the research orientation and agglomeration patterns of regional innovation systems interact. While path dependence opens opportunities for regional development in certain directions it at the same time restricts alternative avenues. Regional innovation systems with local specialization patterns benefit from market-oriented research orientations. Similarly, regional innovation systems with an industrially varied and urban setting profit from a focus on fundamental understanding. Thus, research orientation co-evolves with agglomeration and there are combinations that work better than others.

This study has significant relevance in the theoretical realm. For discussing the success and non-success regions we find that a rotated Stokes' conceptual plane with reinterpreted axes is most useful. On the x-axis you find the basic-applied spectrum of research orientation – representing the trade-off between fundamental motives and use-inspiration for research – and on the y-axis you find the research intensity of a region. Thereby, we suggest a diversion from the narrow perspective of the basic-applied spectrum as well as a reinterpretation of the Stokes' (1997) quadrant model. Our framework incorporates research orientation, agglomeration patterns and research intensity and our results show how the interaction between these three factors is associated with varying economic performance. This reconsidered framework meaningfully distinguishes between different types of regions. Well-performing regions of Jacobs' type are often predominantly oriented towards basic research and have a high research intensity, e.g. Rhône-Alpes (FR71), Stockholm (SE11) and the Danish Capital Region (DK01). By contrast, MAR-type regions perform well with an above average intensity and orientation towards applied research. This is illustrated by the regions of North-Brabant (NL41), South East England (UKJ), Upper Austria (AT33) and others. In general, low research intensity and lack of agglomeration patterns are associated with modest or low economic performance (e.g. Nord-Pas de Calais, FR30; Picardy, FR22). In conclusion, one should be aware that dominant research orientations and existing agglomeration patterns shape the opportunities for regions to develop. We urge policy makers to resist the appeal of widely recognized success stories and, instead, ask them to be inspired by their own success-story-to-be.

Our findings indicate at least three fruitful roads for further research. First, future research should uncover the exact role of basic research in MAR-type regions. We propose that MAR-type regions perform well when they pursue a predominantly applied research agenda. However, theoretically one would be inclined to argue that basic research has a positive effect on economic performance (e.g. Salter and Martin, 2001), and that a lack of a basic research orientation is potentially harmful. This contrast calls for further research into the consequences of trading basic research for applied research and vice versa. Second, from the perspective of our theoretical lens researchers can design in-depth case studies for regions characterized by different configurations of research orientation and agglomeration patterns. Thereby, they would answer questions such as: What roles do institutions have in different settings? How can universities contribute to regional innovation in, for example, regions with an applied research orientation and locally specialized nature? In what ways does this differ from the contribution a university would make in a science-driven metropolitan region? Different configurations of Uyarra's (2010b) stylized roles for universities could fit specific types of regions. Furthermore, regional profiles may change over time. It would be worthwhile for future research to investigate the degree of adaptability to a changing environment. Third, our results indicate that it is worthwhile to conduct more qualitative research syntheses in fields with clear implications for practice, such as innovation studies and economic geography. Integrating and interpreting findings from separate primary studies is valuable to policy makers striving for evidence-based approaches and also to theorizing in order to advance these scientific fields. Synthesis allows for more elaborate theory development than the results from the individual qualitative case studies that proceed it.

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Appendix A

See Appendix Table A.1

Table A.1
Definition of codes.

Code	Abbreviation	Definition	Source(s)[a]
Private R&D	EDI_PRIVATE	Research conducted in or by private organizations	Stokes (1997), Varga et al. (2012), Bush (1945)
Business expenditure on R&D	EDI_BERD	Expenditure by businesses on research and development activities	
Predominantly considerations of use	EDI_USE	Research intended to have immediate or near-term impact on technological, economic or societal advances	
Market-oriented	EDI_MARKET	Research conducted to meet well-defined or apparent market needs	
Cooperative research	PAS_COOP	Research conducted by some combination of universities, firms, government and/or public research organizations and often of a precompetitive nature	
Balance pure considerations and considerations of use	PAS_BALANCE	Fundamental science with expectations of near-term or long-term impact on technological, economic or societal advances	
Public R&D	PAS_PRO	Research conducted in or by universities or public research organizations	
Public expenditure on R&D	PAS_PERD	Expenditure by government or higher education on research and development activities	
Science-driven	PAS_SCIENCE	Fundamental research conducted in response to the needs of evolving technologies, economies and societies	
No considerations of use	BOHR_NOUSE	Curiosity-driven science for the sake of scientific progress	
Pure basic research	BOHR_BASIC	Highly abstract and fundamental or 'blue sky' research	
Cross-fertilization	JAC_CROSS	Information and labour flow between regional industries	Beaudry and Schiffauerova (2009), Glaeser and Gottlieb (2009), North (1994)
Diversification	JAC_DIV	High diversity in regional industries	
Industrial variety	JAC_VAR	High number of active industries in the region and low shares in the total industrial profile of the region	
Local competition	JAC_COMP	Regional firms face local competition	
Inter-industry, horizontal knowledge spillovers	JAC_INTER	Innovations resulting from interaction across industries	
Urbanization	JAC_URBAN	High urbanization	
Institutions limit risks	MAR_INST	Regional informal and formal constraints like norms, rules, conventions, and codes-of-conduct promoting cooperation	
Monopolistic competition	MAR_COMP	Regional firms enjoy little local competition	
Intra-industry, vertical knowledge spillovers	MAR_INTRA	Innovations resulting from within-industry interaction	
Geographical concentration	MAR_GEO	High co-location by similar-sector firms	
Local specialization	MAR_SPEC	Low number of active industries in the region and high shares in the total industrial profile of the region	

[a] Adapted and extended based on the aforementioned sources, which include both theoretical and empirical works.

Appendix B

See Appendix Table B.1

Table B.1
Agglomeration, research orientation and economic performance

Region	Agglomeration	Research orientation	GDP and unemployment	Region	Agglomeration	Research orientation	GDP and unemployment
AT22–Styria	MAR	Edison	++	FR52–Brittany	MAR	Edison	++
AT31–Tyrol	Jacobs	Bohr	++	FR71–Rhône-Alpes	Jacobs	Pasteur	++
AT33–Upper Austria	MAR	Edison	++	IE01–Border, Midland, and Western Region	None	Low overall	−+
BE2–Flanders	MAR	Bohr	++	ITC4–Lombardy	None	Edison	++
DE2–Bavaria	Jacobs	Pasteur	++	ITD2–Trento	None	Edison	++
DE3–Berlin	Jacobs	Bohr	+−	ITE4–Lazio	Jacobs	Bohr	++
DE9–Lower Saxony	MAR	Edison	++	ITF4–Puglia	None	Low overall	−−
DED–Saxony	MAR	Pasteur	−−	NL11–Groningen	MAR	Bohr	+−
DK01–Danish Capital Region	Jacobs	Bohr	++	NL22–Gelderland	MAR	Pasteur	−+
ES22–Navarre	MAR	Edison	++	NL41–North-Brabant	MAR	Pasteur	++
ES51–Catalonia	Jacobs	Bohr	++	PT15–Algarve	None	Pasteur	++
ES52–Valencian Community	MAR	Edison	++	PT17–Lisbon	None	Edison	++
ES61–Andalusia	MAR	Bohr	−−	SE11–Stockholm	Jacobs	Pasteur	++
FI13–Itä-Suomi	MAR	Pasteur	−−	SE31–Northern Central Sweden	MAR	Edison	++
FI1A–Pohjois-Suomi	None	Low overall	+−	ÙKG–West Midlands	None	Low overall	−+
FR22–Picardy	None	Edison	−+	UKI–London	Jacobs	Pasteur	+−
FR30–Nord-Pas de Calais	None	Bohr	−−	UKJ–South East England	MAR	Pasteur	++
FR42–Alsace	None	Bohr	++	UKL–Wales	None	Pasteur	−+

GDP and unemployment data: 2005–2010 averages adapted from Eurostat.
GDP (per capita): Minus (−) represents scores below 84% of the national average, plus (+) represents scores above 84% of the national average. The 84% threshold represents 25th percentile value for this variable.
Unemployment: Minus (−) represents scores above 117% of the national average, plus (+) represents scores below 117% of the national average. The 117% threshold represents the 75th percentile value for this variable.

Appendix C. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/0.1016/j.technovation.2015.08.001.

References

Arencegui, M.N., Martíns, J.J.G., Rodríguez, S.F., Alonso, A.M., 2012. Territorial benchmarking methodology: the need to identify reference regions. In: Cook, P., Parrilli, M.D., Curbelo, J.L. (Eds.), Edward Elgar, Cheltenham, UK, pp. 99–133.
Asheim, B.T., Smith, H.L., Oughton, C., 2011a. Regional innovation systems: theory, empirics and policy. Reg. Stud. 45 (7), 875–891.
Asheim, B.T., Boschma, R., Cooke, P., 2011b. Constructing regional advantage: platform policies based on related variety and differentiated knowledge bases. Reg. Stud. 45 (7), 893–904.
Asheim, B.T., Isaksen, A., 1997. Location, agglomeration and innovation: towards regional innovation systems in Norway? Eur. Plan. Stud. 5 (3), 299–330.
Autio, E., 1998. Evaluation of RTD in regional systems of innovation. Eur. Plan. Stud. 6 (2), 131–140.
Balconi, M., Brusoni, S., Orsenigo, L., 2010. In defence of the linear model: an essay. Res. Policy 39 (1), 1–13.
Beaudry, C., Schiffauerova, A., 2009. Who's right, Marshall or Jacobs? The localization versus urbanization debate. Res. Policy 38 (2), 318–337.
Belderbos, R., Carree, M., Lokshin, B., 2004. Cooperative R&D and firm performance. Res. Policy 33 (10), 1477–1492.
Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., Rickne, A., 2008. Analyzing the functional dynamics of technological innovation systems: a scheme of analysis. Res. Policy 37 (3), 407–429.
Bonaccorsi, A., Daraio, C., 2008. The differentiation of the strategic profile of higher education institutions. New positioning indicators based on microdata. Scientometrics 74 (1), 15–37.
Boschma, R., 2004. Competitiveness of regions from an evolutionary perspective. Reg. Stud. 38 (9), 1001–1014.
Boschma, R., 2005. Proximity and Innovation: a critical assessment. Reg. Stud. 39 (1), 61–74.
Boschma, R., Minondo, A., Navarro, M., 2012. Related variety and regional growth in Spain. Pap. Reg. Sci. 91 (2), 241–256.
Bush, V., 1945. Science: the endless frontier. Trans. Kansas Acad. Sci. 48 (3), 231–264 1903.
Cantner, U., Meder, A., ter Wal, A.L.J., 2010. Innovator networks and regional knowledge base. Technovation 30 (9–10), 496–507.
Chesbrough, H., 2006. Open innovation: a new paradigm for understanding industrial innovation. In: Chesbrough, H., Vanhaverbeke, W., West, J. (Eds.), Eds. Oxford University Press, New York, pp. 1–14.
Clarysse, B., Wright, M., Mustar, P., 2009. Behavioural additionality of R&D subsidies: a learning perspective. Res. Policy 38 (10), 1517–1533.
Co, C.Y., 2004. Do patent rights regimes matter? Rev. Int. Econ. 12 (3), 359–373.
Cooke, P., 2012. Transversality and transition: green innovation and new regional path creation. Eur. Plan. Stud. 20 (5), 817–834.
De la Mothe, J., 2004. The institutional governance of technology, society, and innovation. Technol. Soc. 26 (2–3), 523–536.
Dolfsma, W., Seo, D., 2013. Government policy and technological innovation—a suggested typology. Technovation 33 (6–7), 173–179.
Dosi, G., Llerena, P., Labini, M.S., 2006. The relationships between science, technologies and their industrial exploitation: an illustration through the myths and realities of the so-called European Paradox. Res. Policy 35, 1450–1464.
Edquist, C., 2011. Design of innovation policy through diagnostic analysis: identification of systemic problems (or failures). Ind. Corp. Change 20 (6), 1725–1753.
Edquist, C., Hommen, L., 1999. Systems of innovation: theory and policy for the demand side. Technol. Soc. 21 (1), 63–79.
Eurostat. 2014. NUTS-Nomenclature of territorial units for statistics. Retrieved July 13, 2014, from 〈http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction〉.
Eurostat. 2013. Retrieved May 23, 2013, from 〈http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/bulk_download〉.
Etxaleku, N., Girbés, S. 2011. Regional innovation report (Valencian Community) (p. 61). Retrieved from 〈http://www.rim-europa.com/〉.
Feldman, M.P., 1994. The university and economic development: the case of Johns Hopkins University and Baltimore. Econ. Dev. Q. 8 (1), 67–76.
Feldman, M.P., Audretsch, D.B., 1999. Innovation in cities: science-based diversity, specialization and localized competition. Eur. Econ. Rev. 43 (2), 409–429.
Fiss, P.C., 2011. Building better causal theories: a fuzzy set approach to typologies in organization research. Acad. Manag. J. 54 (2), 393–420.
Foray, D., David, P.A., Hall, B. 2009. Smart specialisation – The Concept.
Fritsch, M., Graf, H., 2011. How sub-national conditions affect regional innovation systems: the case of the two Germanys. Pap. Reg. Sci. 90 (2), 331–353.
Gibbert, M., Ruigrok, W., 2010. The "What" and "How" of case study rigor: three strategies based on published research. Organ. Res. Methods 13 (4), 710–737.
Gilsing, V., Bekkers, R., Freitas, I.M.B., Van der Steen, M., 2011. Differences in technology transfer between science-based and development-based industries: transfer mechanisms and barriers. Technovation 31, 638–647.
Glaeser, E.L., Gottlieb, J.D., 2009. The Wealth of cities: agglomeration economies and spatial equilibrium in the United States. J. Econ. Lit. 47 (4), 983–1028.
Glaeser, E.L., Kallal, H.D., Scheinkman, J.A., Shleifer, A., 1992. Growth in cities. J. Political Econ. 100 (6), 1126–1152.
Haefliger, S., Jäger, P., von Krogh, G., 2010. Under the radar: Industry entry by user entrepreneurs. Research Policy 39 (9), 1198–1213.
Henderson, V., Kuncoro, A., Turner, M., 1995. Industrial development in cities. J. Political Econ. 103 (5), 1067–1090.
Hewitt-Dundas, N., 2012. Research intensity and knowledge transfer activity in UK universities. Res. Policy 41 (2), 262–275.
Hien, P.D., 2010. A comparative study of research capabilities of East Asian countries and implications for Vietnam. Higher Educ. 60 (6), 615–625.
Hospers, G.-J., Beugelsdijk, S., 2002. Regional cluster policies: learning by comparing? Kyklos 55 (3), 381–402.
Huggins, R., 2010. Regional competitive intelligence: benchmarking and policy-making. Reg. Stud. 44 (5), 639–658.
Iammarino, S., 2005. An evolutionary integrated view of regional systems of innovation: concepts, measures and historical perspectives. Eur. Plan. Stud. 13 (4), 497–519.
Isaksen, A., 2001. Building regional innovation systems: is endogenous industrial development possible in the global economy? Can. J. Reg. Sci., 101–120, Spring 2001.
Isaksen, A., Karlsen, J., 2013. Can small regions construct regional advantages? The case of four Norwegian regions. Eur. Urban Reg. Stud. 20 (2), 243–257.
Jacobs, J., 1969. The Economies of Cities. Random House, New York.
Kline, S.J., Rosenberg, N., 1986. An overview of innovation. In: Landua, R., Rosenberg, N. (Eds.), National Academy Press, Washington.
Lacave, M. 2012. Regional Innovation Report (Brittany) (p. 63). Retrieved from 〈http://www.rim-europa.eu/〉.
Lambooy, J.G., Boschma, R.A., 2001. Evolutionary economics and regional policy. Ann. Reg. Sci. 35 (1), 113–131.
Major, C.H., Savin-Baden, M., 2010. An Introduction to qualitative research synthesis: managing the information explosion in social science research. Routledge, Oxon, UK.
Major, C.H., Savin-Baden, M., 2011. Integration of qualitative evidence: towards construction of academic knowledge in social science and professional fields. Qual. Res. 11 (6), 645–663.
Malmberg, A., Maskell, P., 1997. Towards an explanation of regional specialization and industry agglomeration. Eur. Plan. Stud. 5 (1), 25–41.
Markard, J., Truffer, B., 2008. Technological innovation systems and the multi-level perspective: towards an integrated framework. Res. Policy 37 (4), 596–615.
Martin, R., Sunley, P., 2006. The place of path dependence in an evolutionary perspective on the economic landscape. In: Boschma, R., Martin, R. (Eds.), Edward Elgar, Chichester, pp. 62–92.
McCann, P., Ortega-Argilés, R., 2013. Smart specialization, regional growth and applications to european union cohesion policy. Reg. Stud., 1–12. http://dx.doi.org/10.1080/00343404.2013.799769.
Morgan, K., 2004. The exaggerated death of geography: learning, proximity, and territorial innovation systems. J. Econ. Geogr. 4 (1), 3–21.
Neffke, F., Henning, M., Boschma, R., Lundquist, K.-J., Olander, L.-O., 2011. The dynamics of agglomeration externalities along the life cycle of industries. Reg. Stud. 45 (1), 49–65.
North, D.C., 1994. Economic performance through time. Am. Econ. Rev. 84 (3), 359–368.
Pol, E., Ville, S., 2009. Social innovation: buzz word or enduring term? J. Socio-Econ. 38 (6), 878–885.
Regional Innovation Monitor Plus. 2013. Retrieved December 11, 2014, from 〈http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/report/innovation〉.
Rodríguez-Pose, A., Fitjar, R.D., 2013. Buzz, archipelago economies and the future of intermediate and peripheral areas in a Spiky world. Eur. Plan. Stud. 21 (3), 355–372.
Romer, P.M., 1986. Increasing returns and long-run growth. J. Political Econ. 94 (5), 1002–1037.
Romer, P.M., 1990. Endogenous technological change. J. Political Econ. 98 (5), S71–S102.
Salter, A.J., Martin, B.R., 2001. The economic benefits of publicly funded basic research: a critical review. Res. Policy 30 (3), 509–532.
Saxenian, A., 1990. Regional networks and the resurgence of silicon valley. Calif. Manag. Rev. 33 (1), 89–112.
Saxenian, A., 2006. The new argonauts: regional advantage in a global economy. Harvard University Press, Cambridge, MA, pp. 1–432.
Schumpeter, J.A., 1934. The theory of economic development. Harvard University Press.
Schumpeter, J.A., 1942. Capitalism, socialism, and democracy. Harper & Row, New York.
Stokes, D., 1997. Pasteur's quadrant: basic science and technological innovation. The Brookings Institution, Washington D.C.
Storper, M., 2007. Regional "worlds" of production: learning and innovation in the technology districts of France, Italy and the USA. In: Rutten, R., Boekema, F. (Eds.), Edward Elgar, Cheltenham, UK, pp. 15–57.
Toole, A.A., 2012. The impact of public basic research on industrial innovation: evidence from the pharmaceutical industry. Res. Policy 41 (1), 1–12.
Tödtling, F., Lehner, P., Kaufmann, A., 2009. Do different types of innovation rely on specific kinds of knowledge interactions? Technovation 29 (1), 59–71.
Tödtling, F., Lengauer, L., Höglinger, C., 2011. Knowledge sourcing and innovation in "Thick" and "Thin" regional innovation systems—comparing ICT firms in two Austrian regions. Eur. Plan. Stud. 19 (7), 1245–1276.
Tödtling, F., Trippl, M., 2004. Like Phoenix from the Ashes? The renewal of clusters in old industrial areas. Urban Stud. 41 (5–6), 1175–1195.
Tödtling, F., Trippl, M., 2005. One size fits all? Towards a differentiated regional innovation policy approach. Res. Policy 34 (8), 1203–1219.
Trippl, M., Otto, A., 2009. How to turn the fate of old industrial areas: a comparison of cluster-based renewal processes in Styria and the Saarland. Environ. Plan. A

41 (5), 1217–1233.
Uyarra, E., 2010a. What is evolutionary about “regional systems of innovation”? Implications for regional policy. J. Evolutionary Econo. 20 (1), 115–137.
Uyarra, E., 2010b. Conceptualizing the regional roles of universities, implications and contradictions. Eur. Plan. Stud. 18 (8), 1227–1246.
Van Til, J., 2012. Regional innovation report. Flanders, 63, Retrieved from.
Varga, A., Pontikakis, D., Chorafakis, G., 2012. Metropolitan Edison and cosmopolitan Pasteur? Agglomeration and interregional research network effects on European R&D productivity. J. Econ. Geogr., 1–35.
Verspagen, B., 2006. Innovation and economic growth. In: Fagerberg, J., Mowery, D. C., Nelson, R.R. (Eds.), Oxford University Press, Oxford, pp. 487–513.
Viljamaa, K., Lahtinen, H. 2011. Regional Innovation Report (Eastern Finland/Itä-Suomi) (p. 49). Retrieved from ⟨http://www.rim-europa.eu/⟩.
Werker, C., Athreye, S.S., 2004. Marshall's disciples: knowledge and innovation driving regional economic development and growth. J. Evolut. Econ. 14 (5).