Innovation in non-metropolitan regions: A review of the literature

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Abstract

It is increasingly recognised in regional science and innovation studies that non-metropolitan regions have been overlooked in innovation studies, leading to calls for more innovation studies focusing on these types of regions. This paper argues that a clear inventory of the current state of knowledge on innovation in non-metropolitan regions is required to provide a solid foundation for future innovation research in these regions. Underpinned by this argument, the purpose of this paper is to provide a comprehensive review of the literature on innovation in non-metropolitan areas published in scholarly journals between 1998 and 2016. By highlighting (1) the authorship characteristics of scholars publishing this research; (2) the design used; (3) the scope of this research; (4) the methodologies and (5) the themes discussed; this review provides valuable insights for advancing innovation research in non-metropolitan regions.

Keywords: Innovation, non-metropolitan regions, systematic review

1. Introduction

One of the many paradoxes in the current era of a globalised knowledge economy is the continued importance of the region (in the sense of a sub-national division of a country) as the level at which competitiveness is shaped and governed (Camagni 2002; Coe et al. 2004). The impact of innovation on regional competitiveness is well established, and both scholars and policy makers agree that competitiveness through innovation represents the high road to regional development (Asheim, Moodysson & Tödtling 2011; Christensen et al. 2016). Regions' ability to innovate, however, depend on their endowment, with large metropolitan regions often considered as the loci of innovation (Florida, Adler & Mellander 2017; Shearmur 2012). Not surprisingly, most of the literature on regional innovation has focused on these regions (Asheim & Coenen 2005; Isaksen & Sæther 2015).

The geography of innovation, however, extends beyond metropolitan regions (Escalona-Orcao et al. 2016; Fitjar & Rodríguez-Pose 2011; Grillitsch & Nilsson 2015). Thus, a small but increasing body of research on innovation outside these regions has been published over the years. This paper is concerned with the literature on innovation in non-metropolitan regions, broadly defined as regions located between metropolitan regions and rural areas. A great variety of regions might therefore fall within this spectrum as individual countries use different criteria. For the purpose of the current study, old industrial regions falling within this interval are excluded. There is an extensive body of literature is dedicated to old industrial regions, for example Benneworth (2007), Tödtling et al. (2013) and more recently, Hu (2017).

The term non-metropolitan itself might be considered a fuzzy concept (Markusen 1999; Suorsa 2014), due to the various terminologies used. They are most commonly called: peripheral regions (Mudambi & Santangelo 2016, p. 1967); small regions (Isaksen & Sæther 2015, p. 65); non-metropolitan areas (Escalona-Orcao et al. 2016, p. 112); peripheral areas (McAdam, Reid & Shevlin 2014, p. 66), less-favoured regions or simply regional areas (Eversole 2015, p. 2). Whatever terminology is used, the core idea is that these regions are dominated by small and medium size enterprises, have a low level

of research of development and innovation, and lack the critical mass necessary for triggering agglomeration economies. In theoretical term, these regions are referred to as thin regions (Isaksen 2014; Tödtling & Trippl 2005).

There have been recent calls for more innovation studies in these types of regions (Isaksen & Karlsen 2013; Isaksen & Sæther 2015). This paper argues that an inventory of the current state of the research on innovation in non-metropolitan regions might provide a solid foundation for future research in these regions.

Underpinned by the above argument, the purpose of this paper is to provide a comprehensive review of the literature on innovation in non-metropolitan regions published in scholarly journals between 1998 and 2016. As noted by Jungmann, Baur and Ametowobla (2015) innovation research is dominated by two distinct lines: systems of innovations and ethnographies of innovation. Studies on regional innovation fall under the regional systems of innovation approach pioneered by Cooke, Gomez Uranga and Etxebarria (1997). Therefore, the current review excludes all publications concerned with ethnographic approaches to innovation. The review highlights (a) the sources and nature of articles published on innovation in non-metropolitan regions; (b) their authorship characteristics; (c) the designs used; (d) the scope of this research; (e) the methodologies adopted and (f) the themes discussed in this literature.

The remainder of this paper is structured as follows: the next section presents the methodology used to undertake this review, followed by the presentation of findings, which precedes the discussion. The paper ends by concluding and presenting some avenues for future research.

2. Research method

This paper adopts a systematic review approach. A systematic review is appropriate for gathering evidence in the literature to answer specific questions (Boell & Cecez-Kecmanovic 2015), as it is the case in this paper. Compared to other types of reviews (for example: thematic or historical reviews), it offers a rigorous, transparent, replicable and scientific process (Becheikh, Landry & Amara 2006; Okoli & Schabram 2010).

The current review spans across a sixteen year period between 1998 and 2016. The choice of 1998 as the lower limit follows the argument by Doloreux and Porto Gomez (2017). The year 1998 was marked by a major publication by Braczyk, Cooke and Heidenreich (1998) titled *"Regional innovation systems: The role of governance in a globalised word"* – clarifying and exemplifying the concept of regional innovation systems (RISs). Since this publication, the number of publication on regional innovation have increased significantly (Doloreux & Porto Gomez 2017).

According to Doloreux and Porto Gomez (2017), establishing the inclusion criteria, identifying and selecting the potential articles and, classifying them is essential when undertaking a systematic review. Four criteria were developed for inclusion in the study. First, the term region in each article must refer to a sub-national division of a country. Second, at least a non-metropolitan region must be analysed in the study. Third, the article had to be published in a peer reviewed journal between 1988 and 2016. Fourth, one of the following terms: "innovation", "non-metropolitan regions", "non-metropolitan areas", "peripheral regions", "peripheral areas", "small regions", "lees-favoured region", "regional areas" or "thin regions" has to be found in the title, abstract, or keywords of each article.

With regard to the identification and selection of the articles, a three stage approach was used. First, keyword searches using the combination of the terms "Innovation" AND "non-metropolitan regions",

"innovation" AND "non-metropolitan areas", "innovation" AND "peripheral regions", "innovation" AND "peripheral areas" and "innovation" AND "small regions" were used. Each of these combinations were used in the search engines Scopus, Web of Science and ProQuest. The initial selection included articles published between 1988 and 2016 including one of the above words in its title, abstract or keywords. This initial step led to the identification of a total of 331 articles (Table 1). After correcting for duplicated articles and reading the all the remaining abstracts, a total of 85 articles was deemed relevant. When the abstracts were not clear enough for a decision to be made, full articles were read.

Table 1: Initial number of articles identified

Keywords	**Search engines and number of hits**		
	Scopus	**Web of Science**	**ProQuest**
"innovation" AND "non- metropolitan regions"	7	2	1
"innovation" AND 'non-metropolitan areas"	3	2	3
"innovation" AND "peripheral regions"	101	62	6
"Innovation" AND "peripheral areas"	30	23	7
"innovation" AND "small regions"	14	5	3
"innovation" AND " less- favoured regions"	17	8	3
"innovation" AND "regional areas"	20	8	2
"Innovation'' AND "thin regions"	2	2	0

Source: Author

With regard to the classification of articles, the coding framework for 'undertaking a systematic and replicable investigation of text and documents with the objective of quantifying content using pre-set categories' proposed by (Leonidou et al. 2010) and Gomes, Barnes and Mahmood (2016, p. 17) was used. Each article was analysed using content analysis, a reliable method for systematically classifying and comparing data (Krippendorff 2004). In accordance with Doloreux and Porto Gomez (2017), Gomes, Barnes and Mahmood (2016) and Leonidou et al. (2010), the analysis of each article covered six dimensions as follows:

1. Source and nature of articles (i.e. journal name and publication year);
2. Characteristics of authors (i.e. number of authors, number of countries, location of country, number of institutions, number of disciplines);
3. Research design (i.e. problem crystallization, variable association, research environment, communication mode, topical scope, and time dimension);
4. Scope of research (i.e. type of study, countries involved, reference region, nature of country, product focus, and unit of analysis)
5. Research methodology (i.e. sampling design, conceptual framework used, data collection, sample size, response rate, data analysis technique) and;
6. Thematic areas (i.e. institutional actors, firms, region).

The 85 articles were divided into three categories in order to appraise the evolution of publications in the last sixteen years: 1998-2005 (early interest on the topic), 2006-2010 (moderate interest in the topic) and 2011-2016 (increased awareness for the need for more research on the topic).

3. Study findings

3.1 Sources and nature of articles

The 85 articles published are dispersed across 44 different journals. The rate of publication ranged from 2 article per year (1998-2005) to an average of 4 per year (2006-2010) and 11 per year (2011-2016). As per Table 2, *European Planning Studies* is the main source of publications on the topic of innovation in non-metropolitan regions, accounting for 23.5% of the articles published. It is followed *by Norsk Geografisk Tidsskrift (9.4%), Entrepreneurship & Regional Development* (5.6%), *Regional Studies* and *Research Policy* (4.7% respectively). *European Urban and Regional Studies* and *Journal of the Knowledge Economy* each contributed 3.5%. These seven journals account for more than half the articles published on innovation in non-metropolitan regions, the remaining thirty-seven journals contributing 44.7%. Innovation research in non-metropolitan regions is essentially empirical.

Table 2: Journal publishing articles on innovation in non-metropolitan regions*

		Time period			Article type	
	Total	1998-2005	2006-2010	2011-2016	Theoretical	Empirical
Journals	(n=85) %	(n=14) %	(n=17) %	(n=54) %	(n=2) %	(n=83) %
Entrepreneurship & Regional Development	(5) 5.6	0.0	(1) 5.9	(4) 7.4	0.0	(5) 6.0
European Planning Studies	(20) 23.5	(5) 35.7	(6) 35.3	(9) 16.7	(1) 50.0	(19) 22.9
European Urban and Regional Studies	(3) 3.5	0.0	(1) 5.9	(2) 3.7	0.0	(3) 3.6
Journal of the knowledge Economy	(3) 3.5	0.0	0.0	(3) 17.6	0.0	(3) 3.6
Norsk Geografisk Tidsskrift	(8) 9.4	0.0	0.0	(8) 14.8	0.0	(8) 9.6
Regional Studies	(4) 4.7	0.0	0.	(4) 7.4	0.0	(4) 4.8
Research Policy	(4) 4.7	(1) 7.1	(2) 11.8	(1) 1.9	(1) 50.0	(3) 3.6

***** Only journals having three or more publications are included in this table. There are 37 journals that published less than three articles related to innovation in non-metropolitan regions. Thus, the sum of the percentage column is not 100%. [1] (↑) Increasing; (V) Decreasing and then increasing; (Λ) Increasing and then decreasing.

3.2 Authorship characteristics

Collaboration between authors is a key characteristic of innovation research in non-metropolitan regions, probably due to the fact that it lies at the intersection of two disciplines: Regional Science and Innovation Research. Consequently, the least number of articles were single-authored, representing 23.5% of published articles, while 35.3% were written by three or more authors (Table 3). Single authorship slightly increased from 2006-2010 but has declined since then. Articles authored by three or more have increased overtime. Most of the articles (41.1%) were double-authored and this type decreased by half in the 2006-2010 period before increasing anew in the next. Regarding the number of countries covered, 80% were single country studies with this trend on the rise. The remaining studies dealt with two (12.9%) and three or more (4.7%) countries respectively. Europe is the main location of scholars publishing research on innovation in non-metropolitan regions with above 80% of total contribution, though this dominance has slightly declined over the year. North American authors accounted for 9.1% of articles with the remainder shared by other continents. Authors from different institutions produced most of this literature, with 40.0% involving two institutions while 23.5% involved three or more institutions.

Authors publishing articles on innovation in non-metropolitan regions come from a variety of backgrounds. Above thirty percent (32.9%) of authors were located in business/management faculties, with this trend increasing over time. A good number of authors are spread across other faculties (30.6%), including just to mention few: sociology; technology or social studies. Regional scientists

wrote 20% of the papers; geographers, 15.3%; economists, 15.3% and innovation scholars, 12.9%. While the number of business/management scholars and geographers have increased over time that of regional scientists have decreased on the contrary. There have been some fluctuations in the number of economists and innovation scholars.

Table 3: Key researchers publishing on the topic of innovation in non-metropolitan regions

Authorship characteristics	Total (n=85) %	Time period			Trend direction[1]
		1998-2005 (n=14) %	2006-2010 (n=17) %	2011-2016 (n=54) %	
Number of authors					
One	(20) 23.5	(4) 28.6	(6) 35.3	(9) 16.7	∧
Two	(35) 41.1	(10) 71.4	(6) 35.3	(23) 42.6	∨
Three or more	(30) 35.3	(3) 21.4	(5) 29.4	(22) 40.7	↑
Number of countries					
One	(68) 80.0	(7) 50.0	(15) 88.2	(46) 85.2	∧
Two	(11) 12.9	(4) 28.6	0.0	(7) 13.0	∨
Three or more	(4) 4.7	(1) 7.1	(2) 11.8	(1) 1.8	∧
Not mentioned	(2) 2.4	(2) 14.3	0.0	0.0	↘
Location of countries					
North America	(8) 9.1	(1) 7.1	(2) 11.8	(5) 9.3	∧
Europe	(69) 81.2	(13) 92.9	(13) 82.4	(43) 79.6	↓
Asia	(4) 4.7	0.0	(1) 5.9	(3) 5.6	∧
South America	(2) 2.6	0.0	0.0	(2) 3.7	↗
Others	(2) 2.6	0.0	(1) 5.9	(1) 1.8	∧
Number of institutions					
One	(31) 36.5	(8) 57.1	(9) 52.9	(14) 26.0	↓
Two	(34) 40.0	(6) 42.9	(7) 41.2	(21) 36.8	↓
Three or more	(20) 23.5	0.0	(1) 5.9	(19) 35.2	↑
Academic disciplines					
Business/Management	(28) 32.9	(2) 14.3	(4) 23.5	(22) 40.7	↑
Economics	(13) 15.3	(2) 14.3	(2) 11.8	(9) 16.7	∨
Geography	(13) 15.3	0.0	(2) 11.8	(11) 20.4	↑
Innovation	(11) 12.9	(1) 7.1	(3) 17.6	(7) 13.0	∧
Regional Science	(17) 20.0	(7) 50.0	(3) 17.6	(7) 13.0	↓
Not mentioned	(6) 7.0	(2) 14.2	(1) 5.9	(3) 5.6	↓
Others	(26) 30.6	(4) 28.6	(7) 41.2	(15) 27.7	∧

[1] (↑) Increasing; (↓) decreasing; (↗) Constant and then increasing; (∧) Increasing and then decreasing; (∨) Decreasing and then increasing. Note that the sum percentage for location of countries is not equal to 100 because of cross country studies, similar for academic disciplines.

3.3 Research design

The research design of the 83 empirical published articles on innovation in non-metropolitan region are shown in Table 3. Most articles (66.2%) were exploratory in nature - had no predetermined hypotheses. Formalised studies - those with a well-defined structure in place and predetermined hypotheses- accounted for 33.7% and increased in the last period, following a sharp decline from 2006 to 2010. Over time, both formalised and exploratory studies oscillated in terms of their regularity. Exploratory studies increased in the 2006-2010 period before declining in the following period. Formalised studies on the contrary first declined sharply in the 2006-2010 period before a hike in the next.

With respect to the research environment, half (50.6%) of the articles collected data through fieldwork. Those that did not require fieldwork – laboratory – accounted for 39.8%. Others include studies combining both field research and laboratory work. The research environment has fluctuated over the year by either decreasing and then increasing (field) or increasing and then decreasing (laboratory and others).

In terms of topical scope, case studies feature in about 75% of studies while statistical studies make up 18%. There was a remarkable decline in the number of statistical and others studies in the 2006-2010 period but a hike in the number of case studies in the same period (93.3%).

Regarding the time dimension, 54.2% of studies deal with cross-sectional data while 31.8% analyse longitudinal data. Cross-sectional studies have steadily increased over time while longitudinal studies fluctuated slightly on the contrary.

In terms of communication mode, most articles (65%) were observational – analyse the behaviour of the sample – whereas survey studies (21.7%) are those generally dealing with large data. Survey studies declined significantly in the 2006-2011 period before picking up again. Observation studies have somewhat been steady, though with a slight increase in the 2006-2010 period.

Regarding variable association, the majority of articles are descriptive, account for 67.5% of studies, and more than doubled in the second period before a slight decline in the next one. Causal studies - explaining relationships between variables – decreased by more than half in the 2006-2010 period before a small increase in the subsequent one.

Table 4: Resign design of innovation in non-metropolitan regions literature.

Research design		Time period			Trend direction[1]
	Total (n=83)	1998-2005 (n= 12) %	2006-2010) (n= 17) %	2011-2016 (n=54) %	
Problem crystallisation					
Exploratory	(55) 66.2	(8) 66.7	(16) 94.1	(31) 57.4	Λ
Formalised	(28) 33.7	(4) 33.3	(1) 5.9	(23) 42.6	V
Research Environment					
Field	(42) 50.6	(6) 50.0	(6) 35.3	(30) 55.6	Λ
Laboratory	(33) 39.8	(6) 50.0	(7) 8.4	(20) 37.0	V
Others	(8) 9.6	0.0	(4) 23.5	(4) 7.4	Λ
Topical scope					
Statistical study	(15) 18.0	(4) 33.3	(2) 11.8	(9) 16.7	V
Case study	(62) 74.7	(6) 50.0	(15) 88.2	(41) 75.9	Λ
Others	(6) 7.2	(2) 16.7	0.0	(4) 7.4	V
Time dimension					
Cross-sectional	(45) 54.2	(4) 33.3	(8) 47.0	(33) 61.1	↑
Longitudinal	(29) 34.9	(7) 58.3	(5) 29.4	(17) 31.5	V
Others	(9) 10.8	(1) 8.4	(4) 23.5	(4) 7.4	
Communication Mode					
Survey	(18) 21.7	(4) 33.3	(1) 5.9	(13) 24.0	V
Observational	(54) 65.0	(7) 58.3	(12) 70.6	(35) 64.8	Λ
Others	(11) 13.3	(1) 8.4	(4) 23.5	(6) 11.1	Λ
Variable association					
Descriptive	(56) 67.5	(7) 33.3	(13) 76.5	(36) 66.7	Λ
Causal	(24) 28.9	(4) 58.3	(3) 17.4	(17) 31.5	V
Others	(3) 3.6	(1) 8.4	(1) 5.9	(1) 1.8	↓

[1] (↑) Increasing; (↓) Decreasing; (Λ) Increasing and then decreasing; (V) Decreasing and then increasing.

3.4 Scope of the research

Table 5 presents the scope of the empirical articles on innovation in non-metropolitan regions. Though most studies (43.4%) analyse three or more regions, this trend is on the decline. This decline can be explained by the increasing number of studies dealing with two or one region. There was a rise in single region studies and the period 2006-2010 and in two regions studies in the period 2011-2016.

As per the location of regions, the European continent stands far above others as four fifths of the articles are concerned with European regions with three European Nordic countries (Norway, Finland and Sweden) contributing about half of this percentage. Norway in particular is the country where most of the research on innovation in non-metropolitan regions has occurred. North America is far behind Europe, accounting for 4.8% of region analysed, with the number of studies focusing on North American regions decreasing over time. North America is represented by Canada, which accounts for 9.6% of articles, with slight fluctuations over the years.

Almost all the regions (88%) analysed are within developed countries, though this is a decreasing trend. Scholars are increasingly interested in non-metropolitan regions of developing countries which now account for 12%. While non-metropolitan regions are the major focus of studies (90.4%), they are in some instances analysed with other types of regions.

Studies analysing regions in a single country account for 84.3% of the articles while those dealing with regional comparison across countries accounted for 15.7%. Both studies analysing regions in a single country and those comparing regions in two or more countries have fluctuated over time.

Table 5: Scope of the non-metropolitan innovation research

Scope of research	Total (n=83) %	Time Period			Trend direction[1]
		1998-2005 (n=12) %	2006-2010 (n=17) %	2011-2016 (n=54) %	
Number of regions analysed					
1	(28) 33.7	0.0	(8) 47.0	(20) 37.0	Λ
2	(16) 19.3	(2) 16.7	(1) 5.9	(13) 24.0	V
3 or more	(36) 43.4	(9) 75.0	(8) 47.0	(19) 35.2	↓
No region specified	(3) 3.6	(1) 8.3	0.0	(2) 3.7	V
Location of the region					
Europe	(66) 79.5	(10) 83.3	(13) 76.5	(43) 79.6	V
North America	(4) 4.8	(1) 8.3	(1) 5.9	(2) 3.7	↓
South America	(1) 1.2	0.0	0.0	(1) 1.8	↗
Asia	(4) 4.8	0.0	(1) 5.9	(3) 5.6	Λ
North America & Europe	(4) 4.8	(1) 8.3	(1) 5.9	(2) 3.7	↓
North & South America	(1) 1.2	0.0	0.0	(1) 1.8	↗
Others	(3) 3.6	0.0	(1) 5.9	(2) 3.7	Λ
Nature of the region					
Developed	(73) 88.0	(12) 100.0	(16) 94.1	(45) 83.3	↓
Developing	(10) 12.0	0.0	(1) 5.9	(9)16.7	↑
Types of regions					
Purely non-metropolitan	(75) 90.4	(10) 83.3	(16) 94.1	(49) 90.7	Λ
Non-metropolitan and others	(8) 9.6	(2) 16.7	(1) 5.9	(5) 9.25	V
Types of studies					
Single country	(70) 84.3	(8) 66.7	(15) 88.2	(47) 87.0	Λ
Cross country studies	(13) 15.7	(4) 33.3	(2) 11.8	(7) 13.0	V
Country of the region					
Norway	(15) 18.0	-	(1) 5.9	(14) 25.9	↑
Spain	(9) 10.8	(2) 16.7	(4) 23.5	(3) 5.6	Λ

Finland	(9) 10.8	-	(3) 17.6	(6) 11.1	Λ
Sweden	(9) 10.8	(2) 16.7	(1) 5.9	(6) 11.1	V
Canada	(8) 9.6	(1) 8.3	(2) 11.8	(5) 9.25	Λ
England	(4) 4.8	(1) 8.3	(2) 11.8	(1) 1.8	Λ
Portugal	(3) 3.6	-	(3) 17.6	-	Λ
Republic of Ireland	(3) 3.6	(1) 8.3	-	(2) 3.7	V
France	(3) 3.6	-	(2) 11.8	(1) 1.8	Λ
Poland	(3) 3.6	-	(1) 5.9	(2) 3.7	Λ
Scotland	(3) 3.6	(1) 8.3	-	(2) 3.7	V
Greece	(3) 3.6	(3) 25.0	-	-	↘
China	(3) 3.6	-	(1) 5.9	(2) 3.7	Λ
Germany	(3) 3.6	(1) 8.3	-	(2) 3.7	V
Northern Ireland	(2) 2.4	-	-	(2) 3.7	↗
Switzerland	(2) 2.4	-	-	(2) 3.7	↗
Austria	(2) 2.4	-	-	(2) 3.7	↗
Belgium	(2) 2.4	-	(2) 11.8	-	Λ
Israel	(2) 2.4	(2) 16.7	-	-	↘
Australia	(2) 2.4	-	(1) 5.9	(1) 1.8	Λ
Czech Republic	(2) 2.4	-	-	(2) 3.7	↗

[1] (↑) Increasing; (↓) Increasing; (↗) Constant and then increasing; (↘) Constant and then decreasing; (Λ) Increasing and then decreasing; (V) Decreasing and then increasing.

3.5 Research methodology

Regarding the methods of investigation of the empirical studies, Table 6 depicts the sampling design, the approach to data collection, the type of data analysis and the analytical technique. In terms of sampling design, non-probability sampling is on the increase and is the main design employed (80.7%). Less than five percent of articles use probabilistic sampling with the remaining (14.5%) failing to mention the sampling approach.

Pertaining to data collection, the use of secondary data (25.3%) is the dominant approach found in most articles with some fluctuations over time. A significant number of articles (21.7%) use multiple methods to collect data. The use of personal interviews increased over time and they are present in 20.5% of articles. Articles using existing databases also represented 20.5% of the sample but with some variations over time. On the other hand, using mail surveys declined and their representation stands at 8.4%.

More than half of the articles (58.3%) qualitatively analysed data. The percentage of articles using qualitative analysis increased in the period 2006-2010 before reducing in the 2011-2016 period. Articles adopting quantitative analysis (16.7%) are on the increase while those using formula modelling (25%) increased in the 2011-2016 period, following a sharp decline in the 2006-2010 period. Other articles (6%) used mixed methods, especially featuring in the last period.

With regard to the analytical technique, though over half of the studies were descriptive (58.3%), this trend has decreased over time. The use of multivariate analyses (41.7%) decreased by more than half in the 2006-2010 period before almost doubling in the 2011-2016 period.

Table 6: Study methodology of innovation in non-metropolitan regions articles

Study methodology	Total (n=83) %	Time period			Trend direction[1]
		1998-2005 (n=12) %	2006-2010 (n=17) %	2011-2016 (n=54) %	
Sampling design					
Probability	(4) 4.8	0.0	(1) 5.9	(3) 5.6	↓
Non-probability	(67) 80.7	(8) 66.7	(13) 76.5	(46) 85.1	↑
Not available	(12) 14.5	(4) 33.3	(3) 17.6	(5) 9.3	↓
Data collection					
Secondary information	(21) 25.3	(4) 33.3	(7) 41.2	(10) 18.5	Λ
Existing database	(17) 20.5	(4) 33.3	(2) 11.8	(11) 30.4	V
Mail/email survey	(7) 8.4	(3) 25.0	(1) 5.9	(3) 5.6	↓
Face to face survey	(1) 1.2	0.0	0.0	(1) 1.8	↗
Telephone survey	(2) 2.4	0.0	0.0	(2) 3.7	↗
Personal interviews	(17) 20.5	0.0	(2) 11.8	(15) 27.8	↑
Others	(18) 21.7	(1) 8.3	(5) 29.4	(12) 22.2	Λ
Data analysis					
Qualitative	(52) 62.6	(7) 58.3	(13) 76.5	(32) 59.3	Λ
Quantitative	(16) 19.3	(2) 16.7	(3) 17.6	(11) 20.4	↑
Modelling (formula)	(11) 13.3	(3) 25.0	(1) 5.9	(7) 13.0	V
Other	(4) 4.8	0.0	0.0	(4) 7.4	↗
Analytical technique					
Descriptive	(37)	(7) 58.3	(8) 47.0	(22) 40.7	↓
Uni-Bivariate	(1)	0.0	(1) 5.9	0.0	Λ
Multivariate	(25)	(5) 41.7	(3) 17.6	(17) 31.5	V
Others	(20)	0.0	(5) 29.4	(15) 27.8	Λ

[1] (↑) Increasing; (↗) Constant and then increasing; (Λ) Increasing and then decreasing; (V) Decreasing and then increasing.

3.6 Structure of the research on innovation in non-metropolitan regions

As per the content dimension, the articles on innovation in non-metropolitan regions were characterised into four broad areas: research topic of interest; the vehicles for innovation analysed; the types of factors influencing the innovation process and the main stakeholders analysed (Table 7).

Table 7: Structure of the research on innovation in non-metropolitan regions

Thematic areas	Total (n=83) %	Time period			Trend direction[1]
		1998-2005 (n=12) %	2006-2010 (n=17) %	2011-2016 (n=54) %	
Research topics					
Innovation drivers or inhibitors in non-metropolitan regions.	(64) 77.1	(10) 83.3	(16) 94.1	(38) 70.4	Λ
Analytical frameworks for analysing and promoting innovation in non-metropolitan regions	(12) 14.5	0.0	0.0	(12) 22.2	↗
Others	(7) 8.4	(2) 16.7	1 (5.9)	(4) 7.4	↓
Vehicles for innovation					
Knowledge organisations	(9) 10.4	0.0	(3) 17.6	(6) 11.1	Λ
Industries	(31) 37.3	(2) 16.7	(6) 35.9	(23) 42.6	↑
Institutional actors	(16) 19.7	(4) 33.3	(3) 17.6	(9) 16.6	↓
Industries and knowledge organisation	(7) 8.4	(2) 16.7	(1) 5.9	(4) 7.4	↓

Industry and institutional actors	(13) 15.7	(2) 16.7	(2) 11.8	(9)16.7	V
Triple helix actors	(7) 8.4	(2) 16.7	(2) 11.8	(3) 5.6	↓
Innovation Process (influenced by)					
Internal practices	(11) 13.3	0.0	(4) 23.5	(7) 13.0	Λ
External sources	(19) 22.9	(1) 8.3	(1) 5.9	(17) 31.5	V
Both internal and external factors	(53) 63.8	(11) 91.7	(12) 70.6	(30) 55.6	↓
Stakeholders					
Firms	(19) 22.9	(4) 33.3	(6) 35.3	(9) 16.6	Λ
Region	(35) 42.2	(5) 41.7	(9) 52.9	(21) 38.9	Λ
Firm and region	(29) 34.9	(3) 25.0	(2) 11.7	(24) 44.4	V

[1] (↑) Increasing; (↗) Constant and then increasing; (Λ) Increasing and then decreasing; (V) Decreasing and then increasing.

With regards to research topics, a substantial number of articles (77.1%) deal with factors promoting or hindering innovation either at the firm or the regional level in non-metropolitan regions. The number of these articles slightly oscillated over time but remains high. Publications focusing on conceptual approaches to innovation in non-metropolitan regions account for 14.5% with this topic gaining interest in the 2011-2016 period.

As per the vehicles for innovation, most articles (37.3%) examine the role played by industries in innovation promotion in non-metropolitan regions, a trend is on the rise. One fifth of the articles look at the role played by institutional actors while 10.4% of them focus on knowledge organisations. Some articles consider both industries and institutional actors (15.7%) while others combine a focus on business organisations and industries (8.4%). A smaller number of studies (8.7%) consider triple helix actors (University-industry-institutional actors).

In terms of innovation process, though on decline, the majority of articles (63.8%) consider both internal and external factors related to innovation in non-metropolitan regions. Some articles however either on internal (13.3%) and external (22.9%) factors.

In relation to stakeholders, 42.2% of studies focus on the region, 34.9% combine a firm and regional focus while 22.9% look at the firm. Some fluctuations are observed in all categories and the last period has witnesses an increase focus on both firm and region.

4. Discussion

With recent calls for more innovation research in non-metropolitan regions, the current state of knowledge on the topic is needed for advancing innovation research in these types of regions.

Following this review, it is evident that research on innovation in non-metropolitan regions has received little attention in the literature, with just 85 articles published in eighteen years (1998-2016). Though scattered in various journals, two of them – *European Planning Studies* and *Norsk Geografisk Tidsskrift* – published about 34.5% of the innovation in non-metropolitan regions research. Very few articles were published in highly ranked journals such as *Regional Studies*, *Research Policy*, *Urban Studies* and *Journal of Economic Geography*. Similarly, this topic is only sporadically discussed in the top ten regional science journals, as classified by Rickman and Winters (2016). The three journals included in this category: *Annals of Regional Science*; *Papers in Regional Science* and *Regional Studies* contributed six articles representing less than ten percent of the publications dealing with this topic. This might be justified by the decrease observed in the number of regional scientists publishing this research over time. The fields interested in this topic in recent years are Business/Management,

Geography and to some extent Economics. While contributions from the first two fields continue to increase, a minor drop was observed in articles written by economist in the 2006-2010 period.

The research designs reported in articles on innovation in non-metropolitan regions have been systematic in the last five years (2011-2016), as reflected in the increase use of formalised hypotheses and interest in causal relationship among variables. This research, however, continues to be dominated by cross-sectional designs and case studies. Though the time and resources needed for longitudinal studies might act as limiting factors, case studies with longitudinal designs might help identify variations over time and design appropriate policies. The large number of case studies and the preference for field research is an indication that scholars interested in the topic are more interested in gaining in-depth knowledge than pragmatic knowledge on innovation in non-metropolitan regions. Research on innovation in non-metropolitan regions will greatly benefit from both in-depth and pragmatic knowledge.

Research on innovation in non-metropolitan regions is concentrated in Europe and dominated by single-country studies often analysing three or more regions. This single country focus limits the transferability of their outcome to other countries' regions. Cross country studies might contribute towards the development of specific theoretical frameworks for analysing and promoting innovation in non-metropolitan regions. This is especially important as a grand theory for innovation in non-metropolitan regions is still missing. More theoretical studies might advance the theoretical debate and equally lead to such an outcome.

Methodology wise, non-probability sampling is the prevailing trend in the literature on innovation in non-metropolitan regions. This is likely due to the small size of firms in non-metropolitan regions, limiting the use of probability sampling. The rise of personal interviews might be attributed to the desire for in-depth knowledge, a key characteristic of case studies. The use of sophisticated analytical techniques (multivariate analysis) and modelling in these studies is limited due to sample size constraints. Not surprisingly, therefore, data are qualitatively analysed and descriptive. The other main methods of data collection are the use of secondary information and that of existing databases, which have both had fluctuations over the years.

Whether in relation to firms or the region, the literature on innovation in non-metropolitan regions is mainly concerned with how to alleviate the barriers to innovation in these regions at the firm and at the regional level. There is an increased awareness that frameworks specific for analysing and promoting innovation in such regions are needed. Most studies on this topic still utilise frameworks primarily modelled on large regions, often without questioning their underlying assumptions (Isaksen & Sæther 2015). Though scholars concur that innovation promotion in such regions entails a combined focus on internal and external factors, this is trend has decreased over time, due to studies concerned either with internal or external factors gaining more popularity. Industries are and continue be analysed as main vehicles for innovation in the articles analysed. Emphasis on institutional actors as drivers of innovation in non-metropolitan regions has waned overtime, though some influential contributions have been made regarding the role played by institutions (see for example: Pike, Rodríguez-Pose & Tomaney 2016; Rodríguez-Pose 2013). While some interest has also been shown in the role played by knowledge organisations in the last two periods, not the same can be said of triple helix actors. Studies with a more holistic approach to innovation in non-metropolitan regions might provide a better picture of the bottlenecks at all levels. The quadruple helix approach might serve as a key framework for such studies. Not surprisingly, emphasis is often on the region, with recent trends showing a combined focus on the firm and the region. The low attention paid to firms in the 2011-2016 period is rather alarming, especially given their central role in driving innovation in these types of regions (Isaksen & Karlsen 2013). Concepts such as absorptive capacity (Cohen & Levinthal 1990;

Zahra & George 2002) and innovation capability (Lawson & Samson 2001) might serve as key lenses for looking inside the firms located in non-metropolitan regions. Looking inside firms located in such regions and strengthening their internal capability might render strategies aimed at enhancing access to external knowledge more fruitful.

5. Conclusion

This review was concerned with the literature on innovation in non-metropolitan regions over a 16 years period based on six dimensions. It has not only revealed some key facts regarding each of the dimension analysed but also some interesting gaps to be examined by future research. The first gap pertains to the need for conceptual approaches tailored to non-metropolitan regions innovation research. Current studies on innovation in non-metropolitan regions borrow concepts 'here' and 'there', often applying them without scrutiny. Though not an easy task, given differences observed in region classification across country, such a theory might eventually be developed either by testing and refining some existing models more adapted to other types of regions. More theoretical debate might also produce the same outcome. The second gap relates to the failure of this literature to incorporate recent advances in innovation research. In particular, concepts such as knowledge bases and open innovation apply to all types of regions but have seldom been utilised as framework for studying innovation in non-metropolitan regions. The knowledge base concept is best modelled in terms of occupation driving innovation at the firm level and might be key to identifying and then completing these occupations. Open innovation on the other hand might compensate for the lack of related variety at the non-metropolitan level. Lastly, this research will greatly benefit from a more holistic approach to innovation in these regions combining a focus on academia, industry, government and the community.

References

Asheim, B & Coenen, L 2005, 'Knowledge bases and regional innovation systems: Comparing Nordic clusters', *Research policy*, vol. 34, no. 8, pp. 1173-1190.

Asheim, B, Moodysson, J & Tödtling, F 2011, 'Constructing regional advantage: Towards state-of-the-art regional innovation system policies in Europe?', *European Planning Studies*, vol. 19, no. 7, pp. 1133-1139.

Becheikh, N, Landry, R & Amara, N 2006, 'Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003', *Technovation*, vol. 26, no. 5, pp. 644-664.

Benneworth, P 2007, 'Seven samurai opening up the ivory tower? The construction of Newcastle as an entrepreneurial university', *European Planning Studies*, vol. 15, no. 4, pp. 487-509.

Boell, SK & Cecez-Kecmanovic, D 2015, 'On being 'systematic' in literature reviews in IS', *Journal of Information Technology*, vol. 30, no. 2, pp. 161-173.

Braczyk, HJ, Cooke, PN & Heidenreich, M 1998, *Regional innovation systems: The role of governances in a globalized world*, UCL Press.

Camagni, R 2002, 'On the concept of territorial competitiveness: sound or misleading?', *Urban studies*, vol. 39, no. 13, pp. 2395-2411.

Christensen, JL, Drejer, I, Andersen, PH & Holm, JR 2016, 'Innovation policy: how can it best make a difference?', *Industry and Innovation*, vol. 23, no. 2, pp. 135-139.

Coe, NM, Hess, M, Yeung, HWc, Dicken, P & Henderson, J 2004, ''Globalizing'regional development: a global production networks perspective', *Transactions of the Institute of British Geographers*, vol. 29, no. 4, pp. 468-484.

Cohen, WM & Levinthal, DA 1990, 'Absorptive capacity: A new perspective on learning and innovation', *Administrative Science Quarterly*, vol. 35, no. 1, pp. 128-152.

Cooke, P, Gomez Uranga, M & Etxebarria, G 1997, 'Regional innovation systems: Institutional and organisational dimensions', *Research policy*, vol. 26, no. 4–5, pp. 475-491.

Doloreux, D & Porto Gomez, I 2017, 'A review of (almost) 20 years of regional innovation systems research', *European Planning Studies*, vol. 25, no. 3, pp. 371-387.

Escalona-Orcao, A, Escolano-Utrilla, S, Sáez-Pérez, L & García, BS-V 2016, 'The location of creative clusters in non-metropolitan areas: A methodological proposition', *Journal of Rural Studies*, vol. 45, pp. 112-122.

Eversole, R 2015, *Regional development in Australia : Being regional*, Taylor and Francis, Florence, KY.

Fitjar, RD & Rodríguez-Pose, A 2011, 'Innovating in the periphery: firms, values and innovation in Southwest Norway', *European Planning Studies*, vol. 19, no. 4, pp. 555-574.

Florida, R, Adler, P & Mellander, C 2017, 'The city as innovation machine', *Regional Studies*, vol. 51, no. 1, pp. 86-96.

Gomes, E, Barnes, BR & Mahmood, T 2016, 'A 22 year review of strategic alliance research in the leading management journals', *International Business Review*, vol. 25, no. 1, pp. 15-27.

Grillitsch, M & Nilsson, M 2015, 'Innovation in peripheral regions: Do collaborations compensate for a lack of local knowledge spillovers?', *The Annals of regional science*, vol. 54, no. 1, pp. 299-321.

Hu, X 2017, 'From coal mining to coal chemicals? Unpacking new path creation in an old industrial region of transitional China', *Growth and change*.

Isaksen, A 2014, 'Industrial development in thin regions: trapped in path extension?', *Journal of economic geography*, vol. 15, no. 3, pp. 585-600.

Isaksen, A & Karlsen, J 2013, 'Can small regions construct regional advantages? The case of four Norwegian regions', *European Urban and Regional Studies*, vol. 20, no. 2, pp. 243-257.

Isaksen, A & Sæther, B 2015, 'Innovation in small regions', *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography*, vol. 69, no. 2, pp. 65-66.

Jungmann, R, Baur, N & Ametowobla, D 2015, 'Grasping processes of innovation empirically. A call for expanding the methodological toolkit. An introduction', *Historical Social Research / Historische Sozialforschung*, vol. 40, no. 3 (153), pp. 7-29.

Krippendorff, K 2004, 'Reliability in content analysis', *Human communication research*, vol. 30, no. 3, pp. 411-433.

Lawson, B & Samson, D 2001, 'Developing innovation capability in organisations: a dynamic capabilities approach', *International Journal of Innovation Management*, vol. 5, no. 03, pp. 377-400.

Leonidou, LC, Barnes, BR, Spyropoulou, S & Katsikeas, CS 2010, 'Assessing the contribution of leading mainstream marketing journals to the international marketing discipline', *International Marketing Review*, vol. 27, no. 5, pp. 491-518.

Markusen, A 1999, 'Fuzzy concepts, scanty evidence, policy distance: the case for rigour and policy relevance in critical regional studies', *Regional Studies*, vol. 33, no. 9, pp. 869-884.

McAdam, R, Reid, R & Shevlin, M 2014, 'Determinants for innovation implementation at SME and inter SME levels within peripheral regions', *International Journal of Entrepreneurial Behaviour and Research*, vol. 20, no. 1, pp. 66-90.

Mudambi, R & Santangelo, GD 2016, 'From shallow resource pools to emerging clusters: The role of multinational enterprise subsidiaries in peripheral areas', *Regional Studies*, vol. 50, no. 12, pp. 1965-1979.

Okoli, C & Schabram, K 2010, *A guide to conducting a systematic literature review of information systems research*.

Pike, A, Rodríguez-Pose, A & Tomaney, J 2016, 'Shifting horizons in local and regional development', *Regional Studies*, pp. 1-12.

Rickman, DS & Winters, JV 2016, 'Ranking Authors and Institutions by Publications in Regional Science Journals: 2010–2014', *Growth and change*, vol. 47, no. 2, pp. 312-336.

Rodríguez-Pose, A 2013, 'Do institutions matter for regional development?', *Regional Studies*, vol. 47, no. 7, pp. 1034-1047.

Shearmur, R 2012, 'Are cities the font of innovation? A critical review of the literature on cities and innovation', *Cities*, vol. 29, pp. S9-S18.

Suorsa, K 2014, 'The concept of 'region' in research on regional innovation systems', *Norsk geografisk tidsskrift*, vol. 68, no. 4, pp. 207-215.

Tödtling, F, Skokan, K, Höglinger, C, Rumpel, P & Grillitsch, M 2013, 'Innovation and knowledge sourcing of modern sectors in old industrial regions: comparing software firms in Moravia-Silesia and Upper Austria', *European Urban and Regional Studies*, vol. 20, no. 2, pp. 188-205.

Tödtling, F & Trippl, M 2005, 'One size fits all? Towards a differentiated regional innovation policy approach', *Research policy*, vol. 34, no. 8, pp. 1203-1219.

Zahra, SA & George, G 2002, 'Absorptive Capacity: A Review, Reconceptualization, and Extension', *The Academy of Management review*, vol. 27, no. 2, pp. 185-203.