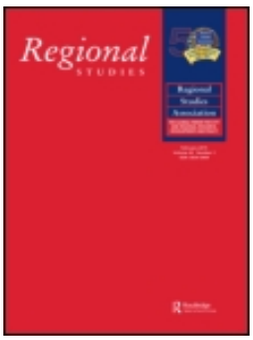

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The Evolution of the Cluster Literature: Shedding Light on the Regional Studies–Regional Science Debate

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CRUZ S. C. S. and TEIXEIRA A. A. C. The evolution of the cluster literature: shedding light on the regional studies–regional science debate, *Regional Studies*. Despite the intuitive awareness about the rising importance of the cluster literature, an empirical study on its precise magnitude and evolution has yet to be accomplished. Based on two complementary bibliometric exercises – comprising 50 000 citations and almost 3000 abstracts, ranging in date from 1962 to 2008 – it was demonstrated that although seminal contributors come both from regional science and regional studies areas, the 'convergence' between regional science and regional studies approaches is still a chimera.

Clusters Industrial clusters Industrial location Bibliometrics

CRUZ S. C. S. and TEIXEIRA A. A. C. 集群相关文献研究的演进：明辨区域研究与区域科学之争，区域研究。尽管学术界已经直觉地意识到了集群研究日渐增长的重要性，但是关于研究文献确切的数量以及演进方向却还有待进一步讨论。基于两组互补的文献计量学——综合了1962–2008 年间约 50，000 条参考文献以及近 3000 篇摘要，研究发现，尽管有创见的研究同时存在于区域科学和区域研究两大领域，区域科学和区域研究方法之间的相互'耦合'关系仍然是有待进一步研究的谜题。

集群 文化产业集群 产业区位 文献计量学

CRUZ S. C. S. et TEIXEIRA A. A. C. L'évolution de la documentation au sujet des grappes: répandre de la lumière sur le débat à propos des études régionales et de la science régionale, *Regional Studies*. Malgré la conscience intuitive à l'égard de l'importance accrue de la documentation au sujet des grappes, il faut encore faire une étude empirique sur son ampleur précise et son évolution. A partir de deux exercices bibliométriques – comportant 50 000 citations et à peu près 3 000 résumés, allant de 1962 jusqu'à 2008 – on montre que l'on poursuit toujours des chimères quant au 'rapprochement' entre la façon prise dans la science régionale et celle employée dans les études régionales.

Grappes Grappes industrielles Implantation industrielle Bibliométrie

CRUZ S. C. S. und TEIXEIRA A. A. C. Die Evolution der Cluster-Literatur: eine Untersuchung der Debatte über Regionalstudien und Regionalwissenschaft, *Regional Studies*. Die wachsende Bedeutung der Literatur über Cluster ist zwar auf intuitive Weise bekannt, doch eine empirische Studie über ihre genaue Größe und Evolution steht noch aus. Ausgehend von zwei komplementären bibliometrischen Untersuchungen – mit 50.000 Zitaten und beinahe 3000 Inhaltsangaben aus den Jahren 1962 bis 2008 – wurde nachgewiesen, dass zukunftsweisende Beiträge zwar sowohl aus dem Bereich der Regionalwissenschaft als auch aus dem der Regionalstudien kommen, aber die 'Konvergenz' der Ansätze der Regionalwissenschaft und der Regionalstudien weiterhin ein Trugbild bleibt.

Cluster Branchencluster Industriestandort Bibliometrie

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DOI: 10.1080/00343400903234670

CRUZ S. C. S. y TEIXEIRA A. A. C. La evolución de la literatura de aglomeraciones: un análisis sobre el debate de estudios regionales y ciencia regional, *Regional Studies*. Aunque la creciente importancia de la literatura sobre aglomeraciones se conoce de modo intuitivo, todavía es necesario un estudio empírico sobre su magnitud precisa y evolución. En base a dos ejercicios bibliométricos complementarios – que contienen 50.000 citaciones y casi 3000 resúmenes, y que van desde 1962 a 2008 – se demostró que aunque las contribuciones importantes proceden tanto de áreas de estudios científicos como regionales, la 'convergencia' entre los enfoques de ciencia regional y estudios regionales es todavía una quimera.

Aglomeraciones Aglomeraciones industriales Ubicación industrial Bibliometría

JEL classifications: C89, L22, R10, R12

INTRODUCTION

Interest in the economics of agglomeration and the geographical distribution of economic activities dates back to the beginning of the nineteenth century. Since then, regional economic studies have evolved into a wide and diversified corpus of literature, which achieved an extraordinary boom in the 1990s, with growing, renewed interest on the part of economists in geography and the spatial dimension of economics (for example, PORTER, 1990; KRUGMAN, 1991; and FUJITA and MORI, 2005).

Notwithstanding the intuitive awareness as to the rising importance of the theoretical debate on regions and clusters, there is a substantial lack of empirical support in ascertaining its precise magnitude and evolution. Moreover, the majority of surveys on the literature of spatial economics and (industrial) clusters consist of mainly qualitative accounts. These highly important and fertile studies tend nevertheless to address specific themes: agglomeration economies (OTTAVIANO and PUGA, 1998; MCCANN and SHEPPARD, 2003; FUJITA and KRUGMAN, 2004; FUJITA and MORI, 2005); evolutionary approaches to clusters (BOSCHMA and LAMBOOY, 1999; BOSCHMA and FRENKEN, 2006); regional development policies (SANZ-MENENDEZ and CRUZ-CASTRO, 2005); institutional approaches (ASHEIM, 2000); global networks and multinationals (YOUNG *et al.*, 1994); and knowledge-based theories/localized learning/knowledge spillovers (BRESCHI, 1995; BRESCHI and LISSONI, 2001; BRESCHI and MALERBA, 2001; MASKELL, 2001; MALMBERG and MASKELL, 2002; MOULAERT and SEKIA, 2003; SIMMIE, 2004, 2005; CANIËLS and ROMIJN, 2005; MOULAERT and NUSSBAUMER, 2005; DÖRING and SCHNELLENBACH, 2006). Seldom, however, do these 'qualitative' surveys provide a wide-ranging, longitudinal and comparative overview of the evolution of these different themes within the regional literature, in general, and the cluster literature, in particular. These surveys offer a focused (and in-depth) perspective, without generally providing a comprehensive picture and the relative positioning of those themes within the regional literature. Bibliometric tools and bibliometric surveys permit, in addition to these more qualitatively led surveys, an analysis of recent paths in a given research field (SILVA and TEIXEIRA, 2009) and, more importantly, an objective assessment of the seminal contributions and contributors (SILVA and TEIXEIRA, 2008). Additionally, they contribute to shedding light on the heated debate (BARNES, 2003; POLÈSE, 2003; PARTRIDGE, 2006; MCCANN, 2007) on the relative strength of regional *science* and regional *studies* approaches by assessing the dynamics of particular types of methodologies (formal versus appreciative and empirical) and themes (agglomeration/New Economic Geography versus socially related issues).

Thus, the main purpose of the present paper is, based on a bibliometric account, to provide evidence that empirically complements the qualitative surveys of the cluster literature, and to clarify the relative positioning of the different lines/themes of research, and the relative strength of the different regional approaches (science versus studies) within the entire corpus of the 'cluster' literature.

Over the period in analysis (1962–2007), a massive amount of potentially relevant literature has been published, and as such, there is no reasonable way in which justice can be done to its entirety. In these conditions, emphasis was placed on selecting 'seminal' contributions, and from there an attempt was made to establish links with more recent works. This was performed by applying bibliometric methods, which were used on two different fronts. First, over 50 000 citations were analysed, taking *Regional Studies* as the 'seed journal' (LEYDESDORFF, 2007).[1] This exercise helped us to identify the most influential contributions. At the same time, it provided some clues on the clustering of contributions and on the identification of the main streams in the literature. Secondly, a review was conducted of the (almost 3000) abstracts of all the theoretical and empirical articles on cluster matters that were published in *all* the economic journals indexed in the EconLit and Business Source Complete databases over the past forty years.[2] The classification of these articles according to the main topic of research and the methodologies used helped the authors to interpret the recent trends in the literature and assess the relative vigour of regional *science* and regional *studies* approaches.

The paper is structured as follows. The next section highlights the main theoretical approaches and schools of thought that have emerged and developed since the nineteenth century, based on the bibliometric citation exercise, framed by a brief 'qualitative' survey of the cluster literature. Based on the main research themes revealed in the 'quantitative' exercise (citations) and the 'qualitative' survey, the third section further provides a detailed 'quantitative' analysis of the literature on clusters using additional bibliometric techniques. The Conclusions highlight the most relevant outcomes of the present study.

SURVEYING 'CLUSTERS': AN OVERVIEW

The wide diversity of the concept of 'cluster'

The 1990s and, particularly, the beginning of the twenty-first century witnessed a remarkable increase in the production of articles on (industrial) cluster literature (Fig. 1). This trend in publications is mostly derived from the growing importance that local specialization and clusters have accrued both in academic and in political fields in recent years, together with increasing research on globalization and global networks (PORTER, 1990, 1998; AMIN and THRIFT, 1992, 1994).

This interest in the 'local' dimension is directly related to globalization effects, such as the external economies of scale that co-located firms may accrue from the expansion of markets and trade liberalization (PYKE and SENGENBERGER, 1992).

It is important to recall that some (previous, and to a lesser extent, subsequent) literature that does not explicitly mention the word 'cluster' may in fact have more cluster content than the literature that has possibly employed clusters as a fashionable label to attract attention.[3] Therefore, when studying 'clusters' from a general perspective, care was be taken to include related and close-to-synonymous concepts, such as agglomeration economies, industrial districts, 'milieux', growth poles, and local production systems (OAKEY *et al.*, 2001; MASKELL, 2001; TALLMAN *et al.*, 2004).[4] These concepts tend to be associated with commonly used keywords such as 'agglomeration', 'external economies', 'concentration (in space)', 'proximity', 'localization economies', and 'local accumulation of knowledge' and 'knowledge spillovers'.

Interestingly, based on the analysis of important edited volumes on cluster literature (see Table A1 in the Appendix),[5] it is clear that derivative keywords of 'agglomeration' (geographical agglomeration, regional agglomeration, spatial agglomeration) are quite pervasive, as are derivatives of the keyword 'concentration' (in space, of specialized industries, industrial concentration). The 'cluster' keyword on its own is more prevalent in the most recent editions of these volumes.

The evolution of the cluster concept has been naturally shaped by the development of the cluster literature. Since its earliest beginnings, the concept of 'cluster' has been subject to a multitude of notions, depending on each school of thought or the particular context in

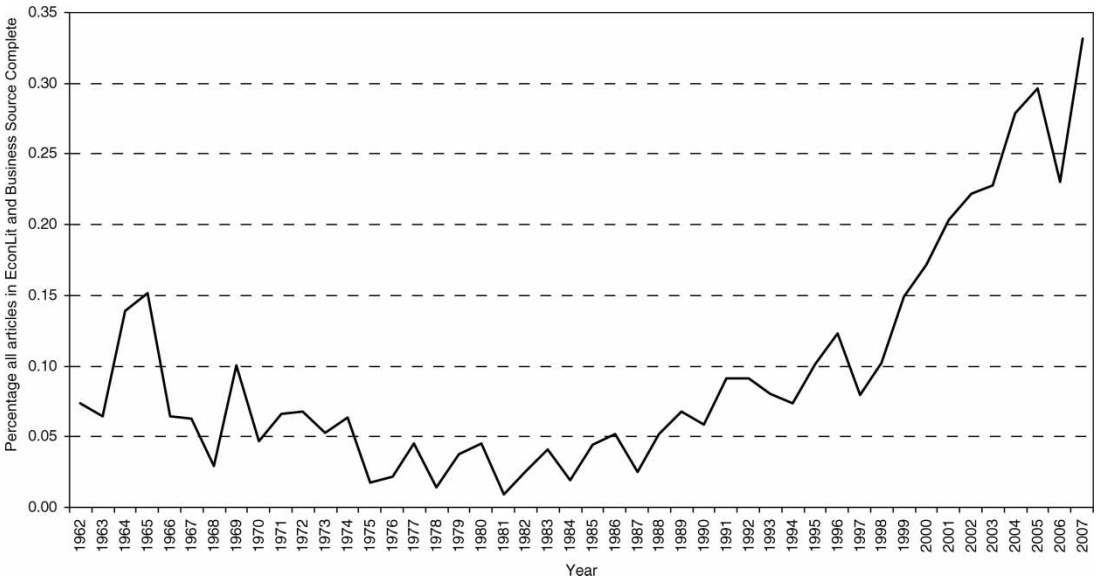

Fig. 1. *Evolution of the total articles published on 'clusters', 1962–2007*

Note: The 2940 articles considered in the cluster-related literature resulted from the unconstrained search in the two selected databases using the keywords cluster* and industry* (thus considering these words' derivations, such as clustering, clusterized, industrial, etc.), in addition to some of their close-to-synonymous concepts, namely agglomeration, external economies, spatial concentrations, and industrial districts

Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit databases (EBSCO). Numbers of all articles = 1 959 022; numbers of 'clusters' = 2940

which it has developed (GORDON and MCCANN, 2000; MARTIN and SUNLEY, 2003). Table 1 puts forward some cluster definitions, grouped according to the relevance given to specific dimensions: spatial proximity, and knowledge and networks. An enquiry into the network elements involved in clusters contributes to a more exact, dynamic, and complex definition of the latter (ALMODOVAR and TEIXEIRA, 2009).

The analysis of Table 1 is supported by MASKELL's (2001) insights. According to this author, the literature on clusters experienced a shift in emphasis from more descriptive accounts (for example, SWANN and PREVEZER, 1996), stressing benefits from agglomeration economies rooted in the Marshallian tradition,[6] to a more dynamic and systemic approach (for example, MASKELL and LORENZEN, 2004; and DAHL and PEDERSEN, 2003), highlighting knowledge, learning, adaptation, and innovation as critical mechanisms.

In an effort to synthesize the wide variety of cluster concepts, the present authors put forward three of its most relevant elements. The first has to do with *geographical proximity* among the cluster's components (DOERINGER and TERKLA, 1995; SWANN and PREVEZER, 1996; COMMISSION OF THE EUROPEAN COMMUNITIES, 2008), which generates agglomeration economies (scale and scope economies) through internal specialization and the division of labour. The other element is related to *social networks* (ROELANDT and DEN HERTOG, 1999; ROSENFELD, 2005), which involve the web of connections within the cluster, leading to the formation of various types of proximities (sharing of common technologies, labour, and infrastructures), and to the transmission of knowledge and collective learning (ASHEIM, 1996). The third element

Table 1. *The diversity of definitions of 'cluster'*

	Cluster definition	Reference
Spatial proximity elements	Groups of firms within one industry based in one geographical area	SWANN and PREVEZER (1996, p. 1139)
	Cluster and agglomeration will be judged to be synonymous since they both define geographical areas where an industry (or industries) is concentrated to produce localized economic advantages	OAKEY *et al.* (2001, p. 401)
	Spatial and sectoral concentration of firms	BRESNAHAN *et al.* (2001, p. 836)
	Referred to as 'locational economies' and embraces those economies that arise from geographical agglomeration of related economic activities. The territorial configuration most likely to enhance the learning process	MASKELL (2001, p. 922)
	Concentration of related activities in a particular area	VAN KLINK and DE LANGEN (2001, p. 450)
	Industrial districts as examples of advantage – generating 'super-firm' groups inside industries, within each member, and within each member firm simultaneously shares and differentiates sources of competitive advantage	TALLMAN *et al.* (2004, p. 259)
Knowledge and network elements	Inter-industry level, underlying networks of interrelated cooperating businesses	DEBRESSON (1996, p. 161)
	Strong collection of related companies located in a small geographical area, sometimes centred on a strong part of a country's science base	BAPTISTA and SWANN (1998, p. 525)
	Geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions in a particular field, linked by communities and complementarities	PORTER (1998, p. 199)
	Networks of production of strongly interdependent firms (including specialized suppliers), knowledge-producing agents (universities, research institutes), bridging institutions (brokers, consultants), and consumers related to each other in a value-adding production chain	HERTOG and MALTHA (1999, p. 193)
	Localized sectoral agglomerations of symbiotic organizations that can achieve superior business performance because of their club-like interaction	STEINLE and SCHIELE (2002, p. 850)
	Homogenous knowledge communities	DAHL and PEDERSEN (2003, p. 7)
	Specific spatial configuration of the economy suitable for the creation, transfer, and usage of knowledge	MASKELL and LORENZEN (2004, p. 991)
	Non-random geographical agglomerations of firms with similar or closely complementary capabilities	MASKELL and KEBIR (2005, p. 1)
	Group of firms, related economic actors, and institutions that are located near each other and have reached a sufficient scale to develop specialized expertise, services resources, suppliers and skills	COMMISSION OF THE EUROPEAN COMMUNITIES (2008, p. 5)

Source: Partially adapted from ALMODOVAR and TEIXEIRA (2009).

concerns *culture* (institutions, common values and beliefs) and *business climate* (such as trust, informal ties, and cooperation), that enables the development of new ventures and, thus, the evolution of the cluster itself (SAXENIAN, 1994; MASKELL, 2001; ROSENFELD, 2005). More recently, the cluster concept has been interpreted in light of systemic and evolutionary perspectives (for example, 'innovation systems' and 'institutional' approaches). These approaches attempt to explain cluster dynamics within broader networks of agents ('regional innovation systems') or based on the technological paths of regions and their historical trajectories (institutions or cultures).

Summing up, a cluster might be defined as a:

> group of firms, related economic actors, and institutions that are located near each other and have reached a sufficient scale to develop specialized expertise, services resources, suppliers and skills.
>
> (COMMISSION OF THE EUROPEAN COMMUNITIES, 2008, p. 5)

Spatial proximity, interrelatedness of capabilities/activities, interaction between agents, and institutional endowment are, therefore, key elements of clusters.

Organizing the literature on clusters

As mentioned above, several related and close-to-synonymous concepts, such as agglomeration economies, industrial districts, 'milieux', growth poles, and local production systems, and the corresponding keywords (for example, agglomeration, concentration, proximity, localization economies, and local accumulation of knowledge and knowledge spillovers) are used in economic research to express, using different 'labels', the same notion (that is, cluster; cf. Table A1 in the Appendix).

For the purposes of this study, only theoretical and empirical studies developed according to the framework of industrial cluster analysis were considered, disregarding all other possible uses of the terms. More precisely, the studies selected were those that included cluster and industry (with their derivations, clustering, clusterized, industrial, etc.) or some of their close-to-synonymous concepts, namely agglomeration, external economies, spatial concentrations, and industrial districts. Studies focusing (only) on 'statistical cluster' analyses were disregarded.

In order to broaden the literature survey and provide additional insight on the main trends of research, two major bibliometric exercises were developed.

The first, which is detailed in this section, consisted in performing citation analysis, taking *Regional Studies* as the 'seed journal'.[7] More precisely, a comprehensive analysis was conducted of the references cited in all articles published in this journal, from its first issue (volume **1**, 1967) to volume **40**(8) (2008). The total number of papers analysed was 1780, and from the list of references obtained (which totalled 52 109) the number of citations for both articles and authors were calculated.[8] It is important to highlight that both cluster and the non-related literature are taken into account in this analysis. This fact, however, does not hinder (quite the contrary) the main goal: to map/organize the literature on regional research.

Among the most cited studies (Table 2) and authors (see Table A2 in the Appendix), a high diversity of different contributions were found, with a relative predominance (in terms of citations to both authors ['circles'] and studies ['stars'], cf. Fig. 2) of the literature related with labour and (un)employment issues (for example, MASSEY, 1984; and STORPER and SCOTT, 1989); entrepreneurship and innovation (KEEBLE, 1976; STOREY, 1982; OAKEY, 1985; HARRIS, 1988; MALECKI, 1991; AUDRETSCH, 2006); New Economic Geography (KRUGMAN, 1991; KRUGMAN and VENABLES, 1996; FUJITA and THISSE, 1996, 2002); (global) networks (GRANOVETTER, 1973, 1985; DICKEN, 1976, 1998, 2007; CAMAGNI, 1991b, 1995; AMIN and THRIFT, 1992; SAXENIAN, 1994); policy-strategy-oriented lines of research (PORTER, 1985, 1990, 1998; MARKUSEN, 1996, 2003); and institutional and evolutionary approaches linked to innovation systems (HALL, 1986; STORPER and WALKER, 1989; LUNDVALL, 1992; COOKE *et al.*, 1997, 1998; MORGAN, 1997; COOKE and MORGAN, 1998; COOKE, 2001; HALL and SOSKICE, 2001).

The majority of the most cited studies (Table 2; 'stars' in Fig. 2) involve an appreciative (MARSHALL, 1890; PORTER, 1990; COOKE and MORGAN, 1998) or appreciative/empirical (PIORE and SABEL, 1984; SCOTT, 1988; STORPER and SCOTT, 1989; CAMAGNI, 1991b; SAXENIAN, 1994) type of research, much in line with regional *studies* approaches, which reflect 'scientific knowledge [that] is shaped by its local context ...' (BARNES, 2003, p. 4). Notwithstanding, formal research, namely studies associated with regional methods (ISARD, 1956, 1960; HIRSCHMANN, 1958), and more recently the New Economic Geography literature (KRUGMAN, 1991; FUJITA *et al.*, 2000; FUJITA and KRUGMAN, 2004), which lies at the heart of regional *science* approaches, also emerge with notable importance.

Having its roots in a diversity of theoretical contributions (as indicated by the arrows in Fig. 2), the current corpus of the regional literature comprises a wider range of research themes (see the period 1990–2000s in Fig. 2). These include 'evolutionary approaches' (BOSCHMA and FRENKEN, 2006); 'agglomeration economies' (namely, the 'New Economic Geography' models of location) (KRUGMAN, 1991; FUJITA and THISSE, 1996, 2002); 'knowledge-based theories' (JAFFE *et al.*, 1993; MORGAN, 1997; FELDMAN, 2000); 'regional innovation systems' (COOKE *et al.*, 1997, 1998); 'industrial and regional policies' (MARKUSEN, 1996; PORTER, 1998); 'global networks and multinationals' (AMIN and THRIFT, 1992; YOUNG *et al.*, 1994; YOUNG, 2004; DICKEN, 2007); 'social networks'

Table 2. The most cited studies in regional research (ordered by number of citations)

Date of publication	Author(s)	Title	Number of citations	Key supporting Fig. 2
1985	PORTER M.	*Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press, New York, NY	90	
1984	PIORE M. and SABEL C.	*The Second Industrial Divide*. Basic Books, New York, NY	65	★
1993	KRUGMAN P.	*Geography and Trade*. MIT Press, Cambridge, MA	63	
1890	MARSHALL A.	*Principles of Economics*, Book IV. Macmillan, London	56	[50; . . .[citations
1958	HIRSCHMANN A.	*The Strategy of Economic Development*. Yale University Press, New Haven, CT	48	
1994	SAXENIAN A.	*Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Harvard University Press, Cambridge, MA	47	
1991a	CAMAGNI R.	*Innovation Networks: Spatial Perspectives*. Belhaven, London	46	
1996	AUDRETSCH D. and FELDMAN M.	R&D spillovers and the geography of innovation and production, *American Economic Review* **86**, 630–640	41	★
1982	FOTHERGILL S. and GUDGIN G.	*Unequal Growth: Urban and Regional Employment Change in the UK*. Heinemann, London	41	
1991	KRUGMAN P.	Increasing returns and economic geography, *Journal of Political Economy* **99**, 413–499	40	
1995	STORPER M.	The resurgence of regional economies 10 years later, *European Urban and Regional Studies* **2**, 191–221	40	[40; 50[citations
1993	GRABHER G.	*The Embedded Firm. On the Socioeconomics of Interfirm Relations*. Routledge, London	39	
1984	MASSEY D.	*Spatial Divisions of Labour, Social Structures and the Structure of Production*. Macmillan, London	39	
1997	STORPER M.	*The Regional World: Territorial Development in a Global Economy*. Guilford, New York, NY	39	
1957	MYRDAL G.	*Economic Theory and Under-developed Regions*. Duckworth, London	38	
2000	FUJITA M., KRUGMAN P. and VENABLES A.	*The Spatial Economy: Cities, Regions and International Trade*. MIT Press, Cambridge, MA	34	★
1976	KEEBLE D.	*Industrial Location and Planning in the United Kingdom*. Methuen, London	33	
1966	VERNON R.	International investment and international trade in the product cycle, *Quarterly Journal of Economics* **80**, 190–207	33	
1975	FIRN J.	External control and regional development: the case of Scotland, *Environment and Planning A* **7**, 393–414	32	
1982	NELSON R. and WINTER S.	*An Evolutionary Theory of Economic Change*. Harvard University Press, London.	32	
1985	GRANOVETTER M.	Economic action and social structure: the problem of embeddedness, *American Journal of Sociology* **91**, 481–510	30	
1982	STOREY D.	*Entrepreneurship and the New Firm*. Croom Helm, London	30	[30; 40[citations
1998	COOKE P. and MORGAN K.	*The Associational Economy – Firms, Regions, and Innovation*. Oxford University Press, New York, NY	29	
1982	BRUSCO S.	The Emilian model: productive decentralization and social integration, *Cambridge Journal of Economics* **6**, 167–184	27	
1993	JAFFE A., TRAJTENBERG M. and HENDERSON R.	Geographic localization of knowledge spillovers as evidenced by patent citations, *Quarterly Journal of Economics* **108**, 577–598	27	
1994	AMIN A. and THRIFT N.	*Globalisation, Institutions and Regional Development in Europe*. Oxford University Press, Oxford	26	★
1942	SCHUMPETER J.	*Capitalism, Socialism and Democracy*. Harper, New York, NY, 1975 Edn	26	
1988	SCOTT A.	*New Industrial Spaces: Flexible Production Organization and Regional Development in North America and Western Europe*. Pion, London	26	
1960	ISARD W.	*Methods of Regional Analysis*. MIT Press, Cambridge, MA	25	
1997	MORGAN K.	The learning regions: institutions, innovation and regional renewal, *Regional Studies* **31**, 491–503	25	
1992	LUNDVALL B.-Å.	*National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. Francis Pinter, London.	25	[25; 30[citations

Note: The database includes 18 030 different (first) authors of 37 531 different articles/books cited in 1780 articles gathered from all the issues of *Regional Studies* from volume **1** (1967) to volume **40**(8) (2008). In total, they account for 52 109 citations. The bulk (slightly over 60%) of (first) authors only has one citation. Only 1.2% (192) of (first) authors have thirty or more citations. The top thirty-one studies, by number of citations, have twenty-five or more citations.

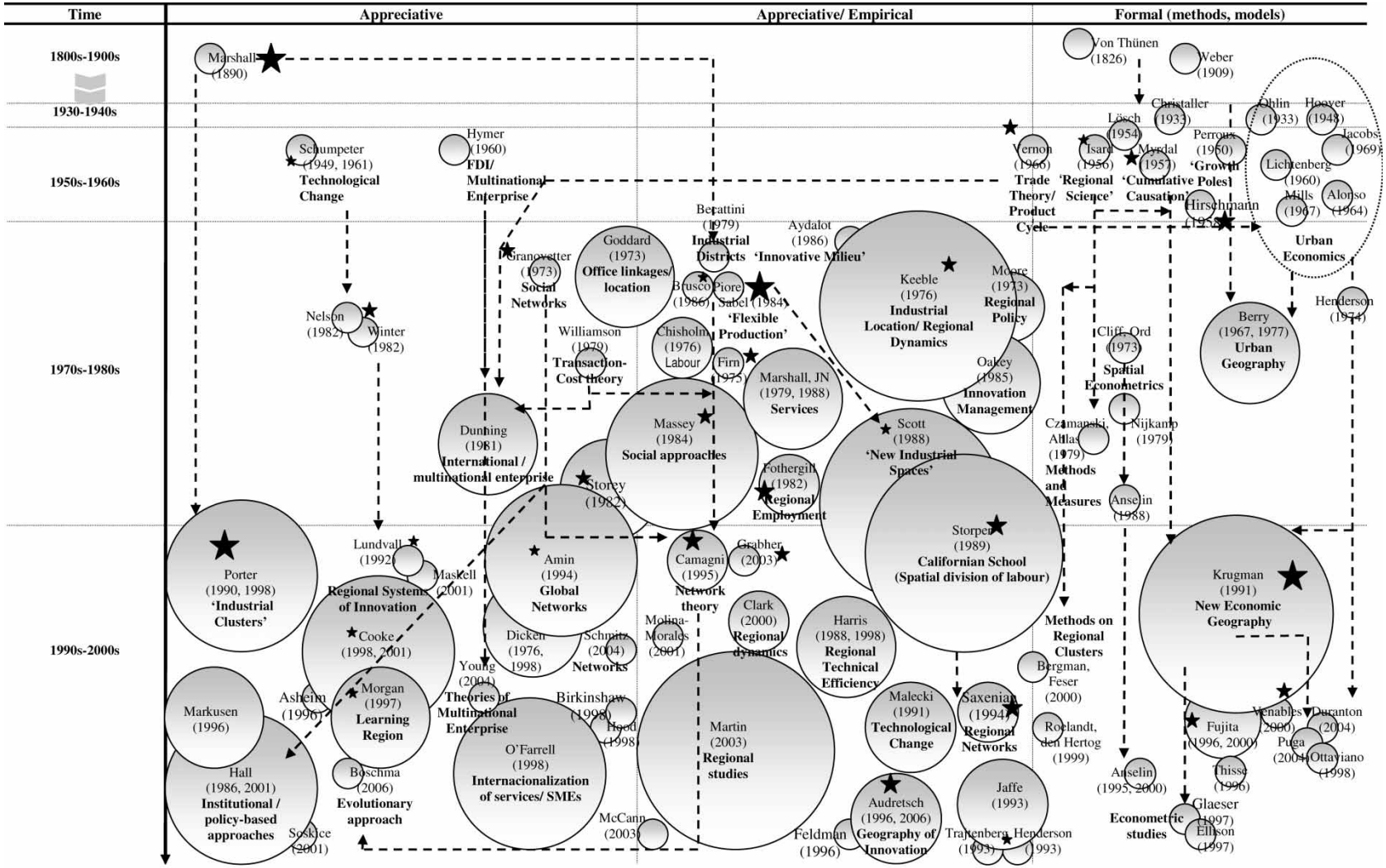

Fig. 2. *Mapping the literature in the Regional field*

Note: Circles where the authors are inscribed vary in size according to the number of citations (see Table A2 in the Appendix) in the 'Industrial Cluster' literature. Arrows indicate linkages between the authors' perspectives/theories

Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit databases (EBSCO) (information gathered in December 2008)

(Saxenian, 1994; Camagni, 1991b, 1995); 'institutional' approaches (Amin and Thrift, 1994); and 'statistical methods and measures' (Bergman and Feser, 2000) of regional and cluster analysis.

The origins of the regional literature can be traced back to the Marshallian seminal contributions on industrial districts and agglomeration economies (Marshall, 1890). Classic theories of location (mainly, the German school of 'location theory') (for example, Von Thünen, 1826/1966; Weber, 1909; Christaller, 1933/1966; and Lösch, 1954) were influential in this literature since its early beginnings. These seminal contributions provided the basis for the emergence of two divergent branches of 'spatial economics': 'economic geography' (a more 'empirically led and eclectic' field) and 'regional science' (based on formal methods of regional analysis) founded by Isard (1956, 1960) and his followers during the 1950s (Martin, 1999; Scott, 2000). From their origins, 'spatial analysis' and 'regional science' were likely to be combined to provide a 'hybrid' field built on the German location theory, on original contemporary works (for example, Perroux, 1950), and on 'input–output analysis and linear programming' techniques (for example, Isard, 1960; Moses, 1958; and Scott, 2000).

Later, during the 1960s, a slight shift in the assumption of 'atomized society' (often employed by regional science) has taken place, with the notion of 'behaviour' (Gould, 1963) underlying spatial reasoning (for example, imperfect information, the 'ability to use information', and cognitive processes of 'learning' and 'perception') in the face of uncertainty in economic geography (Scott, 2000, p. 488).

Regional science and spatial analysis have influenced the evolution of specific research themes in the cluster and regional literature, as is the case of 'methods and measures of regional analysis' (for example, Czamanski and Ablas, 1979; Anselin, 1988; and Ellison and Glaeser, 1997), which has sustained a prolific body of work for the constant improvement of statistical methods and techniques in regional analysis (for example, methods based on Geographic Information Systems [GIS] and recent techniques of spatial econometrics). Although not getting many citations, the work of Czamanski and Ablas (1979) was of particular relevance as it significantly contributed to the methodological identification of industrial groupings as 'clusters' or as 'industrial complexes'.

The legacy of regional science has also served as the basis for the emergence of the 'New Economic Geography' models of location and agglomeration economies (Krugman, 1991; Fujita and Thisse, 1996; Krugman and Venables, 1996; Ottaviano and Puga, 1998), which explains the resurgent interest of mainstream economists in spatial analysis through the development of a new generation of spatial agglomeration models.

During the 1970s and particularly the 1980s, transformations in the theoretical backgrounds of economic geography, namely the 'cultural turn' (for example, Massey, 1984), complemented with inputs from the social, sociological, and political sciences (for example, Becattini, 1979; Brusco, 1982; Aydalot, 1986; and Storper and Walker, 1989), had also contributed to a diversity of perspectives and schools of thought that are currently present in the regional literature in general and in the cluster literature in particular. An example is the apparent (based on the citation count) growing importance of research themes such as 'social and sociological approaches' (Scott, 1988) and 'network theories' (Aydalot and Keeble, 1988). In this context of 'cultural turn', along with a changing international order and a globalizing context, the 'flexible production system' (Piore and Sabel, 1984) emerged as a new paradigm in regional studies (Scott, 1988). The 'flexible production system' called to memory the Marshallian principles and brought about a renewed version of his 'industrial districts' (Paniccia, 2002). 'Industrial districts' were, in fact, a thriving phenomenon throughout the Western world. They were particularly dynamic in Italy (such as the case of the Third Italy), in France (for example, the Scientific City of the Southern Paris region), and in the United States (for example, the Silicon Valley complex). Three main schools and theoretical approaches emerged in the 1970s and 1980s: the Italian School, focusing on 'industrial districts' (Becattini, 1979, 1990; Piore and Sabel, 1984); the Groupe de Recherche Européen sur les Milieux Innovateurs (GREMI) approach, with the notion of 'innovative milieu' (Aydalot, 1986; Aydalot and Keeble, 1988; Camagni, 1995); and finally the Californian School (Storper and Scott, 1989) with the concept of 'new industrial spaces' (Scott, 1988). One interesting fact was that all these schools or approaches had in common both the geographical (based on 'proximity') and the sociological (based on 'social networks') perspectives of clusters (Martin and Sunley, 2003). In contrast with the approaches from the 1950s and 1960s, the research in this period placed particular emphasis on the 'social and relational element' found in industrial locations. Perspectives on location became more socio-relational and contextually driven, often based on sociological approaches (for example, Brusco, 1982), with a specific focus on social networks and the nature of interactions (Granovetter, 1985). Here, the analysis of empirical case studies achieved particular relevance in leading to the consideration of 'geography' as a real phenomenon where interactions and social processes take place (Boschma and Frenken, 2006).

The 1990s and 2000s witnessed the extraordinary importance (measured by the number of citations of both authors and studies) of research related to regions and clusters (Porter, 1990, 1998; Markusen,

1996), along with the 'New Economic Geography' framework (KRUGMAN, 1991). Indeed, in this period new approaches to regions emerged that attempt to consider not only that institutions (AMIN, 1999) and (locally embedded) cultures are determining factors of location, but also that historical paths and technological trajectories play a key role in the evolution of regions (for example, AUDRETSCH and FELDMAN, 1995, 1996; ASHEIM, 1996; and BOSCHMA and LAMBOOY, 1999).

Recent trends in the cluster literature (as is further detailed in the third section) indicate the development of research fields such as 'knowledge-based theories' (for example, ASHEIM, 1996; MORGAN, 1997; MALMBERG and MASKELL, 2002; and BATHELT *et al.*, 2004); 'social networks' (SAXENIAN, 1994); and 'institutional' and 'regional development' approaches (MARKUSEN, 1996, 2003; PORTER, 1998; AMIN, 1999). Here, the role of learning processes and knowledge spillovers is particularly highlighted, as is the importance of social networks and firms' interactions in the diffusion of information and the production of innovations that lead to the clusters' growth and regional development. The 'innovation systems' and 'systemic' approaches (LUNDVALL, 1992; COOKE *et al.*, 1997, 1998) have also been developed, considering clusters as elements of broader networks, such as 'regional innovation systems'. These approaches emphasize the role of interactions among the diverse elements of innovation systems (universities, government, associations, and organizations) as determining factors of innovation processes. They also highlight the systemic and institutional character of the innovative processes. Particularly appreciative in nature (Fig. 2), this 'regional studies' type of literature (BARNES, 2003) considers that locally rooted factors, such as tacit knowledge, institutions, and cultures, are influential in the firms' location, and also take into account that historical and technological paths play a key role in the evolution of clusters (BOSCHMA and FRENKEN, 2006).

Another important branch of literature, increasingly linked to local clusters, has stemmed from research on 'global networks' and 'multinational theories' (for example, DUNNING, 1981). Here, 'multinational enterprise theories' are developed based on transaction costs (WILLIAMSON, 1979) and internalization approaches (HYMER, 1960; VERNON, 1966), embracing a diversity of aspects, such as location choices of foreign direct investment, the role of global chains and supplier networks for the internationalization of firms, linkages between foreign affiliates and domestic firms, face-to-face contacts in transnational companies, etc. This broad corpus of literature, having its roots in the seminal work of HYMER (1960), has been the basis for relevant contributions either on institutional (AMIN, 1999) or on global network approaches (AMIN and THRIFT, 1992, 1994; BIRKINSHAW and HOOD, 1998, 2000).

Based on the bibliometric exercise pursued above, sustained by the analysis of the 'qualitative' survey studies, an organization of the cluster literature into nine main themes is proposed, as detailed in the next section.

A QUANTITATIVE ANALYSIS OF THE EVOLUTION OF CLUSTER LITERATURE IN THE LAST FORTY YEARS

Methodological considerations

The analysis detailed in this section is based on the second bibliometric exercise, which presents a complementary portrayal to the citation analysis performed in the previous section, providing important clues on the more recent trends in the cluster literature. In this case, the scrutiny is based on the analysis of the abstracts from *all* articles published on cluster topics in *all* journals indexed in the EconLit and Business Source Complete (databases accessed through the EBSCOhost®) from January 1962 to May 2007. The database was constructed by searching in the two selected databases. The search procedure was unrestricted and encompassing in the sense that the engine searched not only by subject/keyword, but also by title, abstract, and main text of the articles. It is important to underline that bibliometric exercises always bear a limitation with regard to the chosen keyword(s)'s inability to embrace the entire reality under analysis – in the present case, 'cluster' papers. In order to be as all-inclusive as possible, besides using keywords 'cluster*' and 'industry*',[9] some of their close-to-synonymous concepts were added (cf. Table A1 in the Appendix), namely 'agglomeration', 'external economies', 'spatial concentrations', and 'industrial districts'.

The total number of analysed records was 4943, where texts corresponding to comments, rejoinders, corrigenda or addressing different meanings of clusters (for example, statistical cluster analyses) were eliminated from the categorization. In the end, 2940 records remained (almost 60% of the total gathered from the databases). The records collected were then exported and processed in the Excel® program. The statistical analysis was performed using the SPSS® software.

Publications on 'clusters' were analysed and categorized in terms of nine main topics, which were selected on the basis of the bibliometric citation work and the 'qualitative' literature review undertaken. The categorization of publications in terms of research topics was made possible through the analysis and interpretation of each article's specific abstract. All the articles were classified in terms of nine main topics plus the category 'Others':[10]

- *Genealogical and evolutionary approaches to clusters*: predominantly related to factors underlying the formation and development of clusters.[11]

- *Agglomeration economies*: refers to the economic benefits that co-located firms may accrue from being spatially agglomerated.[12]
- *Knowledge-based theories, localized learning and knowledge spillovers*: highlight the role of learning processes and, particularly, of tacit knowledge (embodied in the socio-institutional structure of the region) in the development and sustainability of localized clusters.[13]
- *Systemic analysis or regional and national innovation systems*: relate the local dimension of clusters to more inclusive levels of governance and institutional contexts.[14]
- *Industrial policy and regional development policies*: related to the (in)efficiency of public policies in the definition of policies to promote the creation of new clusters.[15]
- *Internationalization, global networks, multinationals and local clusters*: related with the debate on the impact of foreign direct investment and multinational corporations on the development of local clusters.[16]
- *Networks and social approaches to clusters*: primarily grounded in the appreciative and empirical analysis of 'cluster case studies', it is related with the role of social capital, organizational networks and 'untraded interdependencies' in the cluster development.[17]
- *Institutional approaches to clusters*: particularly centred on 'institutions' (that is, practices, routines, values, and customs), and local governance (agents' coordination and regional cultures).
- *Methods and measures*: encompasses all the statistical methods and technical tools that have been developed to provide more objective ways to identify, classify, and explain clustering processes.
- *Others*: mostly related to financial (for example, mergers, acquisitions, risk analysis, and stock markets) and ecological (for example, energy saving and environmental risks) approaches to clusters.

The classification according to type of article (that is, survey, empirical, empirical and appreciative, appreciative, formal and empirical, and formal) follows the distinction proposed by NELSON and WINTER (1982) in terms of 'formal' and 'appreciative' theorizing. In an attempt to clarify the difference between theoretical arguments that follow a mathematical logic and those that do not imply any modelization, these authors suggest that 'formal' includes 'logically structured theorizing', whereas 'appreciative' covers a 'more intuitive' form, based on 'judgments and common sense' (NELSON and WINTER, 1982, p. 9). Therefore, in the present work, the articles classified as '*appreciative*' included critiques, judgements, appreciations, appraisals or theoretical arguments. Likewise, the articles characterized as '*formal*' contained mathematical models or were based on an analytical or logical framework. If these formal articles also included the testing of data in the models used, they were classified as '*formal and empirical*'. If the article was only (or substantially)[18] concerned with the econometric or statistical testing of data, it was classified as '*empirical*'. When the article contained appreciations or comments on empirical data analysis, it was classified as '*appreciative and empirical*'. Finally, the '*survey*'-type of articles included studies that involve the documentation of a comprehensive review of the published and unpublished work from secondary source data in the areas of specific interest to the researcher.

After having classified the articles, the authors then proceeded to the construction and statistical analysis of the database, aimed at obtaining a dynamic perspective of how the topics and types evolved in the period under analysis (1962–2007).

The authors also assessed the relation between the 2940 articles' themes and types and the 'quality' of the journals in which they were published. Evaluating 'scientific quality' is a notoriously difficult problem which has no standard solution. The impact factor is a bibliometric tool used to estimate the importance of scientific journals (MOED, 2005). It is calculated and published annually for journals indexed by the Institute for Scientific Information (ISI)[19] and is a reflection of the average number of citations that each journal receives during a certain period of time. Operating under the premise that 'the greater the impact factor, the greater the quality of a journal', it has been subject of numerous controversies (CAMPBELL, 2008), especially due to certain biases around its calculation (for details, see ZARATE and CERDA, 2007). Nevertheless, the ISI impact factor has several advantages, namely its quasi-qualitative nature (BORDONS *et al.*, 2002) and its great accessibility, since it is directly provided by ISI for the most international and renowned journals. Additionally, and more importantly for the purposes of the present analysis, *within each discipline* it can be safely assumed, according to the arguments of some authors (for example, BORDONS *et al.*, 2002; and MOED, 2005), that the highest impact factor journals are the most prestigious ones and show the highest diffusion.

Thus, departing from the *Journal Citation Report*® of 2007 in Social Science, the list of journals and the corresponding impact factors in a multitude of areas were obtained[20] in order to be able to classify the 'quality' of the 677 distinct journals that were included in the database. By (partially) applying the classification system of the Tinbergen Institute,[21] a ranking of the academic journals that publish cluster literature was computed. The Tinbergen Institute has drawn up a classification of journals in the field of economics. In this ranking, journals are classified as follows:

- AA: generally accepted top-level journals.
- A: very good journals covering economics in general and the top journals in each field.
- B: good journals for all research fields.

This classification is roughly based on the following cut-offs (according to the impact factor): AA, greater than

3.0; A, greater than 1.5; and B, greater than 0.3. Three other categories were added by the authors: C, greater than 0.1; D, an impact factor lower than 0.1; and NC, journals that are not ranked (in the 2007 *Journal Citation Report*).[22]

Results for the period 1962–2007

Papers published by main themes. Firms in clusters tend to benefit from scale and scope economies similar to those enjoyed by large companies (PYKE and SENGENBERGER, 1992), and such economies can be largely exploited in global markets. This argument might explain, at least in part, why the topic 'Internationalization, global networks, multinationals and local clusters' observed such a pronounced rise in importance within the cluster literature in recent years – from a meagre percentage (less than 2%), it reached 11% in the period 2005–2007 (Fig. 3).[23] In this theme there is a considerable range of publications that analyse the location and concentration of foreign direct investment in specific regions, and stress the impact of information and communication technology on the diffusion of knowledge, as well as the effect of

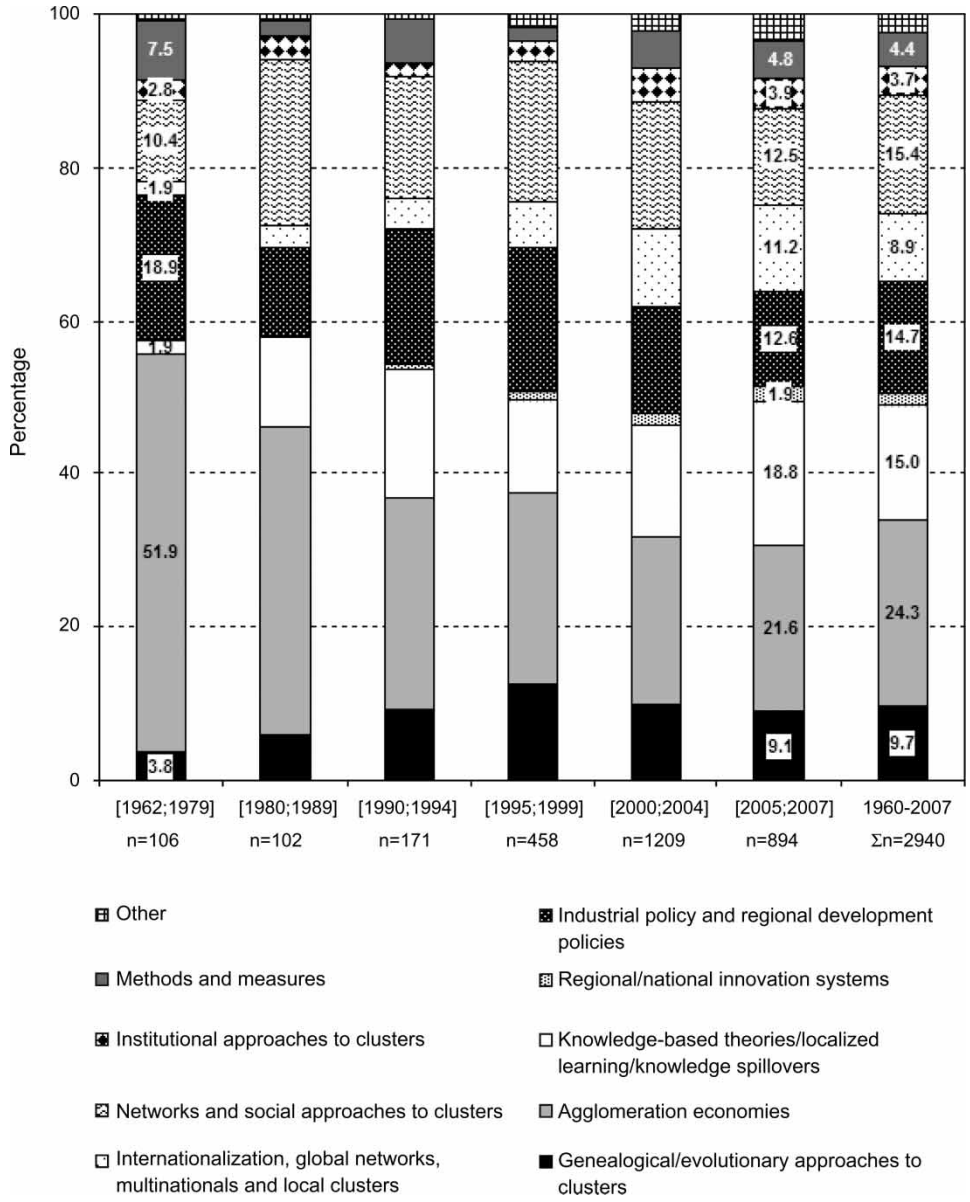

Fig. 3. Total published papers (2940 records) on 'clusters', by topic, 1962–2007

Note: Given the small number (*n*) of papers in the initial periods (1960–1970s), the authors opted to consider ten-year periods for the 1960s and the 1970s and then five-year periods afterwards. The last period, 2005–2007, encompasses only three years as the analysis ends in 2007

Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit databases (EBSCO)

multinational companies on local clusters, and firms' internationalization due to the integration of clusters in global value chains.

Although 'Agglomeration economies' is by far the theme that covers the largest amount (715 articles, almost one-quarter of the total) of the papers published on 'clusters' in the period under analysis (1962–2007), it has suffered a substantial decrease, from 52% in the 1960s and 1970s to 22% in the most recent period (2005–2007).[24]

Also revealing an overall decreasing trend is the 'Industrial policy and regional development policies' topic. More precisely, this trend was in fact quite irregular, reaching its highest peak in the period 1995–1999, which is to a large extent explained by the contribution and influence of PORTER's (1990, 1998) works. Since then, however, it lost ground in favour of the 'Knowledge-based theories' and 'Internationalization, global network' research topics.

In striking contrast to the topic 'Agglomeration economies' stands 'Knowledge-based theories'. Indeed, the rise of 'Knowledge-based theories' – from less than 2% in the initial period (1962–1979) to almost 20% in the final period (2005–2007) – is the driving force behind the recent boom in the cluster literature, as previously noted in the second section. This corpus of theories emphasizes the role of tacit knowledge, local knowledge spillovers, and processes of innovation in the explanation of local cluster dynamics (most of which are concerned with high-technology clusters and the concept of 'innovative milieu'). Worthy of note is that 'Networks and social approaches to clusters' and 'Knowledge-based theories' appear, to some extent, related with each other in the literature (Fig. 2). This is because local networks and organizational cultures play a crucial role in the diffusion of knowledge, especially in the case of tacit and localized learning processes (SAXENIAN, 1994; AUDRETSCH and FELDMAN, 1996), as well as in the production of innovations (BRESCHI and MALERBA, 2001). Thus, local proximity often appears associated to theoretical and empirical work on knowledge-based approaches (namely, those focusing on knowledge spillovers and innovation processes). Taken together, these two topics account for one-third of all papers published on clusters between 1962 and 2007.

'Regional and national innovation systems' as well as 'Institutional approaches' (mostly concerned with local cultures, institutional embeddedness, governance, and traditions and customs) are relatively residual topics in the cluster literature. This seems to be at odds with the importance or contribution that this stream of literature revealed in the bibliometric citation exercise, more specifically shown in Fig. 2, Table 2, and Table A2 in the Appendix. What can be concluded from this is that although not prolific areas per se in terms of *articles* published, they constitute important 'building blocks' for other works within the cluster literature. It is important to underline the close association between the topics of 'regional innovation systems', 'institutional approaches' and 'knowledge-based theories' (Fig. 2), which is explained by the fact that the level of governance and institutional background (ISAKSEN, 2001; WOLFE and GERTLER, 2004), as well as interactions among university, industry, and government (the Triple Helix model; ETZKOWITZ, 2003), represent crucial conditions to the development of knowledge-based clusters and to the production of innovations.

The 1970s represented a highly prolific period in terms of the conceptualization of analytical methods (for example, LATHAM, 1976; CZAMANSKI and ABLAS, 1979; and NIJKAMP, 1979) in the identification/spatial analysis of regions, clusters and other type of agglomerations, which explains the highest percentage (7.5%) achieved in terms of published articles, and the corresponding manifest importance of this line of research in terms of citations (Fig. 2). However, the subsequent periods witnessed a decrease in the relative weight of the formal category 'Methods and measures' in favour of more qualitative-led themes of analysis, such as 'Networks and social approaches', and 'Genealogical/evolutionary approaches'. This last theme includes a whole range of studies, most of which are based on 'appreciative' or 'appreciative-empirical' analyses, on the factors underpinning the formation and dynamics of clusters throughout their life cycles (for example, emergence, growth, maturity, decline, and renewal) (for example, AUDRETSCH and FELDMAN, 1995). These tendencies reflect, on the one hand, the legacy of the 'cultural turn' that occurred in economic geography in the 1980s (for example, MASSEY, 1984; and PIORE and SABEL, 1984), giving rise to the development of approaches that consider clusters and regions as socio-relational entities (for example, AYDALOT, 1986; and SCOTT, 1988), as detailed previously in the second section. On the other hand, and if one looks particularly at the period 1995–1999, the category 'Methods and measures' achieved its minimum relative weight (around 2%), whereas the topic 'Genealogical/evolutionary approaches to clusters' reached its maximum (13%).[25] This specific 'turning point' verified in the present sample clearly reveals that the cluster literature became more centred on qualitative approaches, becoming less exclusively focused on formal and quantitative methods.

Summing up, in the period of analysis, the cluster literature became increasingly embedded in regional *studies* and less in regional *science*, to use the terms of BARNES (2003), POLÈSE (2003), and MCCANN (2007).

Papers published by type. Considering the published articles by main type, it was found (Fig. 4) that the most predominant type in the cluster literature is 'appreciative', covering on average 68.5% ('appreciative' and 'appreciative plus empirical') of the total published papers. Exclusively 'formal' analyses that, in the 1970s

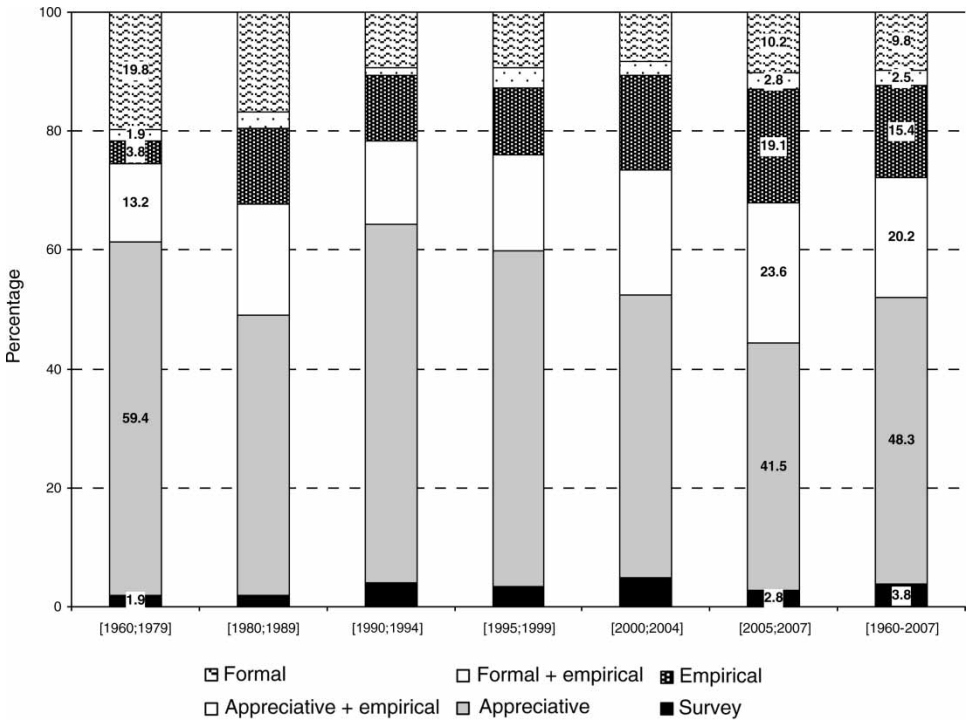

Fig. 4. *Total published papers on clusters by type, 1962–2007*
Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit databases (EBSCO). Numbers of all articles = 2940

and 1980s, covered a relatively important share of published papers (around 20%) saw their relative importance declining from the early 1990s, representing more recently about 10% of the total papers. This clearly reveals the difficulty cluster researchers have had in describing the cluster phenomenon by means of formal modelling or exclusively quantitative analysis. POLÈSE (1999) documents that the 1980s marked the dismissal of large-scale, top-down regional planning models (along with the theoretical and technical apparatus they imply) and their replacement by new approaches based on bottom-up local development, much closer 'real-world' context and phenomena.

The 1990s and especially the current decade (the 2000s) have witnessed a sharp rise in the importance of the empirical literature: the exclusively 'empirical' category experienced a five-fold increase (from 4% in the initial period to 20% in the most recent period), whereas 'appreciative plus empirical' increased almost two-fold (from 13% to 24%).[26] This seems to reveal a growing concern on the part of authors (and editors) publishing the cluster literature to focus on real-world phenomena by testing (increasing) available regional data against 'theory'. As MCCANN (2007) astutely pointed out, to guarantee that 'good' (regional) policies are implemented, it is critical that the design of policies is based on (formal) constructs that lend themselves to empirical evaluation. The evidence depicted in Fig. 4 seems to be in line with McCann's argument, as exclusively 'appreciative' studies suffered a sharp fall in importance, particularly from the 1990s (where it covers over 60% of total papers published) to the most recent period (2005–2007) where it accounts for slightly more than 40%.

Crossing themes and types

Crossing 'themes' and 'types', interesting patterns were found. Taking the overall distribution of papers by type as the 'standard' of comparison, 'agglomeration economies' resorts by far more to formal and empirical methods – 32% (32%) of papers published within the agglomeration topic are formal (empirical) against only 10% (15%) of the overall sample. This predominance of formal and empirical analysis can be explained by the fact that this theme largely involves publications on transport–cost approaches, localization economies, and clustering advantages, mostly described through the use of formal models of location and empirical testing (BOSCHMA and FRENKEN, 2006; MCCANN, 2007). In sheer contrast stand 'Industrial policy and regional development policies' and 'Institutional approaches to clusters'. Indeed, more than 80% of the papers published on these topics are exclusively appreciative, a figure far above the overall average (48%).

When theme and type were crossed the other way around, that is, taking the overall distribution of types by themes as the 'standard' of comparison, it was found that almost 80% of the papers published belonging to the formal category were relatively more concentrated in the 'Agglomeration economies' topic (the corresponding overall weight is 24%). This implies

that formal modelling and mathematical methods are regularly used to explain factors behind industrial location decisions, in terms of agglomeration forces and clustering externalities (such as cost advantages and scale economies). In its turn, this higher incidence of the 'Agglomeration economies' topic in 'formal analysis' is particularly related to the development of cumulative causation theories and transport–costs approaches, that often make use of formal models to explain the theory. The 'New Economic Geography' framework is included in this category (KRUGMAN, 1991). Also, 'empirical' and 'survey' papers are relatively more concentrated in the 'Agglomeration economies' topic – when one considers all the papers (regardless of the type), 'Agglomeration economies' accounts for 24%, whereas when one restricts the papers to the 'empirical' ('survey') category, 'Agglomeration economies' covers 50% (34%). As expected, and based on the survey of the second section, appreciative-type papers are relatively concentrated in the 'Industrial policy and regional development policies' and 'Institutional approaches to clusters' topics with a relative weight of 25% (versus 15%) and 6% (versus 4%), respectively. 'Networks and social approaches to clusters' and 'Knowledge-based theories' follow a similar pattern to 'appreciative plus empirical' papers, having an above-average relative importance in these topics (23% and 20%, respectively, versus the overall corresponding average of 15%). Since the specific goal of these topics is mainly concerned with capturing information on 'intangible' (and not easily quantifiable) factors explaining cluster dynamics or making judgements or appreciations on real case studies, they share a natural tendency to concentrate around inductive methods and qualitative techniques of analysis.

Most prolific authors in terms of papers published

Considering the overall sample of 2940 articles in terms of co-authorship, a similar distribution is found between articles published by one author (52%) and articles produced by more than one author. More specifically, the bulk of the literature on clusters is produced/published by one author or by two authors in co-authorship (2522 articles, which correspond to 86% of the entire sample).

In terms of top authors, by number of (single and joint) papers published, the most prolific researcher on clusters in the period analysed (1962–2007) is Jacques-François Thisse from CORE (Université Catholique de Louvain), with twenty-five papers, followed by Masahisa Fujita, affiliated at Kyoto University, with twenty papers.[27] These two authors are particularly associated with the 'New Economic Geography' line of research, having published joint works together and also with Krugman and Venables (Fujita), and Ottaviano (Thisse). It is interesting to note that six (Thisse, Fujita, Venables, Henderson, Ottaviano, and Duranton) out of the eleven 'top authors' are closely related to the New Economic Geography included in the topic 'Agglomeration economies'. Two of the most cited authors (cf. the second section) appear in this ranking: Allen Scott (University of California – Los Angeles) and Philip Cooke (University of Wales) with, respectively, eighteen and fourteen papers on 'clusters'. The first author's research interests are particularly centred on 'Networks and social approaches to clusters', which are also the research areas of Hubert Schmitz, Xavier Molina-Morales, and Philip McCann. Philip Cooke's publications are more focussed on 'Knowledge-based theories' and 'Regional and national systems'.

In terms of type of papers published, there are more 'formal' authors (Thisse, Fujita, and Venables) and more 'appreciative' authors (Scott, Schmitz, and Cooke). Other authors, such as Henderson and Duranton, published mostly 'empirical' papers, whereas McCann and Molina-Morales published papers that combine appreciative and empirical types of research.

One interesting (although not particularly surprising) finding is that the most prolific authors in the cluster literature tend to publish in the highest-quality journals – on average, almost 75% of the top authors' articles were published in top journals (that is, AA, A, and B), whereas for the entire sample of authors (excluding the top authors), the corresponding figure was 52%. Additionally, restricting the discussion to the top authors, a strong and positive correlation was observed between the 'quality' of the journal in which the author's papers were published and the proportion of 'appreciative' and 'formal plus empirical'-type of articles that the authors published. This seems to indicate that to some extent in the 'cluster' literature, appreciative and testable formal constructs (MCCANN, 2007) are highly valued, at least as far as top authors are concerned. The next section analyses if this is the case for the full sample of authors publishing in cluster research.

'Quality' of the research on clusters

Between 1962 and 2007, slightly more than half (51.9%) of the articles in the 'cluster' literature were published in top journals (that is, AA, A, or B journals).[28] If one restricts top journals to AA and A journals, the figure falls to 16.6%. Although this type of information for the fields of economic geography, regional science, or regional studies as a whole is not available, evidence on the field of evolutionary economics (SILVA and TEIXEIRA, 2009) shows that the percentage of papers published in AA+A journals in this field of research is lower (12.9%) than that of the cluster literature. Considering AA+A+B journals, the percentages associated to the two areas are strikingly similar, 51.9% (clusters) versus 52.5% (evolutionary economics). In this vein, one might consider that research on clusters has been published in relatively high-'quality' journals.

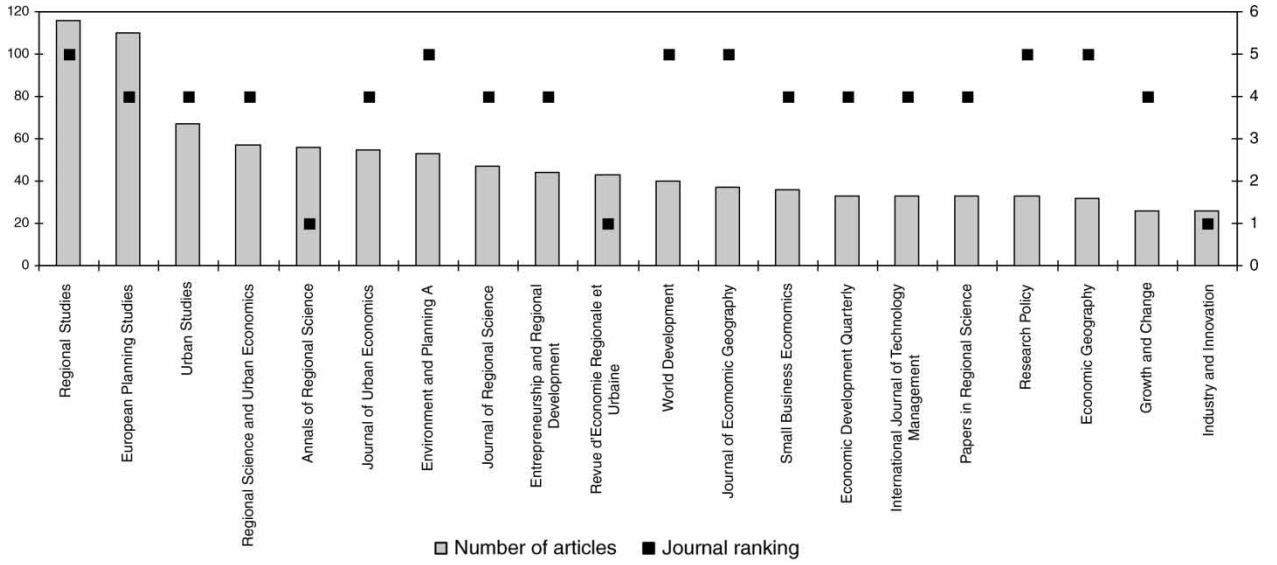

Fig. 5. *Articles on clusters by top-twenty journals, 1962–2007*
Note: Numbers to the left refer to the absolute number of articles published by each journal. Numbers to the right refer to the journal's ranking (considerations about rankings can be found in the methodological notes)
Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit (EBSCO). Numbers of all articles = 2940

The 2940 papers in analysis were published in about 700 distinct journals. However, the thirty journals with higher frequency account for 40% of the total papers (the top twenty journals in Fig. 5 account for one-third of the papers). *Regional Studies* and *European Planning Studies* are journals that cover more papers in cluster research with 116 and 110 papers, respectively. When considering the journals with the highest percentage of published articles on clusters (Fig. 5), it is found that there is a predominance of relatively high-ranking journals – A (six) and B (eleven) – in the top twenty, which again (albeit imperfectly) indicates the good quality of research done in the area.[29]

Among the journals that publish more cluster articles, there are seven non-regional-focused journals (*World Development*, *Small Business Economics*, *Economic Development Quarterly*, *International Journal of Technology Management*, *Research Policy*, *Growth & Change*, and *Industry & Innovation*), which indicates that the interest in cluster issues goes beyond the boundaries of regional *science* and *studies*.

Recent works have found that, in the fields of the economics of structural change (SILVA and TEIXEIRA, 2008) and evolutionary economics (SILVA and TEIXEIRA, 2009), the types and topics of articles mainly employing empirical and formal methodologies, respectively, tend to be published in higher-ranking journals. It is important to assess if that is the case in the field of the cluster literature given the recent lively debate on the need, for some authors, to increase 'formalization' in regional *studies* (MCCANN, 2007) versus the need, according to other authors, for regional *science* to move away from 'its narrowness [and] mathematical abstruseness' (BARNES, 2003, p. 13).

Fig. 6 shows that when one considers the journals in the highest ranking categories (that is, AA and A), 'Networks and social approaches to clusters', 'Institutional approaches to clusters', and 'Methods and measures', present the highest percentages of papers published in these journals: 22.5%, 21.1%, and 20%, respectively. It is found that 'Networks and social approaches to clusters' and 'Institutional approaches to clusters' are indeed over-represented in AA and A journals (the share of these topics in total papers published in AA and A journals is higher than these topics' share when one considers all papers regardless of the type of journal). When one also considers B journals, 'Agglomeration economies' comes to the forefront with 60.8% of the total papers on this topic published in top journals (AA, A or B). 'Networks and social approaches to clusters', with 55.1%, and 'Institutional approaches to clusters', with 53.2%, stand in the subsequent positions. Although the topic 'Agglomeration economies' is over-represented in AA journals (36.8% of papers published in AA journals are from 'Agglomerations economies' against 24.3% of the corresponding overall – all types of journals – average), the shares of this topic in the lowest ranking journals – C (45.1%) and D (46.2%) – are much higher. 'Industrial policy and regional development', and to a lesser extent systemic approaches, 'Regional and National systems', lie at the bottom in this regard with more than half of the papers published in less prestigious outlets.

Based on the above evidence, topics in both regional *science* (that is, 'Agglomeration economies' and 'Methods

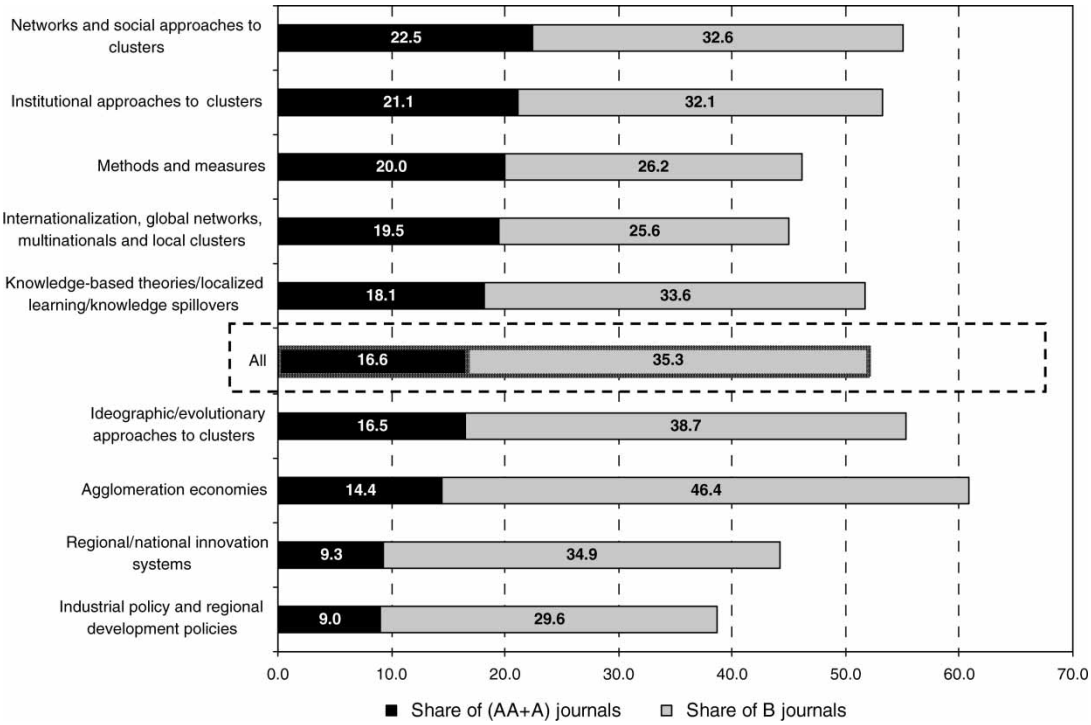

Fig. 6. Share (percentage) of top-ranking (AA, A, and B) journals by main topic, 1962–2007
Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit (EBSCO). Numbers of all articles = 2940

and measures') and regional *studies* (that is, 'Networks and social approaches to clusters' and 'Institutional approaches to clusters') present similar 'quality' (as expressed by the AA + A + B ranking of journals where these papers are published). Nonetheless, topics more connected with regional *studies* appear, within the cluster field, more closely associated with higher-'quality' journals (that is, AA + A journals).

Articles that convey an 'appreciative plus empirical' approach are mostly (20%) published in the highest

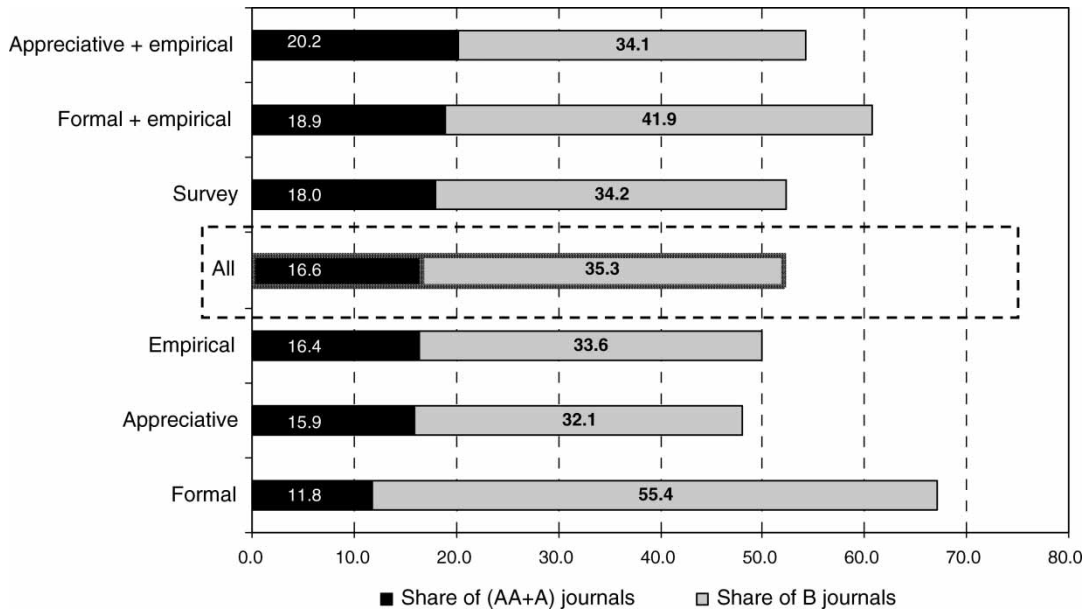

Fig. 7. Articles on clusters by main type and journal ranking, 1962–2007
Source: Authors' computations based on a sample of articles collected from the Business Source Complete and EconLit (EBSCO). Numbers of all articles = 2940

ranking journals (A + AA), followed closely by the 'formal plus empirical' type of articles (with 19%). The corresponding share for 'formal' articles is 'only' 12% (Fig. 7). This picture changes substantially when one adds B journals. In fact, almost 70% of 'formal' articles are published in top-ranking journals (that is, AA + A + B) and the share of 'formal plus empirical' is 60%. Exclusively 'appreciative'-type papers present systematically below-average shares in terms of journal 'quality'.[30]

McCann (2007, p. 1215) points out that in the (recent) literature on clusters and industrial districts there is an acute problem – ill-defined frameworks and constructs – which can only be solved by 'moving way from simply rhetorical devices ... to more formal empirical testing and analysis ...'. Although 'formal' articles are by far those that are published in AA + A + B journals, 'appreciative plus empirical' seem to be more valued in the highest ranking journals (AA + A). Thus, regardless of possible 'internal methodological inconsistencies' (McCann, 2007), when it comes to cluster issues, the regional *studies* literature, which is fundamentally based on appreciative and empirical methods, is, according to this bibliometric exercise, more 'valued' in high-quality (AA + A) journals than the regional *science* literature, which places particular emphasis on formalization (Berliant and ten Raa, 1994).

CONCLUSIONS

The early 1990s and, most particularly, the last few years have witnessed a significant increase in the research on clusters. Besides its importance in academic fields, the role of clusters has also been acknowledged in political spheres (Porter, 1990, 1998; Commission of the European Communities, 2008).

Although to the experts in the regional area this trend comes as no surprise, to the best of our knowledge, no objective evidence had been collected to date on the precise magnitude and dynamics of the cluster literature. Bibliometric tools are particularly useful in this regard. For a given area of scientific research (in this case, clusters), these methods are an essential instrument in depicting an overall picture of the area by assessing the dynamics of its key topics/themes and types/methods of research. Thus, bibliometric surveys allow one, in addition to more qualitative surveys, to capture the recent paths in a given research field and to assess, in an objective manner, the seminal contributions and contributors. In the particular case of the regional and cluster literature, they provide additional evidence that serves to uncover some important elements in the recent debate on the relative strength of regional *science* and regional *studies* approaches.

The present two complementary bibliometric exercises – one based on the analysis of 50 000 citations and the other based on the in-depth interpretation of almost 3000 abstracts of articles published in all (700) journals indexed in EconLit and Business Source, covering the period 1962–2008 – show that the recent boom in the cluster literature has been sustained by the growing number of studies on social and knowledge-based approaches. Indeed, recent trends in the cluster literature indicate the development of topics/themes such as 'knowledge-based theories', 'social networks', 'institutional', and 'regional development' approaches. In these approaches, the role of learning processes and knowledge spillovers is particularly highlighted, as is the importance of social networks and firms' interactions in the diffusion of information and the production of innovations that lead to the clusters' growth and regional development. In these regional *studies*-type of approaches, the 'region' is, according to Barnes (2003, p. 14), favoured over 'science', stressing the view that 'knowledge cannot be brought down from the Heavens, Moses-like, but must be worked modestly at ground level ...'.

Although the bibliometric citation exercise revealed that seminal contributors to the regional literature came from both the areas of regional *science* (for example, Krugman, 1991; Fujita and Thisse, 1996; and Krugman and Venables, 1996) and regional *studies* (for example, Keeble, 1976; Piore and Sabel, 1984; Scott, 1988; and Storper and Scott, 1989), the prominence of regional studies contributors and contributions is apparent. The second bibliometric exercise further corroborates this point. In fact, 'Agglomeration economies', which includes mainly regional *science* contributors and contributions, suffered, between 1962 and 2007, a sharp decline (its share in total papers dropped from 52% to 22%). In contrast, 'Knowledge-based theories' saw its share increase from less than 2% in the initial period (1962–1979) to almost 20% in the final period (2005–2007).

In terms of 'type' of methodologies employed, the evidence indicates that the share of exclusively 'formal' articles halved (from 20% to 10%) and the exclusively 'appreciative' studies also suffered a strong decline (by 20 points). 'Empirical' and 'empirical plus appreciative' types of articles, in contrast, revealed a remarkable increase (from 17% to 43%). This might be explained by the importance that qualitative and inductive techniques have achieved in the cluster literature (Barnes, 2003), particularly in leading topics such as 'Knowledge-based theories' or 'Networks and social approaches to clusters'. Although experiencing a positive trend in the period in analysis, 'formal plus empirical' articles still represent a meagre fraction (2.5%) of total papers published on cluster issues. Following McCann's (2007) remarks, such dynamics in the cluster literature may endanger the goal of guaranteeing that 'good' (regional) policies are implemented. According to this author, it is critical that the design of (regional) policies be based on *formal* constructs

which lend themselves to *empirical* evaluation. More specifically, departing from the view point of regional *studies*, McCann (2007, p. 1215) argues that 'simple rhetorical [appreciative] devices' should be avoided and instead comprehensive and in-depth analyses in regional *studies* should, to some extent, seek to employ the analytical and methodological thoroughness of regional *science* approaches, by making the 'micro foundations of the frameworks' explicit and clearly defined. The failure of regional *studies* approaches in achieving an improved 'internal methodological consistency' will result, according to McCann, in ill-defined policy design and evaluations in this area. McCann urges, therefore, that there be an increased reliance on formalization. Departing from the (alternative) view point of regional *science*, Barnes (2003, p. 14) underlines the need, in the regional scientific area, to move away from 'rationalist, formal and universal explanations, to ones that are relativistic, eclectic, and local ...'. The fixation on mathematical rigour may indeed, according to Partridge (2006), hamper the impact of science on policy by failing to tackle and deal with real-world (social) problems. Although the 'simplicity' of regional *science* models lends itself more easily to policy measurement and evaluation, excessive reliance on the mathematical apparatus runs the risk of rendering spaces/regions 'a-territorial and a-geographic' (Polèse, 1995, p. 315) or more caustically 'the view from everywhere to nowhere' (Barnes, 1998, cited in Barnes, 2003).

Nevertheless, in contrast with Barnes's perspective, Partridge argues that in these matters regional scientists are the ones that 'have it right'. According to this author, whereas 'economics profession continues ... more enamoured by mathematical technique rather than social and policy relevance ...', in regional science a 'workhorse' approach is pursued 'by deriving models and conducting empirical studies that are not only practical, but firmly grounded in broader socioeconomic relevance' (Partridge, 2006, p. 2). These three (McCann, Barnes, and Partridge) apparently distinct perspectives could instead be considered as 'convergent' perspectives: increasing methodological rigour in regional *studies* (quest for regional *studies* approaches to converge to regional *science* approaches) (McCann, 2007); increasing the sensitivity of regional *science* to changing local context and real-word (social) issues (quest for regional *science* approaches to converge to regional *studies* approaches) (Barnes, 2003); and the desirability of producing more a 'formal plus empirical' type of research (a quest for combining regional *science* and regional *studies* approaches) (Partridge, 2006). Even if, according to the bibliometric exercise, exclusively 'formal' and 'appreciative' types are in (sharp) decline, the share of 'formal plus empirical' articles is still too small to sustain Partridge's contention that 'regional scientists have it right'.

The analysis of themes, types, and journal 'quality' complements is in line with the evidence and argument put forward above. Indeed, whereas in economics in general (Silva, 2000; Partridge, 2006), and some particular scientific areas – evolutionary (Silva and Teixeira, 2009) and structural change (Silva and Teixeira, 2008) – there is a clear tendency of top (AA + A) journals to publish more formal research in the cluster literature, in contrast it is 'appreciative plus empirical', followed rather closely by 'formal plus empirical', that present an above-average share of articles published in the top-ranking journals. Thus, the 'formalization turn', which seems to have occurred in the top-ranking journals in economics, did not materialize in top-ranking journals which publish cluster articles. Instead, greater importance is given to hybrid (empirical plus appreciative and empirical plus formal) types of studies. Given, however, the meagre share (less than 3%) of 'empirical plus formal' types of papers, mentioned previously, as compared with 'empirical plus appreciative' (20%), it might be argued that the 'convergence' between regional *studies* and regional *science* approaches is still in the domain of 'wishful thinking'.

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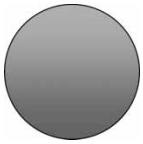
APPENDIX

Table A1. *Keywords associated with related and close-to-synonymous concepts to 'clusters'*

Year	Author(s)/title	+ Geographical						+ Systemic
		Agglomeration		Concentration	Proximity		Knowledge	Cluster
1991	CHESHIRE P. and EVAN A., *Urban and Regional Economics*	Agglomeration						
1995	GREENHUT M. and NORMAN G., *The Economics of Location*	Agglomeration		Spatial concentration	Locational patterns	Locational interdependencies		
2004	CHESHIRE P. and DURANTON G., *Recent Developments in Urban and Regional Economics*			Industrial concentration	Localizational economies			
2005	FUJITA M., *Spatial Economics*	Regional agglomeration	Spatial agglomeration	Concentration in space				Clustering
2005	Henderson J., *New Economic Geography*	Agglomeration	Geographical agglomeration		Locational clusters		Knowledge spillovers	Locational clusters
2007	Jovanovic M., *Economic Integration and Spatial Location of Firms and Industries*		Geographical agglomeration	Concentration of specialized industries	Proximity	Local accumulation of knowledge	Knowledge spillovers	Clusters
			Spatial clustering					Spatial clustering

Source: The International Library of Critical Writings in Economics, An Elgar Reference Collection, Cheltenham, UK (volumes 14, 42, 182, 184, 188, and 212).

Table A2. *The most cited (first) authors in the literature of 'regional studies' (ordered by the number of citations)*

Rank	Author(s)	Number of citations	Legend supporting Fig. 2 (intervals of citations)
1	Keeble D.	325	
2	Scott A. J.	268	
3	Storper M.	243	
4	Krugman P.	229	
5	Martin R.	202	
			[200; . . .[
6	Cooke P.	198	
7	Porter M. E.	194	
8	Massey D.	182	
9	Amin A.	177	
10	O'Farrell P. N.	163	
11	Hall P.	158	[150; 200[
12	Dicken P.	143	
13	Markusen A.	139	
14	Storey D. J.	139	
15	Berry B. J.	125	
16	Dunning J. H.	124	
17	Malecki E. J.	113	
18	Marshall J. N.	110	
19	Goddard J. B.	109	
20	Harris R. I. D.	108	
21	Morgan K.	108	
22	Oakey R.	106	
23	Audretsch D. B.	101	[100; 150[
24	Fothergill S.	99	
25	Saxenian A.	99	
26	Camagni R.	97	
27	Chisholm M.	96	
28	Clark G. L.	96	
29	Johnston R. J.	96	
30	Moore B.	96	≈ 100
	Other authors	< 96	

Note: The database includes 18 030 different (first) authors of 37 531 different articles/books cited in 1780 articles gathered from all the issues of *Regional Studies* from volume **1** (1967) to volume **40**(8) (2008). In total, they account for 52 109 citations. The bulk (slightly over 60%) of (first) authors only have one citation. Only 1.2% (192) (first) authors have thirty or more citations. The top thirty (first) authors, by number of citations, have around one hundred or more citations.

NOTES

1. Since *Regional Studies* is the journal published by the Regional Studies Association, created, according to some authors (for example, BARNES, 2003; and POLÈSE, 2003), as an alternative to the regional approaches followed by the Regional Science Association, it is likely that in some degree this bibliometric citation exercise reveals a bias against these latter (regional science) approaches. Notwithstanding, the second bibliometric exercise does not present such bias as it includes a wide range (almost 700) of journals within regional literature publishing both regional studies and science-related articles.
2. EconLit™, the American Economic Association's electronic database, is the world's foremost source of references on economic literature. EconLit adheres to the high-quality standards long recognized by subscribers to the *Journal of Economic Literature* (JEL) and is a reliable source of citations and abstracts in economic research dating back to 1969. Subjects include all fields of economics, including accounting, capital markets, consumer economics, country studies, econometrics, economic forecasting, environmental economics, government regulations, labour economics, marketing, modelling, monetary theory, planning and urban economics. Business Source Complete is a business database that provides a leading collection of bibliographic and full-text content, with indexing and abstracts for more than 1200 of the most important business journals dating as far back as 1886. Journal ranking studies reveal that Business Source Complete is the forefront database for full-text journals in all disciplines of business, including marketing, management, accounting, finance and economics. These two databases were accessed through EBSCOhost® (see http://www.ebscohost.com/).
3. The authors acknowledge this insightful contribution from one of the referees.

4. Several recent studies (MARTIN and SUNLEY, 2003; MASKELL and KEBIR, 2005) maintain that this interchangeable use of labels seriously affects the concept of clarity and, consequently, the validity of a cluster theory. For instance, MARTIN and SUNLEY (2003, p. 6) view clusters as 'a world-wide fad, a sort of academic and policy fashion item', whose elements are conveniently indeterminate so to embrace a broad range of industrial groupings. Aware of this pitfall, MASKELL and KEBIR (2005) subscribe to REICH's (1990, p. 925) claim that 'the cluster concept will join those rare terms of public discourse that have gone directly from obscurity to meaninglessness without any intervening period of coherence'.
5. Namely, the Elgar Reference Collections Critical Writings in Economics.
6. The Marshallian tradition regards both MARSHALL's (1890) work and the works grouped as New Industrial Districts (SABEL *et al.*, 1987; PYKE and SENGENBERGER, 1992).
7. *Regional Studies* is a journal that is particularly dedicated to this topic, and it contains the highest number of publications on cluster-related research (116 articles, cf. see the third section), according to the authors' research in the EconLit and Business Source Complete databases.
8. It is important to note that gathering this reference/citation data was quite a taxing and time-consuming task. The over 50 000 references were collected from the ISI Web of Knowledge (produced by Thomson Scientific) database. The procedure allowed the references of the 1780 papers published in Regional Studies to be exported to an Excel file. However, only first authors and the journal title of the references are given. In order to reach the most cited studies (cf. Table 2), the authors had to depart from the (limited) available information to search on the Internet, one by one, the remaining information (other co-authors; the full title of the study; volume, issue, and pages in the case of articles; or location, publisher, and edition in the case of books).
9. Considering that the '*' enables one to account not only for the main word ('cluster' or 'industry'), but also for their derivations (such as clustering, clusterized, industrial, etc.).
10. Note that the categorization proposed does not significantly diverge from those proposed by BRESCHI and MALERBA (2001) and MALMBERG and MASKELL (2002).
11. Here are included the descriptions and analyses of clusters, the authors regarding their emergence, growth, maturity, decline and/or renewal stages, as well as the evolutionary perspectives that attempt to explain the clusters' development through concepts such as 'life cycle', 'technological lock in' or 'path dependence'.
12. This refers to scale economies, specialized labour market, reduced interaction costs among co-located firms, due to the intensification of their connections, and access to specialized institutions, suppliers and infrastructures. It includes the 'New Economic Geography' framework.
13. This includes issues such as firms' interactions, the proximity to sources of new technological information, the similarity of organizational cultures, the high mobility of a qualified workforce, and how the entrepreneurial environment itself that facilitate the diffusion of new technical know-how and technological experiences.
14. This includes forms of regional specialization such as 'regional innovation systems' or 'national innovation systems'.
15. This includes 'top-down' interventions, such as the creation of technological parks, technopoles, firm incubators or scientific cities.
16. Some of the literature included in this theme considers that multinational companies take part in global networks and local firms in clusters may benefit from relationships with such enterprises by broadening their technological and technical know-how; other studies, however, recall that if the cluster has low intervention in supplying or cooperating with the located multinational company, then the latter might very well jeopardize the cluster's process of development.
17. The main purpose of these approaches has to do with overcoming the possible flaws derived from the statistically centred methods; they argue that cluster dynamics can only be assessed from a qualitative point of view through the employment of research techniques such as in-depth interviews, surveys, and bibliographic and ideographic information about clusters and their main aspects.
18. It should be acknowledged that the classification of 'types of articles/research' into these six categories might include some degree of subjectivity. The authors tried to attenuate the potential for subjectivity by adopting the following procedure: each of the two (co)authors of the present paper performed the classification exercise in isolation. Each resulting categorization was then compared and the ambiguous cases (1.2%, thirty-five records) were re-read jointly and then classified.
19. This institute's name was changed to Thomson Scientific but in the area these impact factors continue to be labelled as ISI impact factors.
20. Business; Finance; Economics; Geography; History; Industrial Relations and Labor; International Relations; Management; Planning and Development; Political Science; Social Issues; Social Sciences, Mathematical Methods; Social Work; Sociology; Transportation; and Urban Studies.
21. The classification is based on objective rankings, supported by the judgement of experts (see http://www.tinbergen.nl/research-institute/journal-classification.php; last accessed on 4 May 2009). Important inputs to this categorization have been: Social Science Citation Index (SSCI) and Science Citation Index (SCI) impact factors, the ranking by KALAITZIDAKIS *et al.* (2003), and a more recent 'within economics' ranking by KODRZYCKI and YU (2006). Although the Tinbergen list is limited with regard to the fields covered (economics, econometrics, finance, operations research, marketing and accounting), given that the scientific proximity of the fields considered in the present study (mainly economics and management and, to a lesser extent, sociology), the categorization is useful and pertinent.
22. For statistical purposes, a numerical scale corresponding to the original classification was presented: AA, 6; A, 5; B, 4; C, 3; D, 2; and NC, 1.

23. This trend represents an average annual growth rate of approximately 25% in the last two decades (versus 16% for the corresponding global average).
24. This, however, does not mean that in absolute terms the number of articles has not grown. The issue is that the average annual growth (around 12% in the last two decades) was inferior to the global average (16%).
25. 'Genealogical/evolutionary approaches' observed an extraordinary rate of growth – almost 30% per year – between the 1980s and the 1990s.
26. This corresponds to an annual average growth rate of 18%, almost 5 percentage points above the corresponding global average.
27. It is important to underline that this analysis is not standardized by the period in research activity of the different authors. Thus, there is a high likelihood that more senior, active researchers appear at the top of this ranking. Furthermore, differently from the citation analysis pursued in Fig. 2, in the present ranking the authors account not only for the first author, but also for co-authors – the total number of papers includes single and joint papers. This explains in part the fact that some of the most prolific authors, most notoriously Thisse and McCann, do not appear in Fig. 2 as the most cited – a substantial number of papers they produced were joint papers where they were not first authors. This constitutes a severe limitation of ISI citation analysis as the database only gives first authors.
28. These categories are described in the third section.
29. In evolutionary economics (Silva and Teixeira, 2009), the number of A and B journals in the top twenty is respectively two and seven, much lower than the corresponding figures in the cluster-related literature.
30. Analysing the relationship between the type of article and journal quality from another perspective – the distribution of each journal group (AA, A, B, etc.) by the methodology adopted in this paper (formal; formal plus empirical; empirical; appreciative plus empirical; appreciative; survey), leads to not very different conclusions. In particular, the evidence reveals that in AA journals the concentration of 'survey'-related articles is relatively more pronounced (in the sample as a whole the percentage of survey-type papers is 3.8%, whereas the corresponding figure in AA journals is 7.9%). 'A' journals have a relative concentration of 'appreciative plus empirical' articles, whereas 'B' journals present an above-average share of 'formal' articles.

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