Current thinking on cluster theory and its translation in economic geography and strategic and operations management

Is a reconciliation possible?

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Abstract

Purpose – This paper offers an approach for outlining the main dimensions surrounding clusters in three areas of knowledge: economic geography, strategic management and operations management, the first being considered its natural field of knowledge.

Design/methodology/approach – The work was developed using the citation analysis technique as applied to a database of 627 articles and 22,980 citations, taken from 15 important journals in the areas selected.

Findings – The results proved that the theoretical and conceptual bases are unique to each of the areas studied and that they have few topics in common between them. They are complementary, however, and this facilitates their reconciliation.

Research limitations/implications – The sample base, despite considering fairly influential periodicals in the areas of knowledge selected, can be considered to be a limitation.

Originality/value – Common themes and different areas of knowledge surrounding the cluster concept were identified; despite being considered "common", a more detailed examination of their content reveals very different, but certainly complementary emphases, which makes it possible to reconcile the areas of knowledge.

Keywords Strategic management, Operations management, Economic geography, Cluster theory

Paper type Research paper

Introduction

This work uses the word "cluster" as defined by the Cluster Growth Theory of Michael Porter (1998a) which, according to Martin and Sunley (2003), has become the standard adopted by the research field. According to Porter:

> A business cluster is a geographic concentration of interconnected businesses, specialized suppliers, service providers, firms in related industries and associated institutions (for example, universities, regulatory agencies and trade associations) in particular fields that compete but also cooperate (Porter, 1998b, pp. 213-214).

There are two essential elements in this definition. First, the firms in a cluster must be linked in some way. Clusters are constituted by interconnected companies and associated institutions linked by aspects they have in common, or because of their complementarity (Gugler *et al.*, 2015; O'Dwyer *et al.*, 2015; Sölvell, 2015). Links may be vertical (buyer and seller chains) or horizontal (complementary products or services, a

similarity because of the use of specialized inputs, technologies or institutions, etc.). Most of these links involve social relationships or networks that produce benefits for the firms involved, in other words:

> A cluster is a form of network that occurs within a geographic location, in which the geographic proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions (Porter, 1998b, p. 242).

The second element is the geographic concentration of groups of interconnected companies. Co-location boosts formation and expands the value creation benefits that emerge from networks of firms.

The cluster concept has expanded over time from a broad spectrum of disciplines. A series of neologisms has emerged from its various applications, such as "industrial districts", "territorial production complexes", "local production arrangements", "clusters", "regional innovation systems" etc. As Maskell and Kebir (2005) argue, many authors introduced "novelties" that were based on minor alterations, or even imported constructs and variables from neighboring schools of thought, without any concern with regard to avoiding the theoretical and methodological tensions that arose. According to Martin and Sunley (2003), this form of development conferred on the notion of cluster the characteristic of being particularly vague and difficult to interpret. So how can we determine the nature and dimensions of the cluster notion? As Lazzeretti *et al.* (2012) point out, the notion of cluster has currently assumed a global dimension that has both multidisciplinary and transdisciplinary properties.

In this sense, this work proposes an approach for outlining the main dimensions that surround the subject of clusters in three areas of knowledge: economic geography, strategic management and operations management, because it is understood that there is an ample theoretical and conceptual interchange between them.

The emphasis of economic geography is on the principles and processes (locational, organizational and behavioral) associated with the allocation of resources (in a broad sense) and the behaviors and spatial consequences (direct and indirect, social, environmental and economic) resulting from this allocation. Strategic management has to do with the direction and scope of a firm over the long term, in such a way as to achieve a competitive advantage through the configuration of resources within a dynamic environment and fulfill the expectations of its stakeholders. Operations management refers to the systematic management and control of those processes that produce and deliver products and services. This consequently contributes to the implementation of the corporate strategy of a firm. Issues that are dealt with by operations management include determining the size and location of production plants, distribution centers, service structures and communication networks, etc. "Localization" issues are common to all three areas and are based mainly on the availability (allocation) of resources.

To respond to these questions, this work used the co-citation analysis technique. According to Small (1973), co-citation can be defined as the frequency by which two previous works in a particular area of research are cited jointly by subsequent works. It can be assumed that frequently cited articles represent the key concepts, methods or experiments of an area of research. This is an objective way of modeling the intellectual structure of a particular scientific field.

In addition to this introduction, this article is structured in five sections; in other words, the theoretical basis of bibliometric studies; the research methodology used; analysis; the results found and finally conclusions, limitations and directions for future research.

Theoretical basis

Bibliometric studies provide objective perspectives for a bibliographic review based on the analysis of citations, co-citations or a combination of the two (Di Stefano *et al.*, 2012; Landström *et al.*, 2012). The premise underlying this approach maintains that authors cite articles that are relevant to their research; so frequently cited articles are considered more influential than those that are cited less frequently. According to White and Griffith (1981), therefore, bibliometrics offers the "field's view of itself".

Citation analysis is based on the direct counting of references between registers (from/to). Co-citation analysis, on the other hand, which is an extension of the first approach, explores pairs of citations as a measure of association between documents. The underlying logic argues that articles that are most frequently referenced in pairs show a stronger level of association (Small, 1973) (Figure 1).

The basic methodology used for carrying out a co-citation analysis is shown in Figure 2.

Using an internet-based mechanism (e.g. Web of Science), steps 1-3 are carried out directly on indexed databases that contain scientific production and with the citation registers (from/to) for certain areas of science. Researchers need to identify beforehand the most relevant periodicals, the period to be researched, seminal articles, etc. Subsequent steps are carried out using application software dedicated to bibliometrics (e.g. Sitkis, BibExcel, Citespace) in association with statistical packages (e.g. STATA, SPSS) and those dedicated to analyzing social networks (e.g. Ucinet, VOS viewer).

The "end product" of a bibliometric study is generally a map that shows the network of relationships of authors and/or articles, the construction of which is based on the
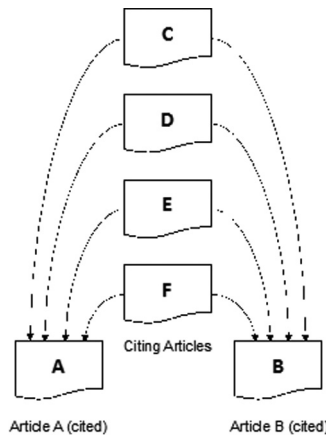

Figure 1.
Co-citation analysis
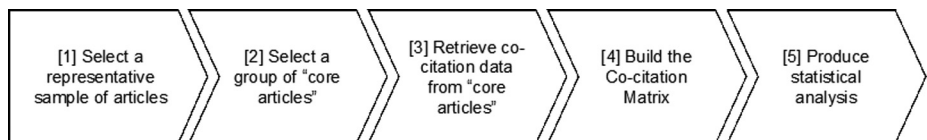
Source: prepared by the authors

Figure 2.
Methodology for
analyzing co-citations
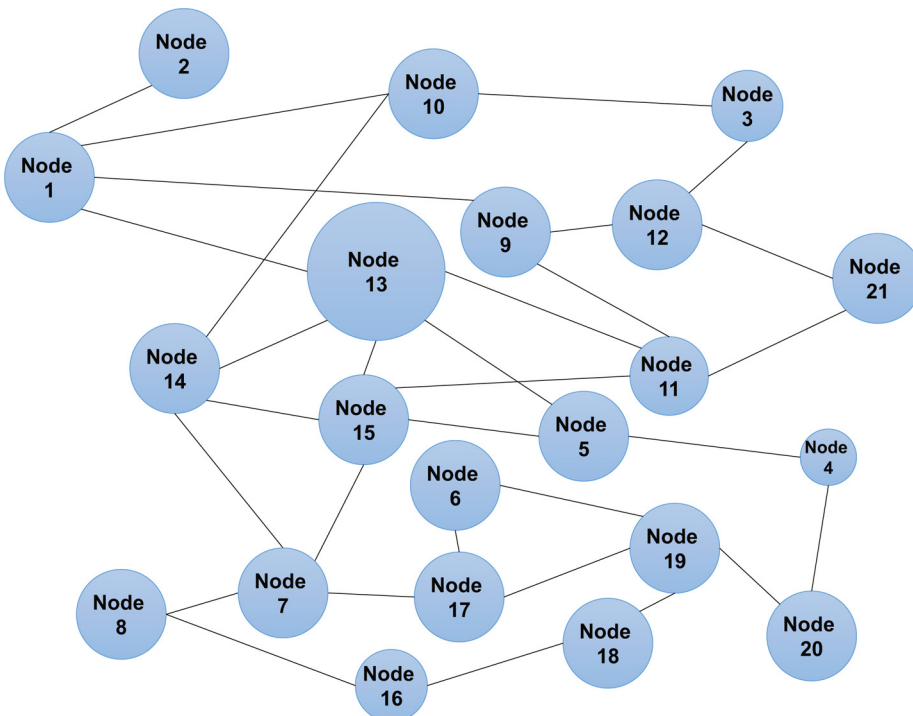
Source: prepared by the authors

bibliographic registers of citations and co-citations. Figure 3 shows an example of a network.

According to Van Eck *et al.* (2010), despite various techniques existing for constructing these maps, the most popular is the multidimensional scaling (MDS) technique (McCain, 1990; White and Griffith, 1981; White and McCain, 1998; Griffith *et al.*, 1974; Small and Garfield, 1985; Small *et al.*, 1985; Peters and van Raan, 1993a, 1993b; Tijssen and van Raan, 1989; Van Eck *et al.*, 2010).

MDS is a mathematical technique for locating points in a network in such a way that the distances between them are significant. It uses "space" and "distance" concepts to represent a network's internal structure, which in its turn may help reveal, among other things, which agents are close to or far from one another. To build the network, it is necessary to have a squared matrix that contains the similarity or dissimilarity measures between the pairs of available registers, in this case the co-citation matrix. The result is a set of estimated distances between these pairs that can be then represented in one or more dimensions (Everton, 2004). The alternative to MDS is a new technique called visualization of similarities (VOS), which was introduced by Van Eck and Waltman (2007a). For details of the differences between these techniques, see Van Eck *et al.* (2010).

Methodology
As Figure 4 shows, the methodology used in this work relied on two stages: co-citation analysis and qualitative data analysis. In the first stage, using the VOS technique, the basic

Source: prepared by the authors

Figure 3.
Example of a network

methodology for analyzing co-citations was applied, as described in the previous section. For each area of knowledge investigated (economic geography, strategic management and operations management), a scientific production map was created that corresponded to the articles considered "essential", which were selected from the distribution of the data set (citation frequency), the cut-off point of which took into consideration those articles in the 2nd and 3rd quartiles. In the second stage, using the NVivo qualitative data analysis software (Version 9.4, from QSR International), the retrieved articles were organized, analyzed and grouped by topic on the basis of an interpretation of their abstracts and, in some cases, of parts of the article itself. The objective of the qualitative data analysis is to allow the interpretation and detection of connections among concepts from different sources, grouping them together in correlated themes and lines of knowledge.

Fifteen peer-reviewed journals were selected for constructing the sample, as shown in Table I. This selection was based on the impact factor of the periodicals in each of the areas of knowledge investigated and also on the importance in publishing on this cluster theme.

From the impact factors and the respective positions, the conclusion is that these periodicals have a lot of influence in their areas of knowledge.

Because terminology varies significantly (e.g. clusters, agglomerations, industrial districts, etc.), the investigation did not use any specific term as its focal point. The articles were retrieved from the following key words associated with the topic field (abstract), according to the structure of the Web of Knowledge (2012 Thomson Reuters) database. The period investigated was from January 1980 to February 2016. The following are Key words associated with the topic of the article:

- Agglomeration;
- Industrial agglomeration;
- Agglomeration of firms;
- Agglomeration theory;
- Cluster;
- Cluster theory; and
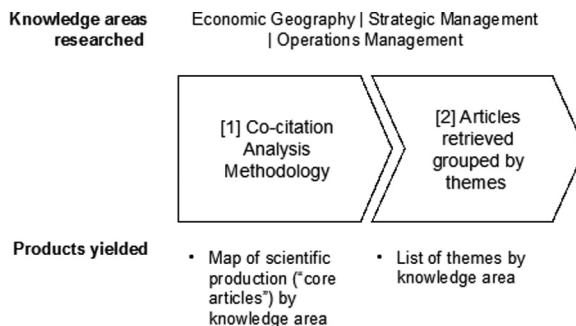- Industrial districts (Source: Prepared by the authors, Adapted from Maskell and Kebir, 2005).

Figure 4.
Methodology used

Source: prepared by the authors

Area of knowledge	Periodical	Impact factor	Journal citation reports®		
			5Y Impact factor	Area	Rank in the area
Economic Geography	*Journal of Economic Geography*	2.494	3.814	Economics	32nd out of 333
				Geography	8th out of 76
	Economic Geography	2.735	5.489	Economics	23rd out of 333
				Geography	5th out of 76
	Quarterly Journal of Economics	6.654	9.794	Economics	1st out of 333
	Regional Studies	2.068	2.372	Economics	41st out of 333
				Geography	12th out of 76
	Progress in Human Geography	5.010	5.570	Geography	2nd out of 76
Strategic management	*Strategic Management Journal*	3.341	6.061	Management	20th out of 185
				Business	13th out of 115
	Journal of Economics & Management Strategy	0.747	1.769	Management	132nd out of 185
				Economics	183rd out of 333
	Journal of Management	6.071	9.238	Management	4th out of 185
				Business	3rd out of 115
	Academy of Management Journal	6.448	9.812	Management	3rd out of 185
				Business	2nd out of 115
	Academy of Management Review	7.475	10.736	Management	2nd out of 185
				Business	1st out of 115
Operations management	*International Journal of Operations and Production Management*	1.736	2.612	Management	61th out of 185
	Journal of Operations Management	3.818	7.692	Management	13th out of 185
	Production and Operations Management	1.439	2.210	Management	76th out of 185
	International Journal of Production Economics	2.752	3.069	Management	25th out of 185
	Supply Chain Management – An International Journal	3.500	3.902	Management	18th out of 185
				Business	11th out of 115

Source: Journal of Citation Reports® - Social Sciences Edition (2014)

The VOS technique
To obtain the scientific production map of the areas of knowledge researched, the work used the VOS technique that suggests adopting a unified approach to mapping out and grouping the bibliometric data, the techniques of which are derived from the same underlying principle, according to Waltman *et al.* (2010).

The purpose of VOS is to locate elements in the area in such a way that the distance between them reflects their similarities, or affinities, as accurately as possible. For each pair of elements *i* and *j*, VOS requires a similarity measure s_{ij} ($s_{ij} \geq 0$) as input. This measure is calculated by using the strength of association between the elements, as Equation (1) shows (Van Eck and Waltman, 2007b; Van Eck *et al.*, 2006).

$$S_{ij} = \frac{c_{ij}}{c_i c_j}$$

(1)

where S_{ij} is the strength of association between elements i and j, and c_{ij} is the number of co-occurrences of j. The strength of the association of elements i and j is proportional to the ratio between the observed number of co-occurrences of i and j and the expected number of co-occurrences of i and j, supposing that the co-occurrences of i and j are statistically independent (Van Eck and Waltman, 2009).

VOS determines the location of the elements on a map, minimizing [equation (2)]:

$$V(x_1, \ldots x_n) = \sum_{i<j} s_{ij}\|x_i - x_j\|^2 \tag{2}$$

subject to [equation (3)]:

$$\frac{2}{n(n-1)} \sum_{i<j} \|x_i - x_j\| = 1 \tag{3}$$

Therefore, the premise of VOS is to minimize the weighted sum of the squared distances between all pairs of elements. The square of the distance between one pair of elements is weighted by the similarity measure between them [equation (2)]. To avoid trivial solutions, in which all elements have the same location, the restriction imposed was that the average distance between two points must be equal to one [equation (3)] (Van Eck *et al.*, 2010).

Analysis and results
Research in the databases of the periodicals listed in Table I, which contained the key words mentioned in Figure 1, produced a total of 957 articles. From this database:

- 36 articles were discarded because they merely used the "cluster analysis" multivariate data analysis technique, but bore no relationship with the object of this work; and

- 191 were discarded because they were not related with the topic (for example: use of the words agglomeration and cluster as a synonymous of a collection of things; use of the concept of agglomeration related with the population of the cities and regions in the economic geography literature).

So the total number of articles processed was 627 (containing a total of 22,980 citations), as shown in Table II.

The terms *agglomeration* (∼41 per cent) and *cluster* (∼34 per cent) correspond to almost 75 per cent (468) of all the articles (627); the *Regional Studies* journal is responsible for some 47 per cent (297) of them. When we consider total article production weighted by the number of periodicals researched, we observe that the topic is most central to economic geography, followed by strategy and then by operations.

Figure 5 shows that the production of economic geography articles begins growing exponentially as from the 1990s. This is the decade in which the works on clusters written by Michael Porter first saw the light of day, namely "Van Eck Competitive Advantage of Nations" (1990) and "On Competitiveness" (1998). But "Geography and Trade" and "Increasing Returns and Economic Geography", both from 1991 and written by Paul Krugman, must also be mentioned. Economic geography has proved to be the natural field of knowledge of the debate about clusters, a statement that will become more obvious as this article develops.

Table III shows the topics identified by area (seven for economic geography, five for strategic management and three for operations management).
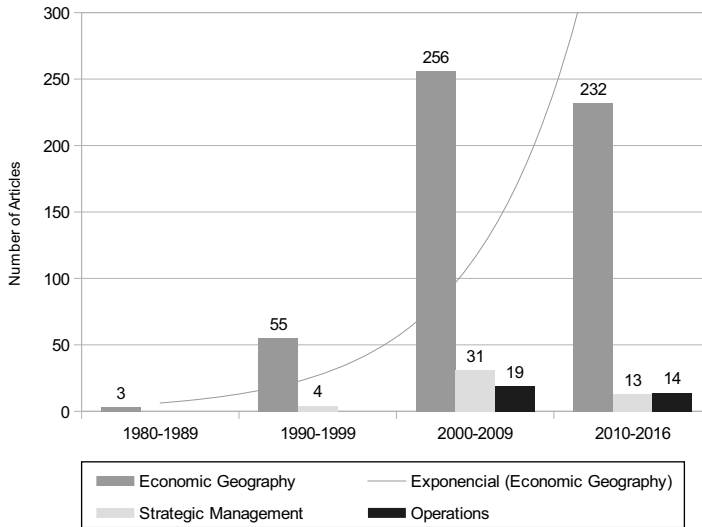
Keywords associated with the topic of the article	Total	Journal of Economic Geography	Economic Geography	Quarterly Journal of Economics	No. of articles Regional Studies	Progress in Human Geography	Strategic Management Journal	Journal of Economics & Management Strategy
Agglomeration	253	61	19	5	134	5	9	6
Cluster	215	35	24	2	116	6	11	1
Agglomeration of firms	42	18	8	0	9	0	3	0
Industrial agglomeration	31	13	11	0	6	0	1	0
Industrial districts	57	12	8	0	26	3	2	0
Agglomeration theory	16	8	3	0	4	0	1	0
Cluster theory	13	4	3	0	2	1	2	0
Total	627	151	76	7	297	15	29	7

(*continued*)

Source: Prepared by the authors

Table II.
Articles identified in the periodicals selected

Table II.

Keywords associated with the topic of the article	No. of articles							
	Journal of Management	Academy of Management Journal	Academy of Management Review	International Journal of Operations and Production Management	Journal of Operations Management	Production and Operations Management	International Journal of Production Economics	Supply Chain Management – an international journal
Agglomeration	2	1	2	6	0	0	2	1
Cluster	1	3	1	4	2	1	4	4
Agglomeration of firms	0	0	0	3	1	0	0	0
Industrial agglomeration	0	0	0	0	0	0	0	0
Industrial districts	0	0	1	2	1	0	2	0
Agglomeration theory	0	0	0	0	0	0	0	0
Cluster theory	1	0	0	0	0	0	0	0
Total	4	4	4	15	4	1	8	5

Figure 5.
Articles produced by decade

Source: Prepared by the author

Economic geography	Strategic management	Operations management
Clusters (*per se*)	Strategic groups	Supply chain
Regional development	Networks	Clusters (*per se*)
Global value chain	Location decisions	Global value chain
The new economic geography	Clusters (*per se*)	
Location decisions	Externalities	
Spatial organization		
The role of geography		

Source: Prepared by the authors

Table III.
Topics identified in economic geography, strategic management and operations management

There is only one common theme between all three areas (cluster *per se*), and there are common themes between two of them, namely:

(1) global value chain for economic geography and operations management; and

(2) location decisions for economic geography and strategic management.

The intellectual bases underpinning each of these areas of knowledge, however, are totally different. The issues debated in these topics by each of the areas also diverge to a certain degree, as Table IV shows.

Intellectual production in economic geography. Seven emerging themes were identified, as shown in Table III, in increasing order of volume of articles produced. Emphasis in this area is on studies of clusters (*per se*) and their influence on local, regional and national development. Together, these themes represent around 57 per cent of all the scientific production carried by the periodicals selected. The following are Emerging themes and articles related to economic geography:

Topic	Area of knowledge	Content
Clusters	Economic geography	Topic of greatest production and diversification in the area; ranges from an understanding of externalities, via industry concentration issues and culminating with the construction of a cluster theory
	Strategic management	Topic with low production (only six articles found); the themes vary from questioning superior performance in cluster, to methodology for cluster identification, to the research of capabilities of collaboration and knowledge
	Operations management	Topic with low production in the area (only nine articles found); the researches deal with several aspects, such as case studies, innovation, performance and relation with the supply chain
Global value chain	Economic geography	Shows an interest in understanding the value chains that are divided between a lot of geographically-spread firms
	Operations management	Seeks to understand the benefits and restrictions of local vs global production and supply systems
Location decisions	Economic geography	Investigates questions linked to the availability of human capital and is dedicated to building and testing decision-making models
	Strategic management	Investigates internationalization strategies, sources of externalities and their influence on performance and decisions regarding location and entry movements in industries

Table IV.
Topics, areas of
knowledge and
content debated

Source: Prepared by the authors

- Clusters (*per se*) (Crespo and Vicente, 2016; James *et al.*, 2016; Macneill and Jeannerat, 2016; Vissers and Dankbaar, 2016; Jeannerat and Kebir, 2016; Wixe, 2015; Guastella and van Oort, 2015; Belderbos and Somers, 2015; Duschl *et al.*, 2015; Galliano *et al.*, 2015; Banno *et al.*, 2015; Levy and Talbot, 2015; Mariotti *et al.*, 2015; Ostergaard and Park, 2015; Foster *et al.*, 2015; Hracs, 2015; Rantisi and Leslie, 2015; Balland *et al.*, 2015; Cassi and Plunket, 2015; Isaksen, 2015; Crafts and Klein, 2015; Meliciani and Savona, 2015; Heijnen *et al.*, 2015; Capasso *et al.*, 2015; Noseleit, 2015; Rigby, 2015; Holm and Ostergaard, 2015; Phelps *et al.*, 2015; Otsuka and Goto, 2015; Mukim, 2015; Drucker, 2015; Frenken *et al.*, 2015; Menon, 2015; Angeli *et al.*, 2014; Rantisi, 2014; Tanner, 2014; Ke *et al.*, 2014; Cole *et al.*, 2014; Li, 2014; Boschma and Hartog, 2014; Liu, 2014; Resende, 2014; Varga *et al.*, 2014; Timmermans and Boschma, 2014; Luthi and Schmidheiny, 2014; Okubo and Tomiura, 2014; James, 2014; Pijnenburg and Kholodilin, 2014; Potter and Watts, 2014; Di Giacinto *et al.*, 2014; Moodysson and Zukauskaite, 2014; Jose Aranguren *et al.*, 2014; Figueiredo *et al.*, 2014; Lazzeretti *et al.*, 2014; Antonietti *et al.*, 2014; Arias *et al.*, 2014; Crespo *et al.*, 2014; Grandadam *et al.*, 2013; Ghani *et al.*, 2013; Mayer, 2013; Ramirez *et al.*, 2013; De Vaan *et al.*, 2013; Beebe *et al.*, 2013; Wrede, 2013; Edgington and Hayter, 2013; D'Este *et al.*, 2013; Wang and Lin, 2013; Falck *et al.*, 2013; Lorenzen and Mudambi, 2013; Ter Wal, 2013; Capasso *et al.*, 2013; Kauffeld-Monz and Fritsch, 2013; Brenner and Muehlig, 2013; Mora and Moreno, 2013; Kasabov and Sundaram, 2013; De Dominicis *et al.*, 2013; Tomlinson and Jackson, 2013; Jofre-Monseny, 2013; Morrison *et al.*, 2013; Huber, 2012; Howells and Bessant, 2012), Crescenzi *et al.*, 2012; Cainelli and Iacobucci, 2012; Freedman and Kosova, 2012; Gabe

and Abel, 2012; Lecocq *et al.*, 2012; Massini and Miozzo, 2012; Asheim, 2012; Malecki, 2012; Neffke *et al.*, 2012; Giunta *et al.*, 2012; Belussi and Sedita, 2012; Giblin and Ryan, 2012; Buerger *et al.*, 2012; Doloreux and Shearmur, 2012) Huber, 2012; Mattes, 2012; Li *et al.*, 2012; Florida *et al.*, 2012; Heebels and Boschma, 2011; Rinallo and Golfetto, 2011; Zademach, 2011; Potter and Wattsy, 2011; Eriksson, 2011; Ottaviano, 2011; Venables, 2011; Boschma and Frenken, 2011; McCann, 2011; Usai, 2011; Kasabov, 2011; Fritsch and Slavtchev, 2011; Meyer *et al.*, 2011; Zhang *et al.*, 2011; Zhang *et al.*, 2011; Rizov and Walsh, 2011; Exposito-Langa *et al.*, 2011; Amighini *et al.*, 2011; Crestanello and Tattara, 2011; Lyberaki, 2011; Antonelli *et al.*, 2011; Neffke *et al.*, 2011; Titze *et al.*, 2011; Lengyel and Leydesdorff, 2011; Asheim *et al.*, 2011; Ter Wal and Boschma, 2011; Vicente *et al.*, 2011; Teraes, 2011; Drucker, 2011; Boschma and Fornahl, 2011; Martin and Sunley, 2011; Hilliard and Jacobson, 2011; Giuliani, 2011; Staber and Sautter, 2011; Brenner and Schlump, 2011; Shin and Hassink, 2011; Turner, 2010; Manning, 2010; Marcon and Puech, 2010; Delgado *et al.*, 2010; Mariotti *et al.*, 2010; Kim *et al.*, 2010; Jenkins and Tallman, 2010; Feldman and Lendel, 2010; Sydow *et al.*, 2010; Lu, 2010; Martin, 2010; Barde, 2010; Velluzzi, 2010; Currid and Williams, 2010; Leahy *et al.*, 2010; Holl *et al.*, 2010; Spencer *et al.*, 2010; van der Groep, 2010; Cruz and Teixeira, 2010; Figueiredo *et al.*, 2009; Trippl *et al.*, 2009; Ibrahim *et al.*, 2009; Hervas-Oliver and Albors-Garrigos, 2009; Maurseth and Frank, 2009; Sanchez-Moral, 2009; Boix and Galletto, 2009; De Propris and Lazzeretti, 2009; Isaksen, 2009; Moodysson, 2008; Wenting, 2008; Kloosterman, 2008; Press, 2008; Phelps, 2008; Yamamoto, 2008; Scott, 2008), Bramwell *et al.*, 2008; Baldwin *et al.*, 2008; Chetty and Agndal, 2008; Kim and Zhang, 2008; Mariotti *et al.*, 2008; Steiner and Ploder, 2008; Morrison, 2008; Lazaric *et al.*, 2008; Bathelt and Schuldt, 2008; Torre, 2008; Cole, 2008; He *et al.*, 2008; Fromhold-Eisebith and Eisebith, 2008; Sepulveda, 2008), Yang, 2007; Wei *et al.*, 2007; Maskell and Malmberg, 2007; Bottazzi *et al.*, 2007; Muscio and Scarpinato, 2007; Becchetti *et al.*, 2007; Kambhampati and McCann, 2007; Vicente and Suire, 2007; Giuliani, 2007; Riguelle *et al.*, 2007; McDonald *et al.*, 2007; Glueckler, 2007; Bronzini, 2007; Koo, 2007; Christopherson and Clark, 2007; Capello, 2007; Harrison, 2007; Brenner, 2006; Revilla Diez and Kiese, 2006; Ketelhohn, 2006; Blay-Palmer and Donald, 2006; Hendry and Brown, 2006; Faulconbridge, 2006; Poon *et al.*, 2006; Steiner and Hartmann, 2006; Cainelli *et al.*, 2006; Baldwin and Okubo, 2006; Matuschewski, 2006; Dupont and Martin, 2006; James, 2005; Garnsey and Heffernan, 2005; Boschma and Weterings, 2005; Roos, 2005; Gibson and Kong, 2005; Klagge and Martin, 2005; Simmie, 2005; Bertinelli and Decrop, 2005; Desmet and Fachamps, 2005; Kenney and Patton, 2005; Bathelt, 2005; De Propris, 2005; Appold, 2005), Bathelt, 2005; Feldman *et al.*, 2005; Depner and Bathelt, 2005; Ivarsson and Alvstam, 2005; Viladecans-Marsal, 2004; O'Donoghue and Gleave, 2004; Roberts, 2004; Bathelt *et al.*, 2004), Sadler, 2004; Perrons, 2004; Alderman, 2004; Jocoy, 2003; Pinch, 2003; Marcon and Puech, 2003; Ottaviano, 2003; Porter, 2003; McCann and Sheppard, 2003; Fan and Scott, 2003; Lublinski, 2003; Moulaert and Sekia, 2003; Zhou and Xin, 2003; Chevassus-Lozza and Galliano, 2003; Rama *et al.*, 2003; Smith, 2003; Martin and Sunley, 2003; Yamamura *et al.*, 2003; Gertler, 2003; Scott, 2002; He, 2002; Brioschi *et al.*, 2002; Smith *et al.*, 2002; Rantisi, 2002; Clark, 2002; Rantisi, 2002; Angel, 2002; Powell *et al.*, 2002; Dornisch, 2002; Ivarsson, 2002; Simmie *et al.*, 2002; Romijn and Albu, 2002; Irwin and Bockstael, 2002; Florida, 2002; Matisziw and Hipple, 2001; Dicken and Malmberg, 2001; Driffield and Munday, 2001; Oakey *et al.*, 2001; Paluzie *et al.*, 2001; Staber, 2001; Roper, 2001; Antonelli, 2000; Paci and Usai, 2000; Hendry *et al.*, 2000; Llobrera *et al.*, 2000; Pinch and Henry, 1999; Sternberg, 1999; Brouwer *et al.*, 1999; Keeble and Wilkinson, 1999;

Lawson and Lorenz, 1999; Capello, 1999; Wever and Stam, 1999; Rabellotti and Schmitz, 1999; Ivarsson, 1999; Winder, 1999; Huggins, 1998; Forrant and Flynn, 1998; Meyer, 1998; Malmberg, 1997; Grotz and Braun, 1997; Izushi, 1997; Park, 1996; Gray *et al.*, 1996; Malmberg, 1996; Harrison *et al.*, 1996; Markusen, 1996; Lyons, 1995; Appold, 1995; Turok, 1993; Storper, 1993; Scott, 1992; Harrison, 1992; Huallachain, 1991; Debbage and Rees, 1991; Scott and Kwok, 1989; Oakey and Cooper, 1989; Glasmeier, 1988);

• Regional development (Wohl, 2016; Brenner and Kauermann, 2016; Schroeder and Voelzkow, 2016; Kemeny and Storper, 2015; Boschma, 2015; Wei, 2015; Burger *et al.*, 2014; Fallah *et al.*, 2014; Colombo and Turati, 2014; Fowler and Kleit, 2014; Jacobs *et al.*, 2014; Consoli *et al.*, 2013; Boschma *et al.*, 2013; Henning *et al.*, 2013; Ossa, 2013; Tonts *et al.*, 2012; Hassink and Klaerding, 2012; Gardiner *et al.*, 2011; Storper, 2011; Zhou *et al.*, 2011; McCann and Acs, 2011; Le Gallo and Kamarianakis, 2011; Asheim *et al.*, 2011; Lu, 2011; Scott, 2010; Menghinello *et al.*, 2010; Moulaert and Mehmood, 2010; Jonas *et al.*, 2010; Chapain and Comunian, 2010; Jansson and Power, 2010; Le Blanc, 2010; Wiberg, 2009; Boschma and Iammarino, 2009; Saito and Gopinath, 2009; Storper and Scott, 2009; Yeung, 2009; Lee, 2009; Yang *et al.*, 2009; Chun, 2009; Wei *et al.*, 2009; Lepawsky, 2009; Sajarattanochote and Poon, 2009; Goncalves and Almeida, 2009; Gambardella *et al.*, 2009; Cho and Hassink, 2009; Partridge *et al.*, 2008; ltomonte and Colantone, 2008; Pelegrin and Bolance, 2008; Portnov and Schwartz, 2008; Kelton *et al.*, 2008; Courtney *et al.*, 2008; Geppert *et al.*, 2008; Broersma and van Dijk, 2008; Logan, 2008; Bagchi-Sen and Smith, 2008; Hoyler *et al.*, 2008; Halbert, 2008; Chertow *et al.*, 2008; Deutz and Gibbs, 2008; Crescenzi *et al.*, 2007; Kitagawa, 2007; Salazar and Holbrook, 2008; Zheng, 2007; Romero and Javier Santos, 2007; Oosterhaven and Broersma, 2007; Helsley and Strange, 2007; Zhao and Zhang, 2007; McCann, 2007; Malecki, 2007; Bockerman and Lehto, 2006; Kim, 2006; Leslie and Ohuallachain, 2006; Mason and Harrison, 2006; Meliciani, 2006; Tabuchi *et al.*, 2005; Taymaz and Kilicaslan, 2005; Bristow, 2005; Lopez-Bazo *et al.*, 2005; Venables, 2005; Henderson and Wang, 2005; Kitson *et al.*, 2004; Budd and Hirmis, 2004; Polenske, 2004; Turok, 2004; Malecki, 2004; Braunerhjelm and Borgman, 2004; Storper and Venables, 2004), Wheeler, 2004; Kemper, 2004; Cieslik and Kaniewsk, 2004; Johnson and Brown, 2004; Sjoberg and Sjoholm, 2004; Clark *et al.*, 2004; Jensen, 2004; Van Stel and Nieuwenhuijsen, 2004; Anas, 2004; Essletzbichler, 2003; Scott and Storper, 2003; Antonelli, 2003; Markusen, 2003; Bathelt and Boggs, 2003; Nijkamp, 2003; Driffield and Hughes, 2003; Puga, 2002; Rigby and Essletzbichler, 2002; Parr *et al.*, 2002; Potter *et al.*, 2002; Wei *et al.*, 1999; Echeverri-Carroll *et al.*1998; Martin and Sunley, 1998; Gambarotto and Maggioni, 1998; Digiovanna, 1996; Crewe, 1996; Hollard and Storper, 1996; Musyck, 1995; Vaessen and Keeble, 1995; Young *et al.*, 1994; Keeble and Walker, 1994; Reynolds, 1994; Chakravorty, 1994; Scott, 1992; Storper, 1992); and

• Global value chain (Fitjar and Huber, 2015; Crescenzi *et al.*, 2014; Smith *et al.*, 2014; Maskell, 2014; Bathelt and Li, 2014; Li, 2014; Vale and Carvalho, 2013; Werner, 2012; Pickles and Smith, 2011; Crestanello and Tattara, 2011; Lyberaki, 2011; Iammarino, 2011; Zademach, 2009; Sunley *et al.*, 2008; Rutherford and Holmes, 2008; Sturgeon *et al.*, 2008; Phelps, 2008; Wink, 2008; Lambregts, 2008; Weller, 2007; Tokatli, 2007; Bowen and Leinbach, 2006; Dunford, 2006; van Egeraat and Jacobson, 2005; Phelps and Waley, 2004; Huber, 2003; Sturgeon, 2003; Humphrey and Schmitz, 2002; Angel and Engstrom, 1995; Sadler, 1994; Scott, 1993).

- The new economic geography (Dunford *et al.*, 2014; Reades and Smith, 2014; Hadjimichalis and Hudson, 2014; Klein and Crafts, 2012; Storper, 2011; Krugman, 2011; Bosker *et al.*, 2010; Moncarz and Bleaney, 2010; Clinch *et al.*, 2009; Potter, 2009; Pflueger and Suedekum, 2008; Martin and Sunley, 2007; Ottaviano *et al.*, 2006; Gaigne, 2006; Crafts and Mulatu, 2005; Robert-Nicoud, 2005; Scott, 2004; Varga and Schalk, 2004; Crozet, 2004; Ottaviano, 2003; Forslid and Ottaviano, 2003; Martin and Sunley, 1996).

- Location decisions (Gallego and Maroto, 2015; Bottazzi and Gragnolati, 2015; Liviano and Arauzo-Carod, 2014; Farole and Winkler, 2014; Jo and Lee, 2014; Vitali *et al.*, 2013; Ng and Cetin, 2012; He and Yeung, 2011; Borck *et al.*, 2010; Suire and Vicente, 2009; Boschma *et al.*, 2009; Bacolod *et al.*, 2009; Eriksson and Lindgren, 2009; Arauzo-Carod and Viladecans-Marsal (2009; Peck and Cabras, 2009; Hong, 2007; Giarratani *et al.*, 2006; Behrens *et al.*, 2006; Timmins, 2005; Yu, 1998; Reid, 1995; Rauch, 1993; Malecki and Bradbury, 1992;

- The role of geography (Martin and Sunley, 2015; Felkner and Townsend, 2011; Knoben, 2011; Brakman *et al.*, 2011; Rodriguez-Pose, 2011; Coe, 2011; Morrison, 2011; Hanink *et al.*, 2011; Huallachain and Lee, 2011; Fifarek and Veloso, 2010; Asheim and Hansen, 2009; Reimer, 2009; Beugelsdijk, 2007; Ibert, 2007; Shearmu and Polese, 2007; Murphy, 2006; Lagendijk, 2006; Doring and Schnellenbach, 2006; Driffield, 2006; Duranton and Storper, 2006; Gordon and McCann, 2005; Peck, 2005; Ellison and Fudenberg, 2005; Phelps and Ozawa, 2003); and

- Spatial organization (Menzel, 2015; Koh and Riedel, 2014; Mariotti *et al.*, 2014; Brown *et al.*, 2013; Ahlfeldt and Wendland, 2013; Galliano and Soulie, 2012; Watts *et al.*, 2011; Cutrini, E, 2010; Barrios *et al.*, 2009; Krugman and Venables, 1995; Markusen and Park, 1993; Kleinknecht and Poot, 1992) (Source: prepared by the authors).

Studies involving the theme "cluster" (*per se*) include:

- externalities: the biggest volume of works is directed at aspects related to generating, spreading and sharing knowledge between firms. The research seeks to understand the level of creativity and the innovation patterns of clusters;

- analysis of the influences arising from industrial concentration;

- influences of clusters on the heterogeneity of firms;

- dependence of the trajectory of clusters *vis-à-vis* the evolution of industry;

- performance of the firms;

- intensity of spin-offs;

- role of the entrepreneur throughout the evolution cycle of clusters;

- dynamic of networks and the evolution of clusters;

- cluster theory;

- influences of human resources, capital resources, scientific and technological infrastructure in the agglomeration of firms; and

- analysis of the influence of geographical, social, organizational, institutional and cognitive dimensions in learning and innovation.

With regard to regional development, the works deal with regional growth and productivity based on activities arising from clusters, the regional inequalities occasioned by them, the variation in human capital in time and space and the rural-urban transformation of cities.

Works dealing with global value chain, which are mostly empirical, seek to understand value chains, which are divided between many, geographically-spread firms. Most of the works deal with networks or global production and supply systems. These studies mainly focus on the automobile and fashion industries.

In the new economic geography, research is directed at testing its logic, according to which an economy grows in a particular location as a function of growing returns (gains in scale) and the connections that lie both ahead and behind the firms, which generate an agglomeration of activities that are progressively self-strengthening. The advantage of location proves attractive to firms, not because of any of its intrinsic factors (region), but because of the large number of firms that are already producing there.

With regard to location decisions, the research explores the aspects of the "availability of human capital" and "decision-making models". In the former, the issues are linked to mobility, to the relationship between the specialization and generalization of competences and to the relational skills considered necessary for innovation activities. The latter takes into account factors such as distance, transport costs, externalities, etc.

On the one hand, the role of geography deals with more practical aspects, aimed at innovation activities, such as their intensity in time and space, their spatial distribution and how important the characteristics of a particular region are to them, whereas on the other, it deals with philosophical questions that seek to address the epistemological differences between geography and economics.

Works dealing with spatial organization explore the geographical agglomeration of the firms and industries, searching for explanations about the spatial distribution of firms and industries. What caused the agglomerations and the agglomerations is also studied, looking at economical evolution and globalization to explain these movements.

Figure 6 shows the relationship map of the essential articles, obtained from putting together the co-citation matrix and applying the VOS technique. The free software used was VOSviewer (Van Eck and Waltman, 2012), available at: www.vosviewer.com, accessed 17 December 2012. The length of the circumference reflects the strength of the article's association and, therefore, the bigger it is, the more influential it is.

The map enables identification of three groups or lines of thought:

(1) regional development and the relationships between economic agents;

(2) knowledge generation, learning processes and innovation; and

(3) finally the externalities generated by the clusters and the organization forms of the industries.

Table V shows the most influential articles in each of these groups.

Intellectual production in strategic management. The following list shows the five emerging themes that were identified, ordered by volume of article production:

- Strategic groups (Wang and Shaver, 2014; Meyer *et al.*, 2009; Zhang *et al.*, 2009; McCann and Folta, 2008), Canina *et al.*, 2005; Tallman *et al.*, 2004; Ketchen *et al.*, 2004; Johnson and Hoopes, 2003; McNamara *et al.*, 2003; Osborne *et al.*, 2001; Peteraf and Shanley, 1997; Pouder and StJohn, 1996; Reger and Huff, 1993).

- Networks (Skilton and Bernardes, 2015; Ozer and Zhang, 2015; Funk and Russell, 2014; Zhang and Li, 2010; McDermott *et al.*, 2009; Xavier Molina-Morales *et al.*, 2009; Greve, 2009; Forman *et al.*, 2008; Mesquita and Lazzarini, 2008; Bell, 2005), Inkpen and Tsang, 2005; Madhavan *et al.*, 2004; McEvily and Zaheer, 1999).

- Location decisions (Alcacer *et al.*, 2015; Alcacer and Chung, 2014; Belderbos *et al.*, 2011; Chan *et al.*, 2010; McCann and Vroom 2010; Ridley, 2008; Peng and Tabuchi, 2007;
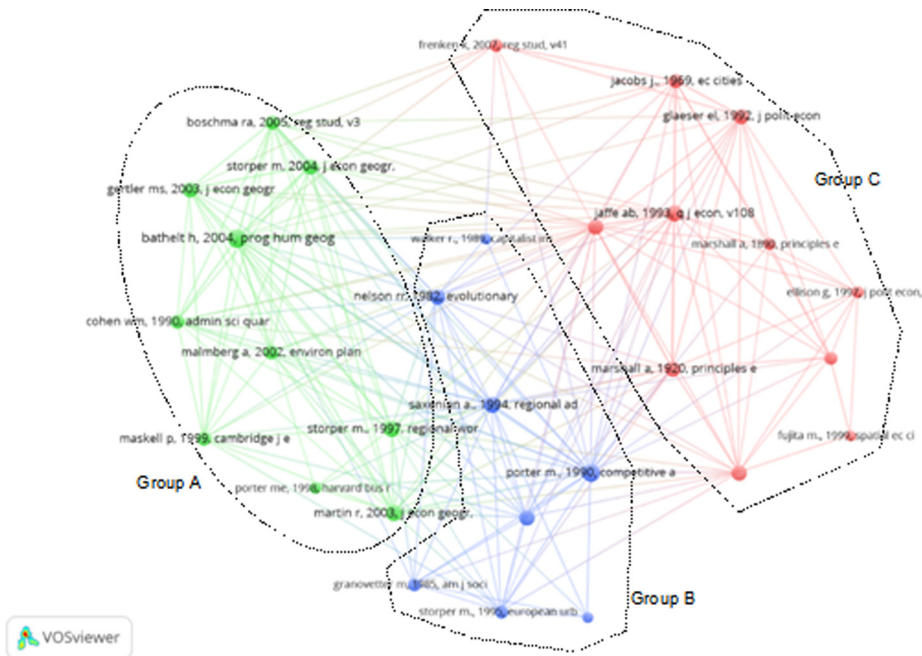
Source: prepared by the authors

Chang and Park 2005; Gimeno *et al.*, 2005; Smith and Hay, 2005; Chung and Song, 2004; Kalnins and Chung, 2004).

- Cluster (*per se*) (Alcacer and Zhao, 2016; Wang *et al.*, 2014; Kukalis, 2010; Bell *et al.*, 2009; Arikan, 2009; Mesquita, 2007); and
- Externalities (Glaeser and Kerr, 2009; King *et al.*, 2003; Chung and Kalnins, 2001; Shaver and Flyer, 2000) (Source: Prepared by the authors).

It is possible to note a slight emphasis on studies directed at the strategic groups.

Research in the "strategic groups" theme is directed at understanding the factors that have an influence on company performance, on the execution of entry strategies, on hybrid competitive postures, on relationships between the mental models of the leaders and the performance levels of the firms, on beliefs and shared values (shared by the firms that adhere to them) that begin to have an influence on the industries which adopt them and, finally, on the construction of a strategic group identity theory that explains how groups emerge in an industry and how they can affect both the results as well as the behavior of firms. In the "networks" theme, the investigation looks at the effects they have on innovation, the extent and speed of the spread of competitive advantage, customer-supplier relationships, access to competitive skills as a function of the position occupied in the network and, finally, at the isolation of the benefits provided by the network of interactions from those provided by the cluster *per se*. As for the "location decision" theme, the research tries to understand the learning mechanisms in internationalization strategies, the factors that exist in the geographic region and their

Group	Most influential works	Citations
A	Bathelt *et al.* (2004)	119
	Martin and Sunley (2003)	84
	Storper (1997)	79
	Storper and Venables (2004)	71
	Gertler (2003)	70
	Boschma (2005)	74
	Malmberg and Maskell (2002)	51
	Maskell and Malmberg (1999)	52
	Cohen and Levinthal (1990)	58
B	Porter (1990)	114
	Saxenian (1994)	88
	Nelson and Winter (1982)	73
	Markusen (1996)	80
	Storper (1995)	52
	Granovetter (1985)	54
	Storper and Walker (1989)	49
C	Jaffe *et al.* (1993)	70
	Audretsch and Feldman (1996)	78
	Marshall (1920b)	78
	Glaeser *et al.* (1992)	88
	Krugman (1991a)	94
	Jacobs (1969)	77
	Marshall (1890)	54

Table V.
Most influential works in economic geography

Source: Prepared by the authors

impact on the performance of firms, the opportunities provided to incumbent firms that derive from entry movements in the industry and the sources of externalities and their influence on location decisions. Regarding "cluster (*per se*)", the focus of the research tries to define and identify clusters based on economic activity, analyze the dependence of the trajectory of clusters *vis-à-vis* the evolution of industry, analyze the performance of the firms in a cluster and explore trust and collaboration in a cluster. Finally, the "externalities" theme examines the extent of the benefits coming from cluster economies in the light of how up-to-date the firms are technologically and managerially.

Figure 7 shows the relationship map of essential articles obtained from putting together a co-citation matrix and applying the VOS technique.

The map allows for identification of two groups, or lines of thinking, whose bases are the strategic groups. Group A emphasizes structures, agglomeration and cognition models and Group B focuses on intragroup and intergroup rivalry. Table VI shows the most influential articles in each of these groups.

Intellectual production in operations management. Three emerging themes were identified in the periodicals selected, shows, with the emphasis being on supply chain studies:

- Supply chain (Giannocaro, 2015; Kim *et al.*, 2015; Grosvold *et al.*, 2014; D'Ignazio and Giovannetti, 2014; Yusuf *et al.*, 2014; Zhang and Huang, 2012; Kirytopoulos *et al.*, 2010), Caniato *et al.*, 2009; Sha *et al.*, 2008; Bozarth *et al.*, 2007; Adebanjo *et al.*, 2006; Wasti *et al.*, 2006; Jin, 2004; Ryder and Fearne, 2003; Batenburg and Rutten, 2003; Carbonara *et al.*, 2002; Perry and Sohal, 2001);
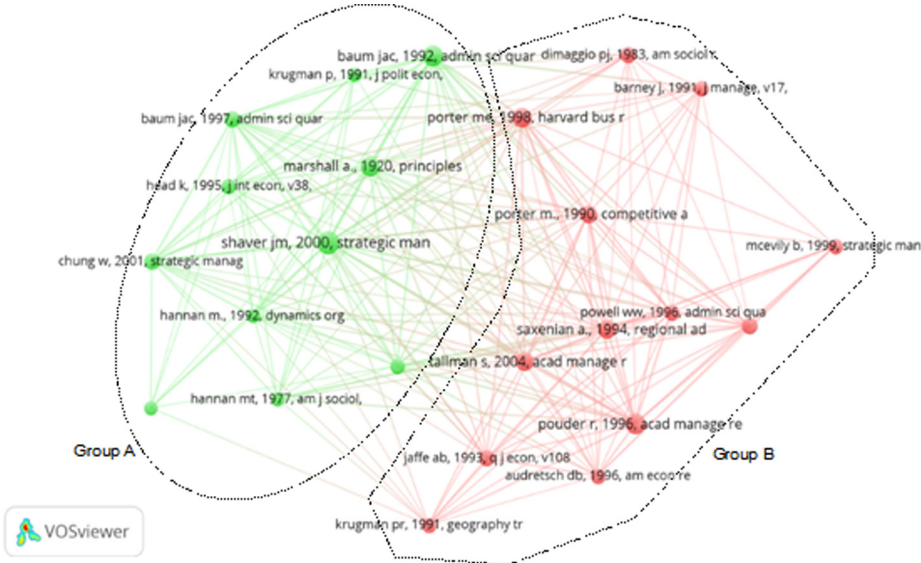
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Source: prepared by the authors

Group	Most influential works	Citations
A	Shaver and Flyer (2000)	18
	Baum and Mezias (1992)	15
	Marshall (1920a)	14
	Baum and Haveman (1997)	10
	Chung and Kalnins (2001)	10
	Almeida and Kogut (1999)	9
	Hannan and Carroll (1992)	7
	Head *et al.* (1995)	9
B	Pouder *et al.* (1996)	16
	Porter (1998a)	14
	Saxenian (1996)	12
	Porter (1990)	11
	Tallman *et al.* (2004)	12
	Powell *et al.* (1996)	9
	Cohen and Levinthal (1990)	10
	Jaffe *et al.* (1993)	10

Source: Prepared by the authors

- Clusters (*per se*) (Yusuf *et al.*, 2014; Autant-Bernard *et al.*, 2011; Mao *et al.*, 2009; Relchhart and Holweg, 2008; Albino *et al.*, 2006; Grando and Belvedere, 2006; Patti, 2006; Wilk and Fensterseifer, 2003; Day *et al.*, 2000); and
- Global value chain (Macchion *et al.*, 2015; Puig *et al.*, 2009; Chiarvesio and Di Maria, 2009; Lu *et al.*, 2008; Nassimbeni, 2003) (Source: Prepared by the authors).

In "Supply Chain", the works seek to understand the use of information technology (specifically the Internet), the extent to which it is used and the results arising from customer-supplier interaction. In clusters (*per se*), the articles investigate the influence of the resources and capacities shared by the cluster on the performance and innovation of the firms, the relation of the firm in a cluster and its supply chain, the typology of supplier clusters and co-location. In global value chain, an attempt was made to understand the benefits and restrictions between local and global production and supply systems.

Figure 8 shows the relationship map of the essential articles obtained from putting together the co-citation matrix and applying the VOS technique.

Three groups or lines of thinking were identified in the map that form the basis of the production in the above-mentioned works. Operations strategy (manufacturing) is the basis of group B, but it is also form the basis of Group A together with supply chain. Group C emphasizes competitive priorities. Table VII shows the most influential articles in each of these groups.

Conclusions

In economic geography, there is a profusion of themes and sub-themes surrounding the cluster concept and they are often so granular (Chen *et al.*, 2010) that they make research lines somewhat confused and difficult to understand.

As the results show, there is only one common theme ("Clusters (*per se*)") of the 15 that were identified in the three areas of knowledge. There are also two common themes for two areas of knowledge investigated: "Location" is common only to economic geography and strategic management, and "Global Value Chain" was found in economic geography and operations management. Despite being considered "common", a more detailed examination of their content reveals very different, but certainly complementary emphases, which makes it possible to reconcile the areas of knowledge.
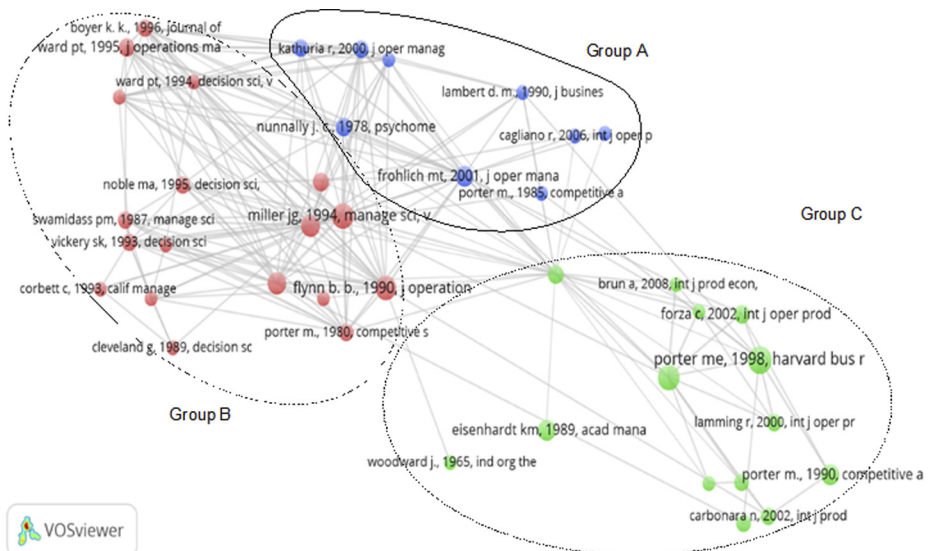

Figure 8.
Relationship map of essential articles in operations management

Source: prepared by the author

Group	Most influential works	Citations
A	Frohlich and Westbrook (2001)	6
	Nunnally (1978)	5
	Kathuria (2000)	4
B	Miller and Roth (1994)	9
	Flynn *et al.* (1990)	8
	Ferdows and De Meyer (1990)	7
	Hayes and Wheelwright (1984)	7
C	Porter (1998)	11
	Fisher (1997)	9
	Porter (1990)	6

Source: Prepared by the authors

Table VII.
Most influential works
in operations
management

As for the theoretical-conceptual bases, it was obvious that these are absolutely separate bases of knowledge – economic geography, strategy and operations – and there is no overlapping between them. The only author who emerges in the three bases is Michael Porter, with his work on competitiveness, because authors from the three lines of knowledge use the word "cluster" or the concepts of cluster defined by the Cluster Growth Theory of Michael Porter (1998a). It is recognized by the three lines of knowledge that Porter is the author who has shed light on the concept, which brings importance referring to his works. So, this study confirms the statement that Porter's work became the standard adopted by the research field (Martin and Sunley, 2003).

Finally, because the research chose to try and understand the use spectrum and structure of concepts correlated to the concept of cluster (agglomeration, industrial agglomeration, agglomeration of firms, agglomeration theory, cluster, cluster theory, industrial districts), if the themes of greatest production in each of the areas of knowledge are considered to be concepts (e.g. clusters *per se*, strategic groups and supply chain), it is perhaps not wrong to state that they are the translation of the cluster concept for each of them. After all, a strategic group *is* an agglomeration of firms; they are competitors, but share some beliefs and values. The supply chain can also be seen as an agglomeration of firms – customers and suppliers – but one that is even closer to the original concept when compared with the strategic group. The cluster seems to find its natural field of knowledge in economic geography.

Limitations and future research
The sample base, despite considering fairly influential periodicals in the areas of knowledge selected, can be considered to be a limitation. Future research should consider expanding it or even choosing other sources to examine if the conclusion would be the same.

The use of qualitative data analysis is also a potential source of limitation because it depends on the level of abstraction of the researches and may influence the themes found. Future research can conduct the qualitative analysis using other lines of knowledge, because a multidisciplinary approach could possibly make the process more robust and authoritative.

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