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A NEW LOOK INTO THE EVOLUTION OF CLUSTERS LITERATURE. A BIBLIOMETRIC EXERCISE

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A new look into the evolution of clusters literature. A bibliometric exercise

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Abstract:

In the contemporary globalising knowledge-based economies, local clusters have become crucial elements of regional development, assuming a significant role in both academic and political fields. Although there is an intuitive awareness about the raising importance of the theoretical debate on clusters, there is a substantial lack of empirical support of its precise magnitude and evolution. Moreover, the majority of literature surveys on clusters are exclusively qualitative-based.

Aiming at filling this gap, the main purpose of this paper is to provide a quantitative survey of the cluster literature, using bibliometric techniques based on articles. Based on a throughout analysis of all abstracts of articles on clusters published in journals indexed on the *Econlit* and EBSCO databases, covering the period 1962-2007, our research show that besides their importance in academic fields, the role of clusters has also been widely acknowledged in political spheres.

In parallel with the increasing interest in the 'local', there has been, as well, an emergent body of literature on global networks and clusters. Moreover, on the basis of the recent boom on clusters literature stands the emergent themes of 'local networks and social approaches' and 'knowledge-based theories'. Literature associated to 'regional and national innovation systems' and to 'institutional approaches' (local enrooted cultures, governance and customs) has been object of a particular dynamism since the 1990s.

Despite the evidence of a clear positive correlation between journals 'quality' and formal related research, the evolution of the literature on clusters continues to be mostly appreciative led.

Keywords: Clusters, Industrial Clusters, Industrial Location; Bibliometrics

JEL-codes: L22, R3, R10, R12, C89

1. Introduction

Interest in the economics of agglomeration and the distribution of economic activities geographically dates from the beginning of the nineteenth century. The earliest approaches to spatial economics can be traced back, among others, to the pioneering studies of Ricardo (1817), von Thünen (1826), Launhardt (1882) and Weber (1909). Despite the relevance of the previous insights, the issue of specialized industrial location gained particular importance with the seminal work of Alfred Marshall (1890), who recognized that the clustering of activities in a geographical area represented an important source of externalities to co-located firms (vom Hofe and Chen, 2006).

The seminal contributions from the classical authors set the path for subsequent theories on regional economic development, with emergent neoclassical literature in the 1950s and '60s (Perroux, 1950; Myrdal, 1957, Isard, 1956; Moses, 1958; Alonso, 1964; Muth, 1969; Mills, 1970; Evans, 1973). This literature played a crucial role in the improvement of classical models of spatial economics and theories of location; however, none of the neoclassical frameworks was able to provide a comprehensive and dynamic explanation of *why* and *how* economic activities tended to agglomerate in a specific geographical area (McCann and Sheppard, 2003).

Over the past two decades, research has provided important developments in the field of industrial location and spatial economics (Scott, 1988, 1998; Amin and Thrift, 1992). It has drawn the interest of a number of sciences, particularly that of economics (e.g., Krugman, 1991, 1998; Fujita et al., 2000). A whole range of *neologisms* related to the spatial patterns of local economic concentration has blossomed, with expressions such as 'new industrial spaces' (Scott, 1988), 'innovative milieux' (Aydalot, 1986; Maillat, 1991), 'neo-Marshallian nodes' (Amin and Thrift, 1992), 'learning regions' (Asheim, 1995) or 'local production systems' (Crouch et al., 2001). This growing interest of economists has produced an array of contributions that has also led to the emergence of the *New Economic Geography*, with a new generation of models of location (e.g., Krugman, 1991; Krugman and Fujita, 2004).

Globalization has challenged the classical premise of spatial and territorial proximity, highlighting the existence of technological and entrepreneurial proximity between firms, with no boundaries, based on the logic of codified knowledge and a *network* society (Enright, 1998; Bathelt et al., 2004). However, whereas the *global* is an emergent paradigm, the thriving phenomenon of 'industrial districts' and 'new industrial spaces' has led to an

important debate focused on regional development, since geographical proximity, in these cases, has generated rapid endogenous growth (Scott, 1988; Rosenfeld, 1997). In a logic of innovation and knowledge-based approaches, these highly specialized regions, also called 'innovative milieux' (Aydalot, 1986; Maillat, 1991) and 'learning regions' (Asheim, 1995), share common values, cultures and institutions, which promote an interactive learning process, and, thus, the diffusion of knowledge. They also share an intense network of informal linkages, and play an active role in the socio-cultural development of regions, promoting innovation as a sociological and learning process (Asheim, 2000).

Notwithstanding the intuitive awareness about the raising importance of the theoretical debate on clusters, there is a substantial lack of empirical support in the acknowledgement of its precise magnitude and evolution. Moreover, the majority of surveys on clusters literature constitute exclusively qualitative-based accounts.

Thus, the main purpose of this paper is to provide evidence that empirically complements a qualitative survey of the cluster literature, based on a bibliometric account which includes a comprehensive analysis and statistical treatment of all articles published in journals indexed in *Econlit* and EBSCO bibliographic databases, from 1962 up to 2007.

The paper is structured as follows. In the next section we highlight the main theoretical approaches and schools of thought that have emerged and developed since the nineteenth century, that is, we provide a 'qualitative' survey of the cluster literature. Based on the main research themes uncovered in our 'qualitative' survey, in Section 3 we put forward a 'quantitative' survey using bibliometric techniques. Finally, in Conclusions, we draw the most relevant outcomes of the 'qualitative' and 'quantitative' surveys on clusters.

2. Surveying clusters. A qualitative approach

2.1. The wide diversity of the concept of cluster

The evolution of 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 which it has developed. From the several perspectives that have been advanced in literature, it result a wide variety of concepts and definitions (Martin and Sunley, 2003).

Summarizing this wide variety, we might put forward three main relevant dimensions of the concept of cluster. The first of them is *geographical proximity* among cluster's elements (Doeringer and Terkla, 1995; Swann and Prevezer, 1996), which generates agglomeration

economies (scale and scope economies), through internal specialization and division of labour. The other dimension 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 (share of common technologies, labour, infrastructures), and to the transmission of knowledge and collective learning (Asheim, 1995). The third dimension respects to *culture* (institutions, common values and beliefs) *and business climate* (such as trust, informal ties, cooperation), that allows to the development of new ventures and, thus, to the evolution of the cluster itself (Maskell, 2001; Rosenfeld, 2005).

More recently, the cluster concept has been interpreted in the light of systemic and evolutionary perspectives (e.g., 'innovation systems' and 'institutional' approaches). These approaches attempt to explain clusters' dynamics into broader networks of agents ('regional innovation systems') or based on technological paths of regions and their historical trajectories (institutions or cultures).

2.2. The evolution of the literature on clusters: from a *resource* emphasis to a focus on *institutions and systems*

Literature on clusters has its primary foundations in the classical theories of location of the nineteenth century (Marshall, 1890), but has reached its most significant expression in the recent decades, after the 1970s (Scott, 2000).

Over the last fifty years, it is possible to differentiate four important periods in the literature about industrial location and clusters. First, the mid-century period (decades of 1950s and 1960s), that inspired the development of neoclassical models and theories of location (Isard, 1956; Moses, 1958; Alonso, 1964; Muth, 1969; Mills, 1970). Second, the decades of 1970s and 1980s, which explained a shift in literature, with the phenomena of the 'italian industrial districts' (Becattini, 1979; Brusco, 1982) and the 'new industrial areas' (Scott, 1988). Third, the period of the 1990s, that witnessed an increasing and renewed interest of the economists in geography and the economics of location (Porter, 1990; Krugman, 1991; Fujita, 1996) and led to an extraordinary boom of the research activity about industrial regions and clusters (Scott, 2000; Martin and Sunley, 2003), as well as to the emergence of the 'new economic geography' (Krugman, 1991). At last, the period that we are now experiencing, in this beginning of the twenty-first century, in which new institutional and evolutionary approaches (Lundvall, 1992; Asheim, 1995; Cooke et al., 1997, 1998) to the economic geography have been developed to analyse the development of regions and their evolution over time.

Based on these specific periods and, more generally, it is also possible to mark out (albeit in a simplified way) three main key issues wherein the research activity has been mainly focused. These are: focus on *resources* (physical raw materials, production factors); focus on *social networks* (firms' interdependencies); and focus on *institutions and systems*.

The classical and neoclassical theories: focus on 'resources'

The *focus on resources* is particularly linked to the period between the nineteenth century and the first half of the twentieth century, where the development of the classical theories and the neoclassical models of location have clearly put an emphasis on *physical resources and production factors*. Here, the concept of 'territorial space' is purely theoretical and the analysis of industrial location is mainly based on static modelling and on the simplifying assumptions of competitive markets and constant returns to scale (Boschma and Frenken, 2006). Although there may be quite idealistic assumptions underlining the neoclassical models of location, classical and neoclassical literature had always intended to constitute a framework of analysis for all types of industrial localization phenomena, generalized to all sectors and industries (McCann, 1999).

Recent studies of the 'new economic geography' and 'industrial clustering' (Porter, 1990; Krugman, 1991; Fujita, 1996) also attempt to provide a general approach to the analysis of industrial location behaviour, adaptable to all contexts and sectors of activity. However, these new approaches exclusively explain the tendency of firms to agglomerate in a particular geographical area through the existence of positive externalities deriving from firms' co-location processes (Fujita and Thisse, 2002).

The 'social turn' in the economic geography: focus on 'social networks'

The decades of 1970s and 1980s represented a turning point in the cluster literature. After the effects of the post-war reconstruction and the Fordist regime of mass production have fallen into a paradigm's crisis, many spatial asymmetries, that during the decades of 1950s and 1960s were already a distressing reality, became highly perceptible. This was particularly true in long-established industrial regions, based on raw materials locations and on traditional manufacturing sectors. This has raised deep concerns in terms of regional development both in political decision-making and in academic circles (Moulaert and Sekia, 2003). In this context, the 'flexible production system' has entirely risen as a new paradigm along with a changing international order and a globalizing context of intensified competition and rapid changes (Scott, 1988). This 'flexible production system' called to memory the Marshallian principles and brought about an innovative and refreshed version of his 'industrial districts'

(Paniccia, 2002). 'Industrial districts' were, in fact, a thriving phenomenon across the western countries. They were particularly observed in Italy (such as the case of the Third Italy), in France (such as the Scientific City of the Southern Paris region) and in the United States (such as the Silicon Valley complex) (Scott, 1988).

From these successful cases of industrial dynamics, in the decades of 1970s and 1980s, three main schools and theoretical approaches have emerged. First, the Italian School on 'industrial districts' (Becattini, 1979, 1990; Piore and Sabel, 1984). Second, the GREMI approach, with the notion of "innovative milieu" (Aydalot, 1986; Aydalot and Keeble, 1988; Camagni, 1991). At last, the Californian School, with the concept of the "new industrial spaces" (Scott, 1988). One interesting fact was that all of these schools or approaches had in common both the geographical and the sociological dimensions of the clusters (Martin and Sunley, 2003).

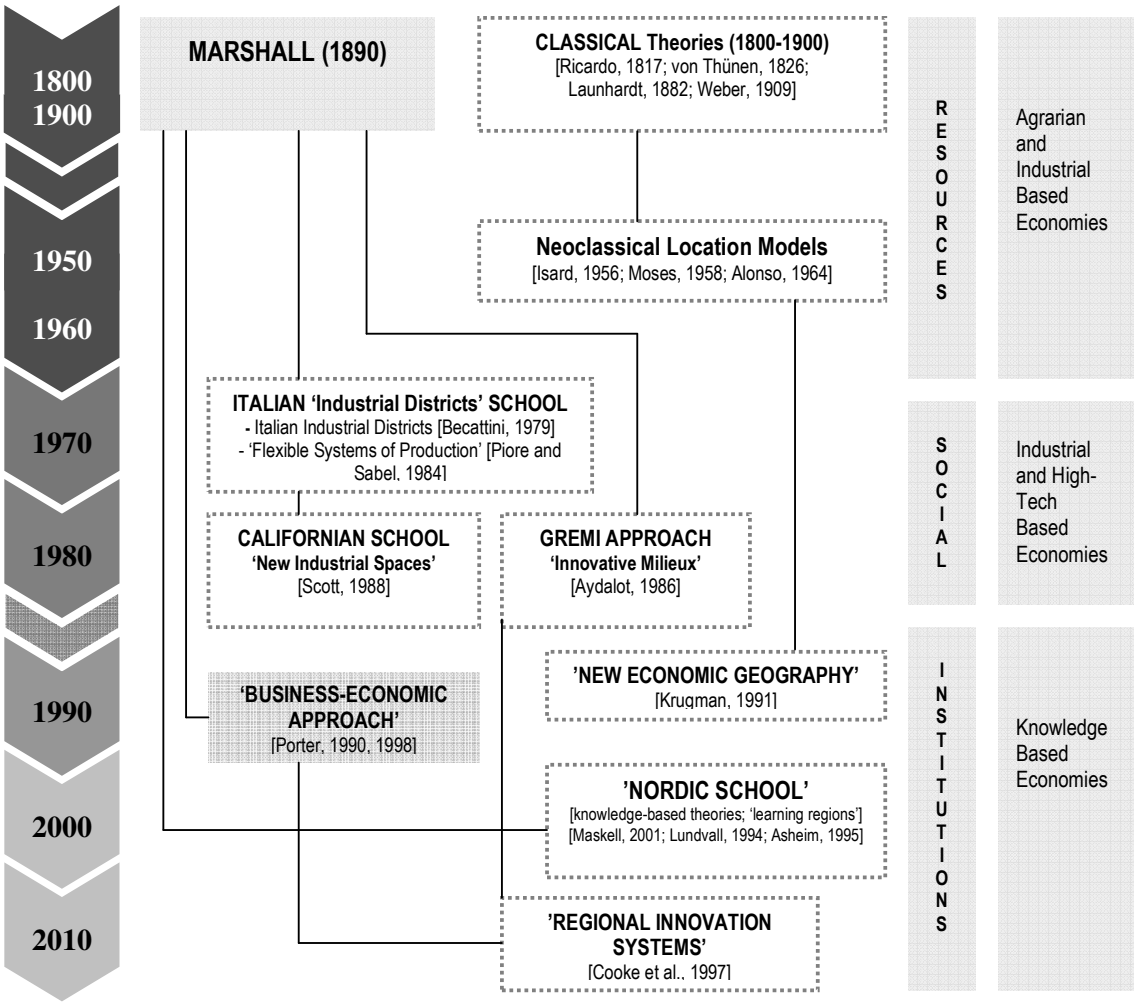

Figure 1: Cluster Literature - Schools of thought and their derivations

Contrasting with the previous neoclassical approaches, the research of this period has given special emphasis not to 'physical resources' but to the 'social and relational element' present in industrial locations: it *focused on social networks*. Thus, perspectives on location became socio-relational and contextual-driven. They were particularly based on sociological approaches to clusters, with a specific focus on social networks and the nature of firms' interactions (Granovetter, 1985). Here, the analysis of empirical case studies has gained particular significance and led to the assumption of 'geography' as a real phenomenon where interactions and social processes take place.

The decades of 1970's and 1980's also constituted a very enriching period in terms of production and study of analytical techniques and quantitative methods for the identification of clusters, industrial complexes, and for the investigation of regional trading patterns (Latham, 1976). Of particular relevance was the remarkable study, presented in the end of the 1970's, by Czamanski and Ablas (1979), about the clarification of the concepts of 'industrial clusters' and 'industrial complexes'. These authors proposed a comprehensive review of the mathematical tools and quantitative methods that had already been employed in the literature for the methodological identification of industrial groupings as 'clusters' or as 'industrial complexes' and, at the end, they attempt to provide an uniform measure to allow the comparison of all the results.

The recent boom in the cluster literature: focus on 'institutions' and 'systems'

The decades of 1990s and 2000s have witnessed the emergence of new approaches to regions, which attempt to consider not only that institutions and cultures (locally embedded) are determining factors of location, but also that historical paths and technological trajectories play a key role in the evolution of regions (Boschma and Frenken, 2006).

Recent trends in clusters literature are mainly explained by the development of 'knowledge-based theories' (e.g., Asheim, 1995; Malmberg and Maskell, 2002; Bathelt et al., 2004) and 'social and network approaches'. It is particularly highlighted the role of learning processes and knowledge spillovers as well as the importance of social networks and firms' interactions in the diffusion of information and the creation of new projects (products, businesses, ideas) (Saxenian, 1994), that lead to the cluster's development.

'Innovation systems' and 'systemic' approaches (Lundvall, 1992; Cooke et al., 1997, 1998) to clusters have also been developed, considering clusters as elements of broader networks, such as 'regional innovation systems'. These approaches emphasise the role of interactions among the diverse agents of the innovation system (universities, government, associations,

organizations) as determining factors of innovation processes. They also highlight the systemic and institutional character of the innovative processes.

Here, appreciative studies have been developed with a particular focus on *institutions* and *systems of innovation.* These approaches consider that locally rooted factors, such as tacit knowledge, institutions and cultures, are influential in firms' location, as well as that historical and technological paths play a key role in the evolution of clusters (Boschma and Frenken, 2006). In this context, appreciative methods and evolutionary approaches have been developed with a particular focus on *institutions* and *systems of innovation.*

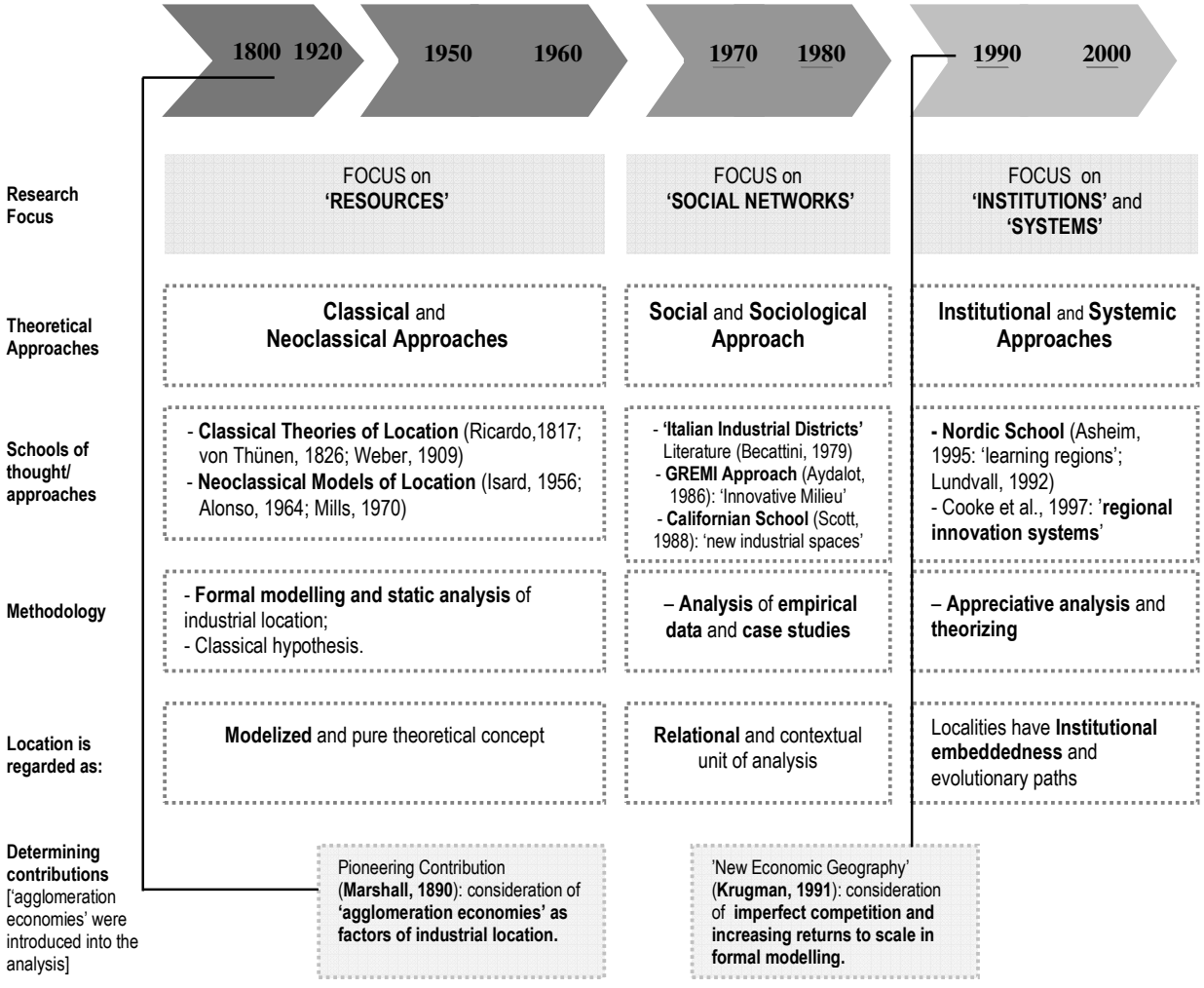

Figure 2: Theoretical approaches on the economics of location

From Figure 2, we observe that the most recent approaches have put a particular emphasis on the role of 'cultures and institutions' in order to explain the dynamics of spatial clusters and regions. One of their most innovative contributions, in the explanation of regions' performance, was the fact that they have gradually turned from 'economic factors' (grounded

on ‘agglomeration’ or ‘location’ economies), to rely progressively more upon ‘social, cultural and institutional’ determinants (Amin and Thrift, 1994). Here, we clearly notice the ‘institutional focus’ that these most recent approaches have given to the analysis of clusters and regions.

Thus, as we gradually move from agrarian and industrial-based economies to knowledge-based societies, research perspectives on clusters and regions have become focused onto more ‘institutional’ and ‘systemic’ analysis. This is explained by the fact that dynamics of regions have become grounded on more complex and intangible assets, such as knowledge, creativity and innovation processes (Scott, 2007), that are captured with difficulty by pure formal modelling and general theorizing. They can be better recognized with more qualitative or appreciative analysis of each case and this has been the methodological focus of institutional approaches (Boschma and Frenken, 2006).

2.3. The main research themes in cluster literature

As mentioned in the previous sections, the literature on clusters has been subject of a rapid expansion in the recent years, covering a wide range of research topics (McCann, 1995; Scott, 2000; Martin and Sunley, 2003). The combination of the articles by Breschi and Malerba (2001) and Malmberg and Maskell (2002), together with a throughout analysis of the literature on clusters, permitted to come up with a set of main research themes on this rich area of research.

In a first level, literature on clusters is predominantly related to *‘ideographic’ studies* (Malmberg and Maskell, 2002), based on factors behind the formation and the development of clusters. This stream of literature (e.g., van der Linde, 2003; Brenner, 2004; Maskell and Malmberg, 2007) attempts to explore the historical roots and origins of localized clusters and the potential episodes that might have conducted to their formation. This also explores the subsequent stages of evolution, from growth to maturity and, eventually, the decline and renewal of clusters (e.g., Audretsch and Feldman, 1995). These ‘genealogical approaches’ (Malmberg and Maskell, 2002) have put forward some key factors on the clusters’ emergence and development. In the emergence phase, they have been related to the entrepreneurship of a local manufacturer that gave rise to new businesses in the geographical area of his residence. By its turn, in the growth stage, they have been mostly associated with spin-offs, attraction of new firms or even the presence of local rigidities or ‘inertia’ (Maskell and Malmberg, 2007), resulting from the fact that, once established in a particular location,

firms rarely move to another region (Malmberg and Maskell, 2002). There have been also some noticeable attempts to describe reasons behind the decline and depression of 'old' regions (Boschma and Lambooy, 1999), and theoretical approaches related to 'path dependence' or 'technological and institutional lock-in' (Grabher, 1993) have been advanced in order to explain the declining stages of mature and long-established clusters and industrial regions.

A second research stream of the literature on clusters is mainly concerned with the 'transaction costs-minimization' approach and relates to the *agglomeration economies* deriving from the clustering process (Fujita, 1996; Fujita and Thisse, 2002). This line of research is founded on the Marshallian principles of industrial location and, as mentioned earlier, refers to the economic benefits that co-located firms may accrue from being spatially agglomerated: scale economies; specialized labour market; reduced interaction costs among co-located firms, due to the intensification of their connections; and the access to specialized institutions, suppliers and infrastructures.

The third subject in the cluster literature, consisting in one of the most prominent approaches of these recent years, is the *'knowledge based' and learning approaches* (Lundvall, 1994; Asheim, 1995; Maskell, 2001). They 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. In this perspective, the creation and dissemination of new knowledge can be only assured by the local proximity of the agents. Firms' interactions; the proximity to sources of new technological information (such as research institutions, leading firms, or specialized entities); similarity of organizational cultures; high mobility of qualified workforce; and the proper entrepreneurial environment facilitate the diffusion of new technical know-how and technological experiences (Isaksen, 2001).

The broader *systems of networks* stand as another research theme and it is concerned with the scale of analysis of clusters as structures within such systems. For instance, they take part of wider or universal relationships, such as global 'pipelines' of connections (Bathelt et al., 2004), with one of its major exponents in the 'Information and Communication Technologies' sector. On the other hand, they may belong to other forms of regional specialization, such as 'regional innovation systems' (Cooke et al., 1997, 1998) or 'national innovation systems' (Lundvall, 1992). These wider structures influence clusters' development by the incorporation of more ample and transversal networks of agents. The

latter can be the public administration, the general system of education, research centers or local entities, among others. They play a role in promoting investment, new technologies and innovation. This is a systemic perspective of analysis that relates the local dimension of clusters to more inclusive levels of governance and institutional contexts (Isaksen, 2001; Wolfe and Gertler, 2004).

The relation between clusters' competitiveness and the development of regions is the main focus of an approach which suggests a framework of analysis in terms of *regional innovation policies* (Porter, 1998; Ketels, 2003). In this topic, the majority of the literature relates to the (in)efficiency of public policies in the definition of policies to the creation of new clusters, by employing 'top-down' interventions, such as the creation of technological parks, technopoles, firms' incubators or scientific cities (Breschi and Malerba, 2001).

The international perspective is also present in the cluster literature through the recent debate concerned with the impact of *multinational corporations on the development of local clusters* (Young et al., 1994). By their dimension, multinational companies take part of global networks and local firms in clusters may benefit from the relationship with such enterprises, by widening their technological and technical know-how. This happens if there are strong ties between the local firms and the multinational subsidiaries (Young et al., 1994). However, foreign-owned companies may have a negative effect over the cluster's growth, when there are weak linkages and synergies between the region and the multinational subsidiary. If the cluster has low intervention in supplying or co-operating with the located multinational company, then, the latter may well jeopardize the cluster's process of development, since it will be mostly preserving strong links with centralized suppliers of its parent corporation (Birkinshaw and Hood, 2000). This raises the issue about what are the privileged means of diffusion at distance ('pipelines') of the codified knowledge. The Information and Communication Technologies (ICT) sector is one of the most recognized cases where it is possible to transfer high flows of information that can be rapidly decodified over longer distances. However, these global systems of communications have limitations, since localized and tacit knowledge represents a crucial factor in the interpretation, acquisition and assimilation of new technologies and technical know-how by firms (Morgan, 2004).

A path breaking approach within the clusters literature is related to *social networks and institutional approaches to clusters*. The associated insights are mainly found on the appreciative and empirical analysis of 'clusters case studies' (Boschma and Frenken, 2006). These branches imply particularly a qualitative analysis. It comes out with the purpose of

overcoming the possible flaws derived from the statistically-centred methods. In this perspective, clusters' dynamics can only be assessed from a qualitative point of view, through the employment of research techniques such as in-depth interviews, inquiries, bibliographic and ideographic information about clusters and their main aspects (Saxenian, 1994; van der Linde, 2003).

Finally, the *methodological approaches* to cluster analysis have been a prominent topic in the literature. Here, a great diversity of methods and techniques has characterized the literature concerning quantitative and empirical descriptions of clusters' dynamics. There exists one particular stream of this literature that encompasses all the statistical oriented methods and technical mechanisms that have been developed to provide more objective ways of identification, classification and explanation of clustering processes. In this context, one of the most popular techniques is the use of the 'employment location quotient' to the diagnosis of the region's degree of specialisation (Wolfe and Gertler, 2004). More enhanced techniques are constituted by the input-output matrixes and models of multivariate analysis, in order to capture the inter-firm and inter-industries' networks of connections (vom Hofe and Chen, 2006). In the most recent range of contributions employing stochastic methods to analyse clusters' dynamics, particular relevance shall be given to the work of Brenner (2004), who developed a mathematical model that allows to the analysis of conditions for the emergence of clusters, through empirical testing.

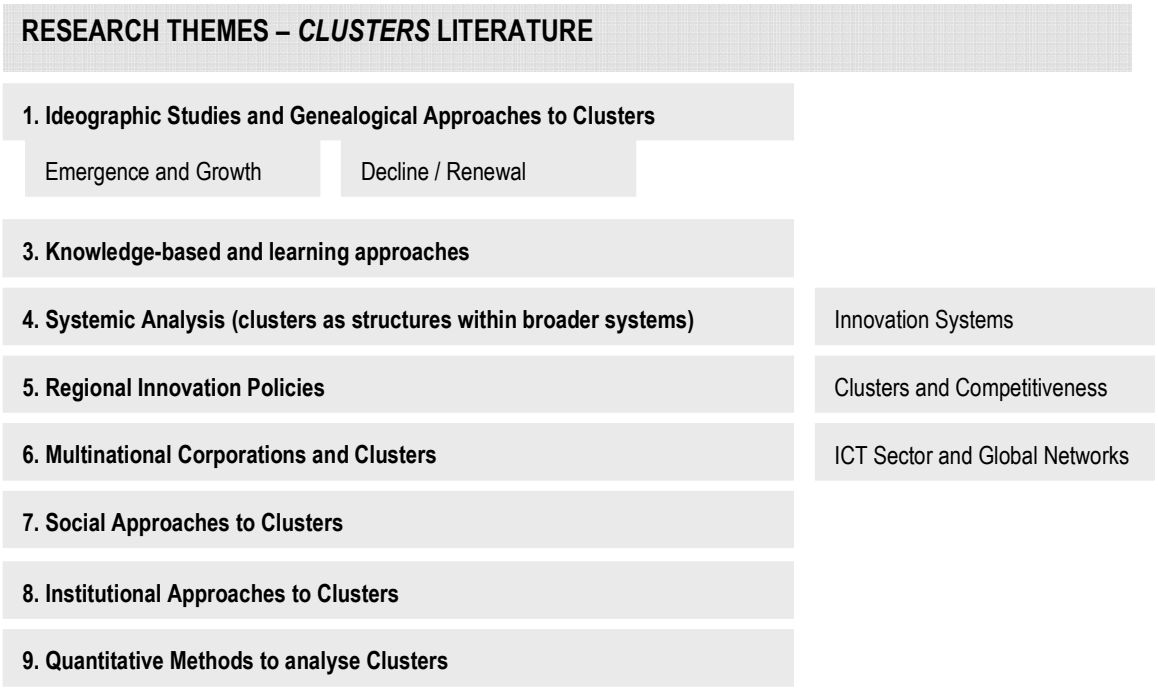

Figure 3: Summarizing the main research themes on *Clusters* Literature

3. Surveying clusters. A quantitative approach

3.1. Methodological underpins

Our point of departure was the articles published in journals from economics and management areas that were indexed in the *Econlit* and EBSCO databases. Accordingly, the time span covers the period May 1962 to May 2007.

Using the expression 'cluster*' as the search keyword, we constructed a database of articles published on clusters.[1] Information corresponding to 'erratum', 'corrigendas' or 'notes' from editors was not considered in the analysis. The references collected were then directly exported and treated in the Excel® program. The statistical analysis was performed using the SPSS® software.

Relative to the EBSCO database, from the ancient to the most recent article (i.e., from May 1962 up to May 2007), we obtained 6356 articles (with and without abstracts). However, after reading thoroughly each abstract or title information, we found evidence that not all the articles constituted relevant information to our domain of analysis. As the term 'cluster' signifies, in general terms, 'sets' or 'groups' of interrelated or homogeneous components, most of the articles from the database were not concerned to the cluster concept in terms of economics of location or regional science related research. They were mostly concerned to the use of specific techniques of 'cluster analysis' in statistics or other sciences (e.g., technologies, mathematics, social sciences, etc.).

We selected out the relevant articles from those that were not relevant to our analysis, using straightforward but extensive techniques. They mainly consisted on the systematic reading of each article's abstract, one by one. At the end of this process, we eliminated from the EBSCO database the articles that were not relevant to our analysis. From an initial database of 6356 articles, we ended with 854 records (with and without abstracts), which represent about 13% of the original database.

Concerning *Econlit* database, from the earliest to the latest article (i.e., from February 1979 up to November 2006), we obtained 1934 articles (with and without abstracts). However, after reading carefully each article's abstract, we selected as relevant 671 articles. A part of these relevant articles (276 articles) was repeated in the EBSCO database (the other database that we had analysed). Thus, after removing all the articles not pertinent to the analysis as

[1] Putting the '*' after the word 'cluster' it enables a more encompassing search in the sense that it selects articles where the word 'cluster' and/or its derivations (such as 'clustering' or 'clustered') appear (in the title, abstract or keywords).

well as the repeated records, we came to a result of 395 articles, which represent about 20% of the original *Econlit* database.

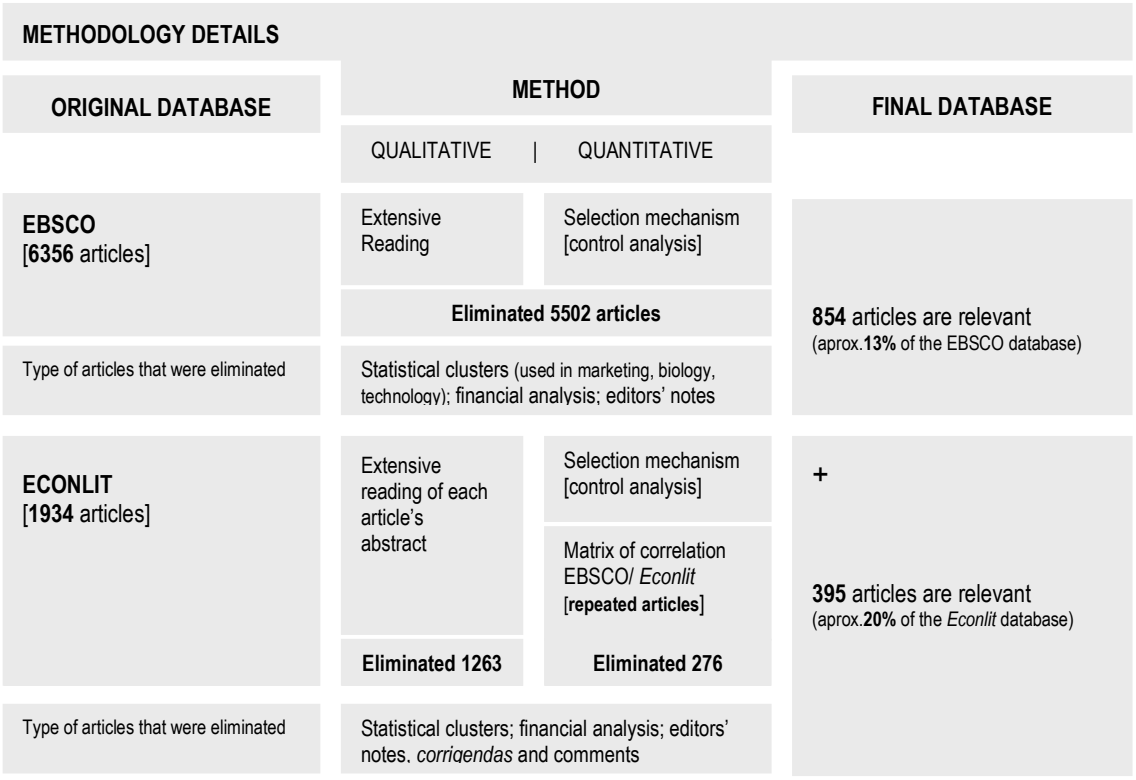

Figure 4: Methodological details

Grouping the results from both databases (*Econlit* and EBSCO), we ended with 1249 relevant articles to classify (about 15% of the overall original amount).

After having the refined databases, we proceeded to the classification of the relevant articles into categories, based on the main themes presented in Section 2.3., and according to their type (i.e., survey, empirical, empirical and appreciative, appreciative, formal and empirical and formal).

The classification according to articles' type follows the distinction proposed by Nelson and Winter (1982) concerning '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 modellization, these authors suggest that 'formal' include a 'logically structured theorizing', whereas 'appreciative' constitute a 'more intuitive' form, based on 'judgments and common sense' (Nelson and Winter, 1982: 9). Therefore, in our work, we classify as 'appreciative' the articles that relied on critics, judgments, appreciations,

appraisals or theoretical arguments. On the other side, we characterize as 'formal' the articles that include a mathematical model or an analytical or logical framework. If these formal articles include, as well, the testing of data on the displayed models, we classify them as 'formal and empirical'. If the article only (or substantially) refers to the econometric or statistical testing of data, we classified it into 'empirical'. Finally, when the article contained an appreciation or a comment plus empirical data analysis, we classified it as 'appreciative and empirical'.

The categorization of publications in terms of research topics was possible through the analysis and interpretation of each article's specific abstract. We classified all the articles in terms of ten main themes: 1) *Ideographic and Evolutionary approaches to Clusters* (here we consider the descriptions and analysis of clusters, concerning 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'); 2) *Agglomeration Economies* (that include either the economies of specialization (Marshallian or localization externalities), or the economies of diversification (Jacobian or urbanization economies), and either 'pecuniary externalities' or 'untraded interdependencies', not measured in monetary terms); 3) *Knowledge based theories, Localized learning and Knowledge spillovers* (this category also comprises articles relative to human capital, high-tech clusters, innovation and R&D processes); 4) *Regional and National Innovation Systems*; 5) *Industrial Policy and Regional Development Policies*; 6) *ICT, Internationalization, Global Networks, Multinationals and Local Clusters*; 7) *Networks and Social approaches to Clusters*; 8) *Institutional approaches to Clusters* (this category is particularly centred on 'institutions' (i.e., practices, routines, values, customs), on local governance, agents' coordination and regional cultures); 9) *Methods and Measures*; 10) *Other* (mostly related to financial (e.g., risk analysis) and ecologic (e.g., energetic resources) approaches to clusters).

After the classification of the articles, we then proceeded to the construction and statistical analysis of the database, aiming at obtaining a dynamic perspective of how the themes and types evolved in the period in analysis (1962-2007). We also assessed published articles' quality based on journal rankings. The classification of journals was made accordingly to WU Wien Journal Ranking 2001.[2] This is a list developed by the Wirtschaftsuniversität Wien (Vienna University of Economics and Business Administration) that covers over 1700 entries

[2] Available on: http://www.wu-wien.ac.at/fides-/rating-definition_en.html, accessed on 29 November 2007.

in the research areas that we found most associated with the journals that we had in our database (both from economics and business management). Accordingly, the journals are classified into six different categories: AA, corresponding to "Top journals, with a worldwide distribution and readership, covering the entire scope of a discipline", where "contributions are methodologically fastidious and innovative"; A, corresponding to "Worldwide distributed journals; emphasis in just one linguistic area", where contributions are "frequently a pioneer work or milestones of the respective discipline"; B, relative to "Journals with, at least, supra regional distribution in any language; covering at least an established sub discipline", where "contributions are scientifically innovative" and "understandable for practitioners without any degree in relevant studies"; C, comprising the categories of journals with "at least, national distribution, covering, at least, an established sub discipline", where "the editors pay attention to legibility for non-scientist"; D, relative to journals with "at least, national distribution; specialized on any level" and where "contributions contain results in simplified form". Finally, we add the category of 'non-classified' (NC) journals, which corresponded to journals that have not yet been subject to any classification by the Wien list of rankings 2001 but that appeared in our database.[3]

3.2. Evolution of the research themes in the thematic of *Clusters*

The decade of 1990s and, particularly, the beginning of the twenty-first century, witnessed a remarkable increase in the production of articles about clusters (see Figure 5). This trend on publications is mostly derived from the increasing importance that, over the recent years, local specialization and clusters have accrued either in academic or in political fields, in parallel with the increasing amount of research about globalization and global networks (Fujita et al., 2000; Krugman, 1991).

This interest in the 'local' is in direct relation with the globalisation effects, such as the external economies of scale that co-located firms may accrue from the enlargement of markets and trade liberalization. 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.

[3] For statistical purposes we made a numerical correspondence scale to the original classification: AA – 6; A – 5; B – 4; C – 3; D – 2; NC - 1).

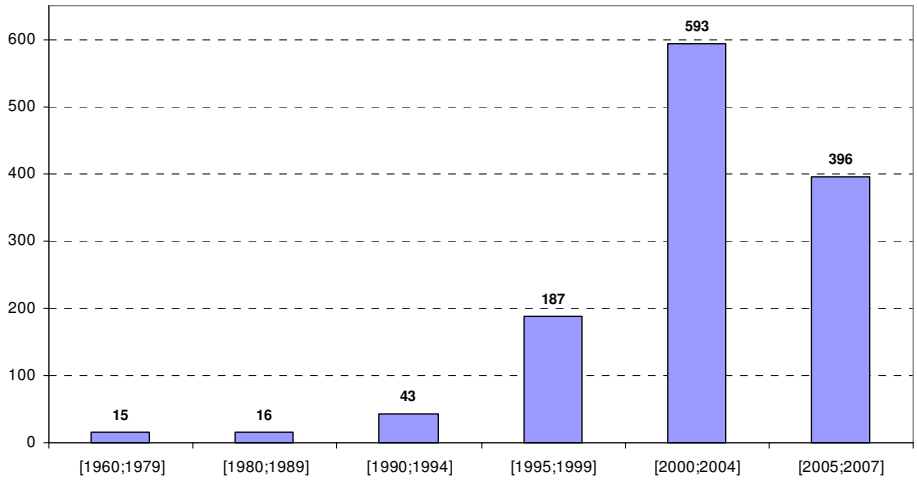

Figure 5: Evolution of the total articles published on clusters, 1962 – 2007

Note: the last column only respects to the last two years, until January 2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

This last argument also explains why the theme 'ICT, global networks, multinationals and clusters' has observed a growing amount of literature in the recent years. Here, there is a considerable range of publications stressing the impact of ICT on the diffusion of knowledge, as well as the effect of multinational companies on local clusters, and firms' internationalization due to the integration of clusters in global value chains (see Figure 6).

Another theme that has registered an increasing trend since the decade of 1990s is 'Networks and Social approaches to clusters', which is related to the importance of local networks and untraded interdependencies (e.g., informal interactions, local 'buzz', business culture, local information flows) among clusters' elements. The studies on local networks and social approaches have accompanied the thriving development of the 'knowledge-based theories', a theme that has also rendered a growing amount of publications in the latest years. Effectively, this rise on the 'knowledge-based theories' is behind the recent boom in clusters' literature, as we have previously seen on Section 2. This corpus of theories emphasizes the role of tacit knowledge, local knowledge spillovers and processes of innovation in the explanation of clusters' local dynamics (most of them, concerned to high-tech clusters and the concept of 'innovative milieu'). We may also add the fact that 'networks and social approaches to clusters' and 'knowledge-based theories' appear, to some extent, related with each other in literature. This is because local networks and organizational cultures play a crucial role in the spread 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, about knowledge spillovers and innovation processes).

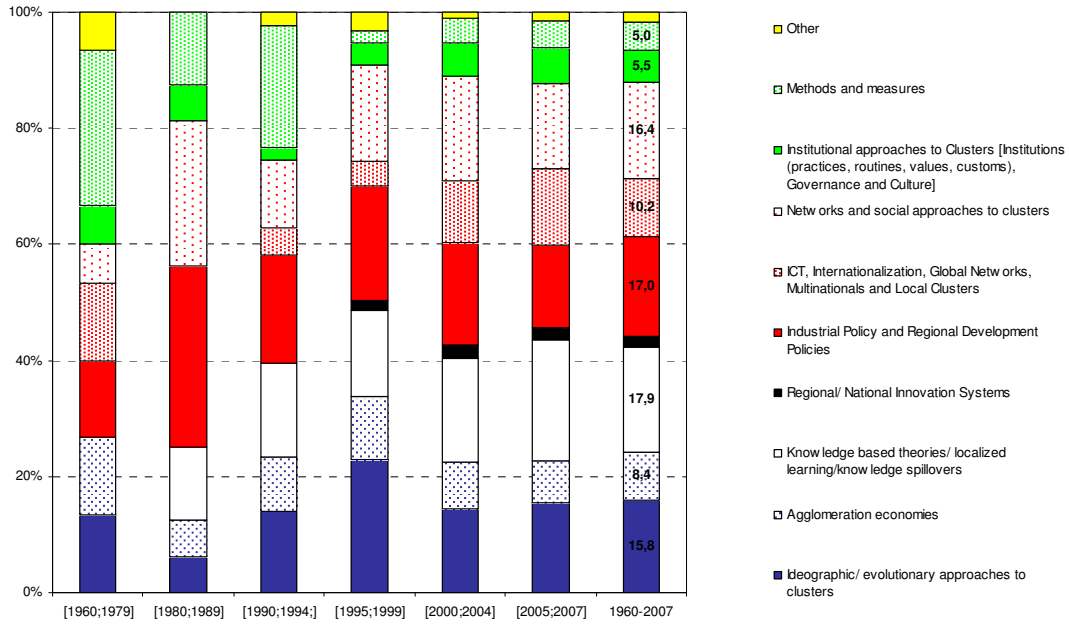

Figure 1: Total published papers (1249 records) on clusters, by theme (1962-2007)

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

There is another interesting conclusion drawn from Figure 6. Since the decade of 1980s, we noticed a gradual decrease in the relative weight of the category 'Methods and Measures' in favour of more qualitative themes of analysis, such as 'Networks and social approaches', 'Industrial policy' and 'Ideographic/ evolutionary approaches'. This last theme, 'Ideographic/ evolutionary approaches to clusters', reflects the range of case studies, most of them based on 'appreciative' or 'empirical' analysis, about the factors underpinning the formation and the dynamics of clusters along their life cycles (e.g., emergence, growth, maturity, decline, renewal). These tendencies represent, on one hand, the 'relational turn', that occurred in the economic geography, in the 1980s, and that gave rise to the development of approaches considering clusters as socio-relational entities, as we have previously seen in Section 2. On the other hand, and if we look particularly at the period 1995-1999, we observe that the category 'Methods and measures' has achieved its minimum relative weight when the theme 'Ideographic/ evolutionary approaches to clusters' reached its maximum. This specific 'turning point' verified in our sample turns it clear that as clusters' literature became more

centred on qualitative and evolutionary approaches, being less dependent on exclusivelly quantitative methods (based on statistical oriented methods).

It is also interesting to notice that the maximum relative weight that 'Methods and measures' have registered was on the 1970s. This decade constituted a very enriching period in terms of conception of analytical methods and quantitative analysis of clusters and other types of industrial phenomena (Latham, 1976). The increasing development of qualitative analysis in the study of clusters is particularly explained by the need that researchers had in considering information that is relevant to understand clusters' dynamics and that are not captured by simple modelling or the exclusive use of analytical methods.

The emergent research themes in cluster literature are related to 'regional and national innovation systems' as well as to 'institutional approaches' (most concerned to local cultures, institutional embeddedness, governance, traditions and customs). Although these categories have only received particular attention in the most recent years, they have been subject to a growing amount of publications since the 1990s. This reflects the role that has been given to clusters as elements of broader systems (such as regional innovation systems), as well as to the importance of institutions (e.g, local cultures and situated political action) in clusters' development.

We also notice a close association between the themes of 'regional innovation systems', 'institutional approaches' and 'knowledge-based theories'. This is likely to be 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, represent crucial conditions to the development of knowledge-based clusters and to the production of innovations (e.g., the Triple Helix model).

A constant feature of the whole period of analysis is the importance that the theme 'Industrial policy and regional development policies' observed over time. Such steady tendency reflects the acknowledged impact that clusters have in the definition of political programmes and in terms of regional policies. Indeed, for instance, Porter's (1990, 1998) approaches on clusters have had a particular influence in political fields.

3.3. Evolution of the research types in the thematic of *Clusters*

Looking at the published articles by main type, we observe (Figure 7) that the most predominant type is 'appreciative', encompassing on average 62,5% of total published papers.

'Formal and empirical' and exclusively 'empirical' analysis that, in the decades of 1970s and 1980s, encompassed a relatively important share of published papers (around 25%), saw its relative importance declining after the beginning of the 1990s, representing more recently around 10% of the total papers.

'Appreciative and empirical' related research, in contrast, registered a significant increase. This type of analysis has been gradually employed in clusters' case study related research, especially in themes such as the 'knowledge-based theories' or the 'networks and social approaches' to clusters (see Table 1), in order to complement theoretical debate with empirical evidence.

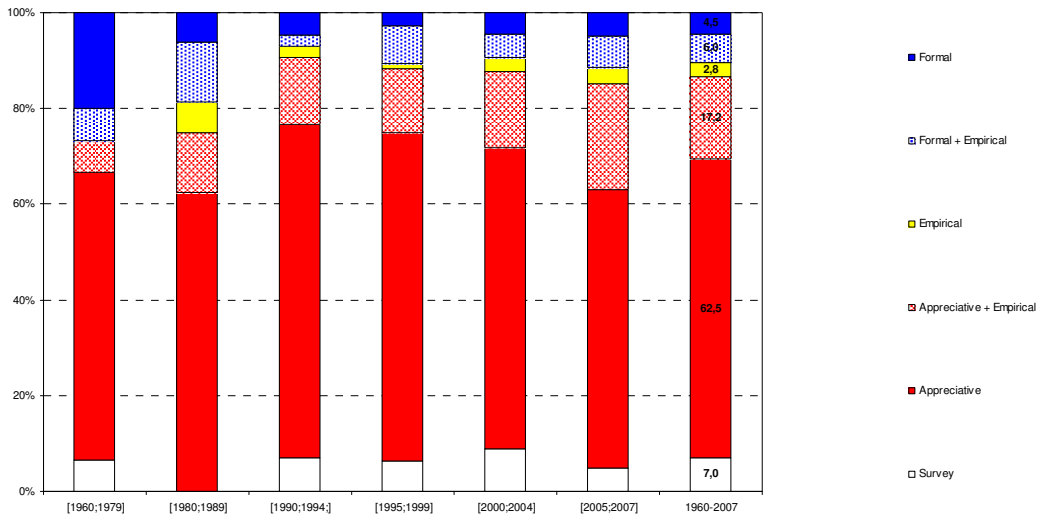

Figure 7: Total published papers on clusters by type, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

Figure 7 clearly displays the difficulty of researchers in describing the cluster phenomenon by means of formal modeling or exclusive quantitative analysis. This gave opportunity to the extensive development of appreciative and qualitative analysis to tackle with the drawbacks of quantitative methods.

Concerning the characterization of type by theme, from Table 1, we observe that the categories of 'Ideographic/ evolutionary approaches to clusters' and 'Agglomeration economies' are those that reveal the highest percentages of formal and empirical analysis from the whole range of themes. In the case of 'ideographic approaches to clusters', this tend to be related with the fact that, in parallel with the development of appreciative analysis of

case studies (e.g., based on 'genealogical approaches' or in 'path dependence' literature), there have been also advanced formal and mathematical models to describe clusters' dynamics, through evolutionary approaches (e.g., Brenner, 2004). Thus, this category comprises a strong component of both qualitative and formal analysis, because evolutionary approaches often employ 'formal modeling' (namely, simulation) as a mechanism to develop testable assumptions (Boschma and Frenken, 2006).

Table 1: Articles on clusters - Type by Theme, 1962-2007

	Survey	Empirical	Appreciative + Empirical	Appreciative	Formal + Empirical	Formal	All papers
Ideographic/ evolutionary approaches to clusters	12,5	2,9	15,8	16,1	17,3	**23,2**	15,8
Agglomeration economies	19,3	**31,4**	8,4	2,4	**24,0**	**39,3**	8,4
Knowledge based theories/ localized learning/knowledge spillovers	**19,3**	17,1	**25,6**	15,7	16,0	19,6	17,9
Regional/ National Innovation Systems	3,4	5,7	2,3	1,7	4,0	0,0	2,1
Industrial Policy and Regional Development Policies	13,6	5,7	8,4	**22,3**	5,3	5,4	17,0
ICT, Internationalization, Global Networks, Multinationals and Local Clusters	3,4	8,6	8,4	**12,8**	2,7	1,8	10,2
Networks and social approaches to clusters	17,0	11,4	**19,5**	16,6	14,7	5,4	16,4
Institutional approaches to Clusters [Institutions (practices, routines, values, customs), Governance and	4,5	2,9	2,3	7,6	0,0	0,0	5,5
Methods and measures	3,4	11,4	5,6	3,8	**16,0**	3,6	5,0
Other	3,4	2,9	3,7	0,9	0,0	1,8	1,6
All papers	100	100	100	100	100	100	100

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

In the case of 'Agglomeration economies', the predominance of formal and empirical analysis can be explained by the fact that this theme largely involves publications on 'transport-costs approaches', localization economies, and clustering advantages, mostly described through the use of formal (neoclassical) models and empirical testing.

In terms of 'Knowledge-based theories', the theme concentrates a higher level of 'appreciative and empirical' as well as of 'survey' and 'formal' analysis in its explanation of clusters. This apparent combination of either qualitative or quantitative analysis with rather identical importance is due to the use of both 'formal analysis' and 'appreciative theorizing' to study local knowledge spillovers, the geography of innovations and localized learning processes. This is also related to the fact that evolutionary approaches (based on both appreciative analysis and formal testing of theoretical hypothesis) have increasingly been used to explain knowledge spillovers as 'self-reinforcing sources' of agglomeration economies that are responsible for the technological path of regions (Boschma and Frenken, 2006).

The categories of 'Industrial policy' and 'ICT and global networks approaches' reveal a particular tendency to use 'appreciative theorizing', which is a natural characteristic in these themes, since they are specifically related to 'assumption debate' and general appreciation of industrial policies and global integration processes.

The category of 'Networks and social approaches to clusters' tends to employ a higher level of 'appreciative and empirical' analysis in the description of clusters' networks. In fact, this theme is concerned to the study of inter-firm linkages, local interdependencies, organizational cultures or business environments, and these issues are regularly investigated through inductive 'case-study research', with the aid of 'appreciative theorizing' and empirical evidence (e.g., based on interviews and inquiries) to illustrate theoretical arguments. There is also a significant component of 'formal and empirical' analysis in this theme, especially due to the use of input-output techniques to evaluate the clusters' networks of interactions.

Finally, the theme 'Methods and measures' make use of a strong component of 'formal and empirical' analysis in order to explain economic location and the geography of clusters. In this category, it is particularly explored the development of a model or a formal method (e.g., stochastic and econometric models), followed by the empirical testing of data, using the developed model.

In terms of theme by type (Table 2), we clearly notice a concentration of articles in the type of 'appreciative' theorizing. This reflects the tendency that we have previously pointed, related, to a large extent, to the extensive development of qualitative approaches to explain clusters' dynamics.

Table 2: Articles on clusters - Theme by Type, 1962-2007

	Survey	Empirical	Appreciative + Empirical	Appreciative	Formal + Empirical	Formal	All papers
Ideographic/ evolutionary approaches to clusters	5,6	0,5	17,2	**63,6**	6,6	6,6	100,0
Agglomeration economies	16,2	10,5	17,1	18,1	17,1	**21,0**	100,0
Knowledge based theories/ localized learning/knowledge spillovers	7,6	2,7	24,6	**54,9**	5,4	4,9	100,0
Regional/ National Innovation Systems	11,5	7,7	19,2	**50,0**	11,5	0,0	100,0
Industrial Policy and Regional Development Policies	5,6	0,9	8,5	**81,7**	1,9	1,4	100,0
ICT, Internationalization, Global Networks, Multinationals and Local Clusters	2,4	2,4	14,2	**78,7**	1,6	0,8	100,0
Networks and social approaches to clusters	7,3	2,0	20,5	**63,4**	5,4	1,5	100,0
Institutional approaches to Clusters [Institutions (practices, routines, values, customs), Governance and	5,8	1,4	7,2	**85,5**	0,0	0,0	100,0
Methods and measures	4,8	6,3	19,0	**47,6**	19,0	3,2	100,0
Other	15,0	5,0	40,0	35,0	0,0	5,0	100,0
All papers	**7,0**	**2,8**	**17,2**	**62,5**	**6,0**	**4,5**	100,0

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

It is also worth noting that the type 'formal' displays a higher level of concentration in terms of the theme 'Agglomeration economies'. This implies that formal modeling and mathematical methods are regularly used to explain factors behind the industrial location decisions, in terms of agglomeration forces and clustering externalities (such as cost advantages and scale economies). By its turn, this higher incidence of the theme 'Agglomeration economies' on '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 theory.

The type 'appreciative theorizing' exhibits its highest levels of incidence in articles concerned to 'Institutional approaches to clusters', 'Industrial policy' and 'ICT, internationalization, global networks, multinationals'. Since the specific subject of these themes is mainly concerned to capture information about 'intangible' (and not easily quantifiable) factors explaining clusters' dynamics or to make judgments or appreciations about real case studies, they share a natural tendency to concentrate around inductive methods and qualitative techniques of analysis.

3.4. Top authors in the thematic of clusters

Considering the overall sample of 1249 articles, we observe that, in terms of co-authorship, we have a similar distribution between articles published by one author and articles produced by more than one author (Figure 8). More specifically, the bulk of literature on clusters is produced by one or two authors in co-authorship (1042 articles, which correspond to 83% of the whole sample).

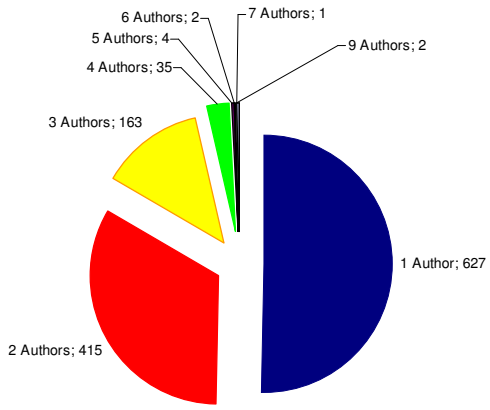

Figure 8: Articles on clusters by Co-Authorship, 1962-2007

Note: the values appearing after the number of authors respect to the number of articles published

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

In terms of top-ten authors (Figure 9), the author that exhibits more publications on the thematic of clusters, for the period in analysis and selected journals, is Phillip Cooke, who is particularly renowned by his association to the development of the 'regional innovation systems' approach. Phillip McCann (and G. Swann) also appear at the forefront in the top-ten list of authors with research particularly focused on the microeconomic foundations of industrial location and 'transaction-costs approaches', and on clustering effects and agglomeration economies.

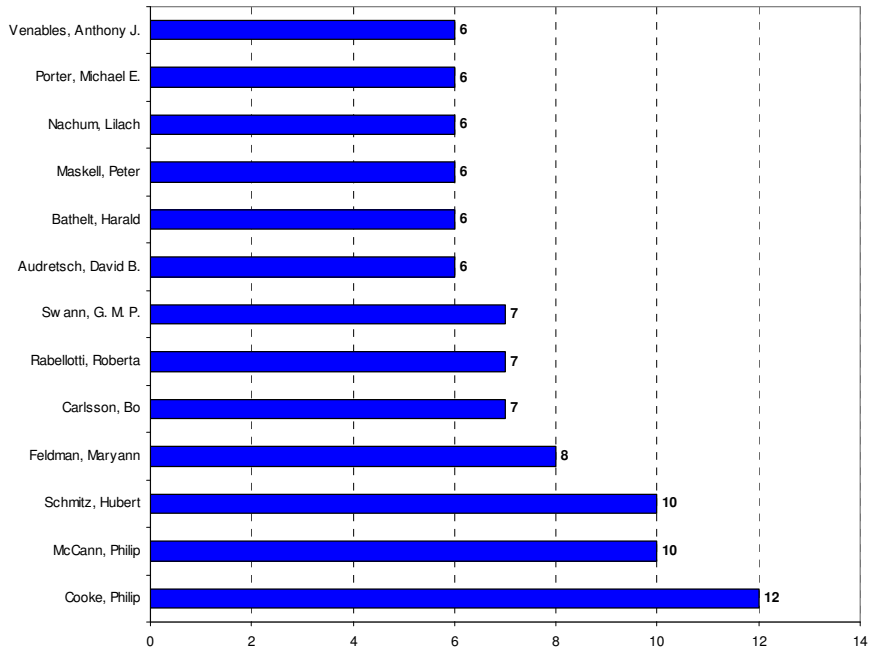

Figure 9: Articles on clusters by Top-10 Authors, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

In publications on 'networks and inter-firm linkages', either in terms of global networks or local interdependencies, we find the particular influence of Schmitz, Rabellotti and Bathelt. These authors focus on local and global networks (e.g., local cooperation, global competition, and external linkages) through case-study analysis mostly related to localized networks of interactions and the inclusion of clusters in global value chains.

Maryann Feldman and David Audretsch also appear at the top, with a range of publications mostly associated with the geography of innovative activities and the locational patterns, and the dynamics of knowledge-based industries (such as biotech and high technological industries). By providing conceptual frameworks to understand factors of emergence of high-tech clusters and the geography of innovation (based on industries' life cycle and 'knowledge

spillovers' approaches), these authors' works represent a good example of the use of evolutionary approaches in the development of knowledge-based theories.

Peter Maskell, with his influential work on knowledge-based theories and geographical clustering processes, also figures among the top-ten authors. Through the appreciative analysis of the literature on clusters, this author proposes to explore the dynamics of clusters from a knowledge-based and learning perspective.

The literature on industrial policies and clusters is represented by the well renowned Michael Porter. In his works he particularly highlighted the role of geographical clusters in regional growth and the development of nations.

Thus, it is interesting to note that in our list of top-ten authors, we have present all the research themes and recent approaches that have been developed within the clusters' literature during the period in analysis.

3.5. On the 'quality' of the research on clusters

This final section aims at uncovering to what extent research on clusters might be considered highly quality research. Such quality is (albeit imperfectly) proxied by journals ranking.

Research is disseminated in many varied forms, whether it be through books, journals, word-of-mouth or the Internet. However, journal articles are almost the only publications that are subject to the widely accepted thorough peer-review process. Therefore, most authors would agree, despite the imperfections of this process, that it provides the 'fairest' measure of quality (Vieira and Teixeira, 2008). Therefore, virtually all studies since the 1980s have ranked economics and management departments on the basis of refereed journal articles (Macri and Sinha, 2006).

The classification of journals was made accordingly to WU Wien Journal Ranking 2001. Although there are other well renowned journal rankings (e.g., Tinbergen Institute Journals Rankings), the selected ranking has the advantage of combining journals from economics and management areas. As referred in the methodological section, in WU ranking, the journals are classified into six different categories, by decreasing order of 'quality': AA (6), A (5), B (4), C (3), D (2). We add an additional category, NC (1), the lowest rank, which includes journals that fail to have any of the above classifications.

Considering the journals with the highest percentage of published articles on clusters (Figure 10), we observe that there is a predominance of relatively highly ranked journals - A (5) and

B (4) - in the top-twenty. It is worth noting that these twenty journals comprise about 37% of the total publications of our sample.

From the five journals that exhibit the highest presence in terms of publications, three of them are A (or rank 5) journals. This is the case of 'Regional Studies', 'Urban Studies' and the 'World Development'. The six non-classified journals (noted with rank 1, in Figure 10) comprise about 17,5% of the total articles on the top-twenty journals (466 articles).

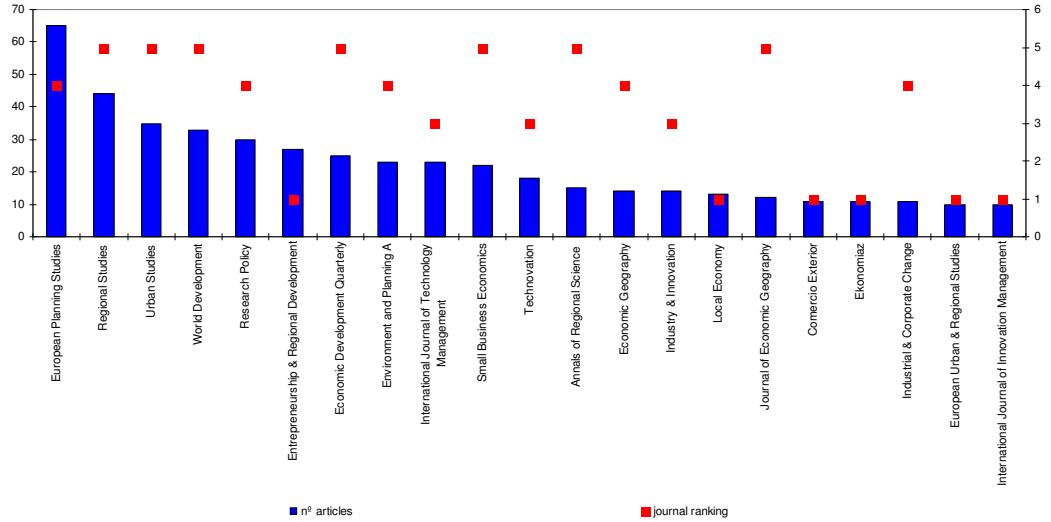

Figure 10: Articles on clusters by Top-20 journals, 1962-2007

Legend: Numbers on your left are relative to the absolute number of articles published by each journal. Numbers on your right are relative to the journal's ranking (considerations about rankings lie on the methodological notes).

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

Around 40% of selected articles on clusters are published in top ranking journals (AA and A). This seems to indicate a relatively high quality of this research area. Notwithstanding, a significant percentage of papers (around 45%) are published in non classified journals. Thus, in terms of quality, we might conclude that there is a bipolarization with the extremes (highest and lowest quality journals) being more representative.

Also interesting to analyze is the relation between journals' ranking and articles' distribution by main themes and types. Recent works (Silva and Teixeira, 2006a; Silva and Teixeira, 2006b) observe that types and themes of articles mainly related to formal and empirical methodologies tend to be published in higher-ranking journals, such as AA and A journals. At first glance, this is also true in clusters literature.

Figure 11 shows that 'Agglomeration economies', and 'Methods and Measures', research associated with formal analysis tend in a larger extent to be published in higher ranked

journals. Appreciative related research - 'Industrial Policy', 'ICT and global networks', and 'Institutional approaches to clusters' – are over represented in the lowest ranked categories.

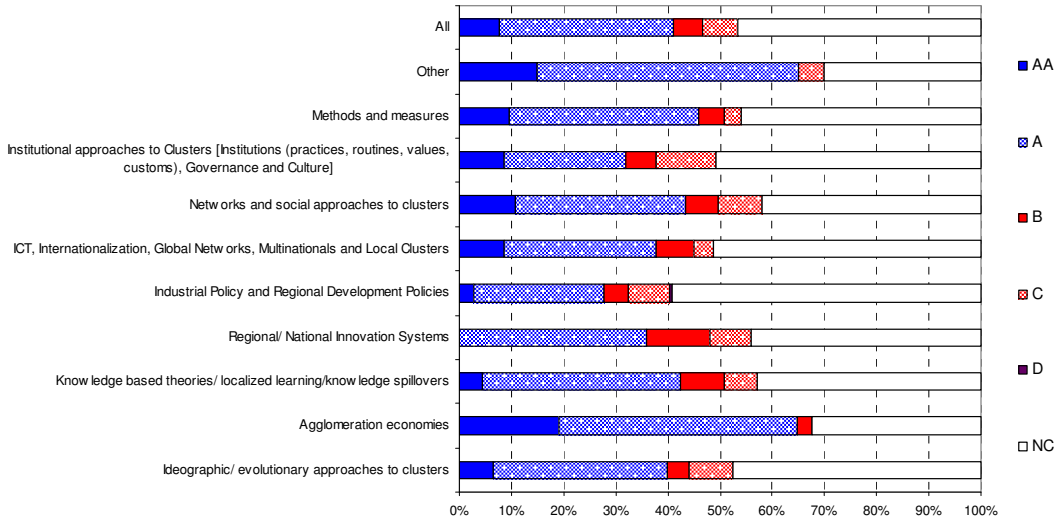

Figure 11: Articles on clusters by main theme and journals' ranking, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

From all themes, those with the most significant expression in B journals are 'Regional innovation systems' and 'Knowledge-based' approaches. These themes also have a minimum or even inexistent presence in AA journals. Despite the novelty of many contributions in these fields, articles reveal a high component of 'appreciative theorizing' due to the difficulty of capturing particularities of knowledge and innovation processes by pure formal methods. This is, however, a path of future research to be further explored, particularly that one concerned to the modelling of 'knowledge spillovers' or 'K-linkages' (Fujita and Mori, 2005).

In Figure 12, it is represented the distribution of themes by journal ranking. Not surprisingly, we observe that AA and A journals (the highest ranking journals) have a higher predominance of themes such as 'agglomeration economies', 'methods and measures' and 'networks approaches', which tend to comprise more 'formally-based' publications, and a lower presence of 'appreciative-based' issues.

On the other hand, as we move to lower journal rankings, prevalent themes tend to be even more based on 'appreciative theorizing'. In fact, as 'Knowledge-based theories' register an incidence in A and B journals, and 'Regional innovation systems approaches' appear more

often in B journals, we observe that 'Institutional approaches' tend to prevail in C journals and 'Industrial policy' has a dominant position on D journals.

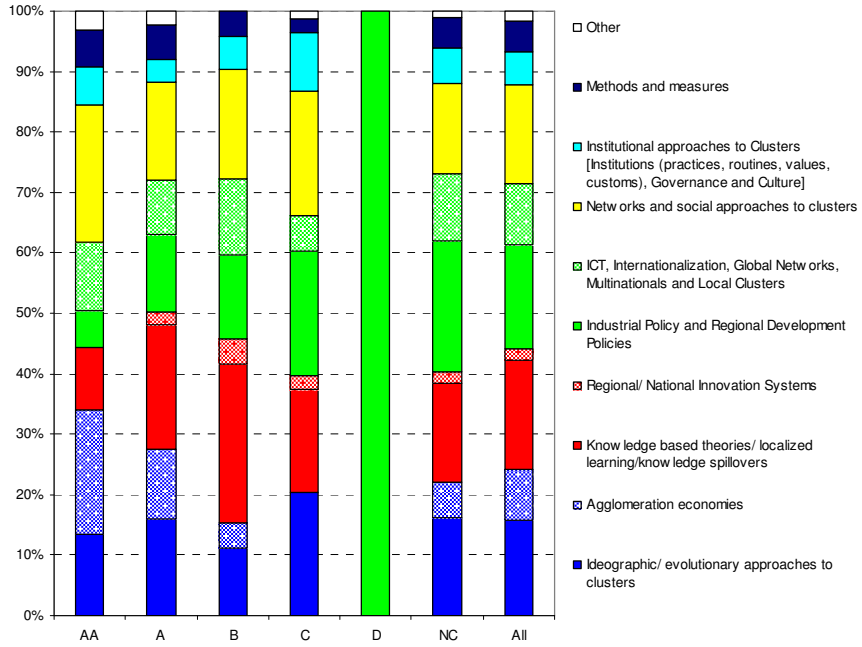

Figure 12: Articles on clusters by journals' ranking and main theme, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

Once again, we confirm that higher-ranking journals favour relatively more themes of research that tend to apply formal and empirical methodologies, when compared to more 'empirically' and 'appreciative-based' themes. This trend is particularly visible in the Figure 13 below.

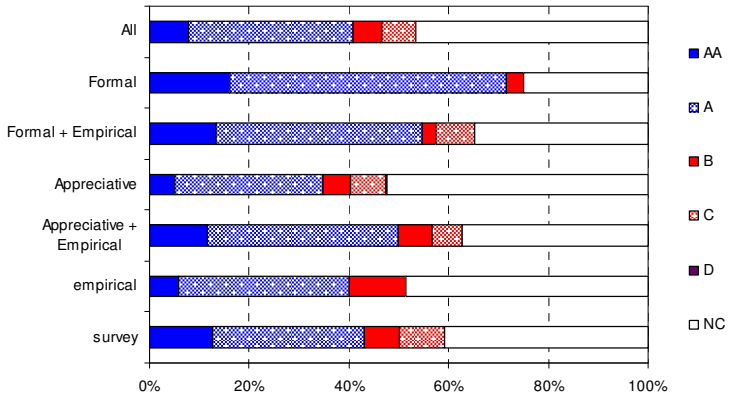

Figure 13: Articles on clusters by main type and journals' ranking, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

In there we observe a higher predominance of AA and A journals in 'formal' (about 71%) as well as in 'formal and empirical' (about 55%) types, and a greater incidence of lower-ranking and non-classified journals in 'appreciative' (about 60%) and 'survey' (about 43%) types.

From Figure 14, note that there is, in general, a dominant presence of the 'appreciative' type in all categories of journals (about 62,5%). This is in line with we had referred previously about the structural predominance of 'appreciative theorizing' in the whole literature on clusters.

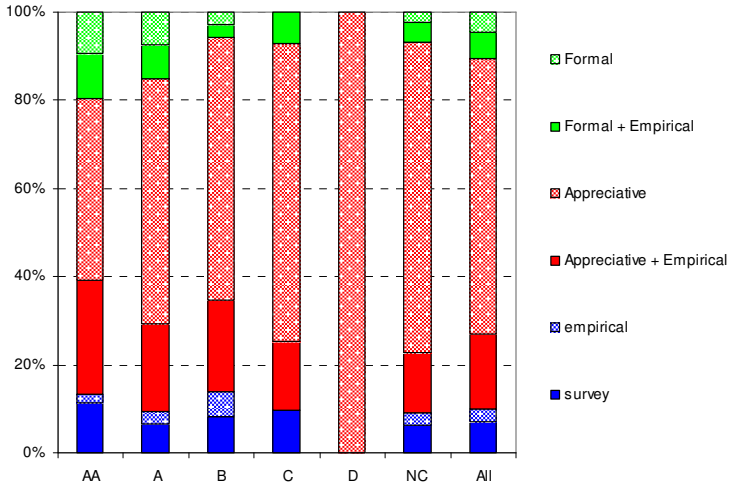

Figure 14: Articles on clusters by journals' ranking: distribution (%) by main type, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

Despite this overall tendency of the 'appreciative' analysis, we observe that higher-ranking journals (AA and A) comprise a more elevated percentage of articles using 'formal', 'formal and empirical' and 'appreciative and empirical' methods than lower- ranking journals (C, D and NC), whose articles typically tend to employ more purely 'appreciative' and 'appreciative and empirical' methodologies.

B journals, by their turn, shape the course between top-ranking journals, more interested in 'formally-based' publications, and lower-ranking journals, focused on mostly 'descriptive' articles. This category of journals, while revealing a minimum percentage of 'formally-based' articles, clearly centers onto more 'appreciative and qualitative methods' (almost 80,6% of articles published on B journals are 'appreciative' and 'appreciative and empirical' types).

Thus, the figures above allow us to conclude that most 'formally-based' articles have a higher probability of being published in higher-ranking journals than more 'appreciative'

articles, which are typically published in B, C and (mainly) lower-ranking categories of journals.

In terms of journals ranking, the authors that, in our sample, are more 'productive', tend also to produce highest quality articles, that is, have a stronger presence in AA and A journals. Authors more focused on themes that tend to employ formal and empirical methods have stronger presence in AA and A journals. This is the case of Swann, on 'knowledge-based theories', of Rabellotti and Schmitz, on 'Networks and global linkages' or McCann, on 'agglomeration economies' and microeconomic foundations of the location processes, such as the 'transaction-costs' approaches.

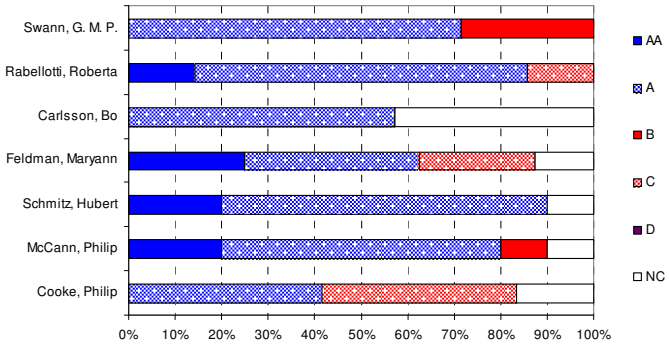

Figure 15: Top authors by journals' ranking, 1962-2007

Source: Authors computations based on our sample of articles collected from EBSCO and ECONLIT databases (n=1249)

Such evidence corroborates the above observed fact – formal related research tends to be published in the highest quality journals.

4. Conclusions

There was a significant increase of the research on clusters in the decade of 1990s and, particularly, over the most recent years. Besides its importance in academic fields, the role of clusters has also been acknowledged in political spheres. In fact, our evidence suggests that the second largest theme of research in this literature is 'industrial policy and regional development policies'. In parallel with the increasing interest in the 'local', there has been, as well, a growing range of publications on the theme 'ICT, global networks, multinationals and clusters', that has been subject to an emergent literature in the recent years.

Our bibliometric study clearly shows that behind the recent boom on clusters literature it is the rising amount of studies on 'local networks and social approaches' and 'knowledge-based

theories'. Our analysis also suggests that since the decade of 1980s, the category 'methods and measures' has been declining in favour of more appreciative led themes of research, such as 'networks and social approaches', 'industrial policy' and 'ideographic/ evolutionary approaches'. As accounted for in the 'qualitative' survey (Section 2), these trends reflect the 'socio-relational turn' in economic geography, occurred in the 1980s, that have changed the focus of research from more resources-based approaches to socio-relational perspectives on clusters. Empirical evidence (Section 3) further demonstrates that literature associated to 'regional and national innovation systems' and to 'institutional approaches' (most concerned to local enrooted cultures, governance and customs) have been object of a particular attention in the latest years, with a growing amount of publications since the 1990s. This clearly reflects the most recent trends on clusters' literature, focusing particularly on 'systemic' and 'institutional' factors.

The evolution of the literature on clusters has been associated with a predominant tendency for appreciative led articles, which represent, on average, on the whole period, about 62,5% of the total articles. In fact, since the 1990s, 'Formal and empirical' and exclusively 'Empirical' analysis have witnessed a decline in their relative share of publications in favour of research papers more based on 'Appreciative and empirical' analysis. This is explained by the importance that qualitative and inductive techniques achieved in the clusters literature, particularly, in leading themes such as the 'knowledge-based theories' or the 'networks and social approaches' to clusters.

In terms of the 'quality' of research on clusters, based on journals ranking, we might point to its two peak symmetric distribution. On the one side, 40% of the articles have been published in top ranking journals (AA and A), which apparently suggests a rather high quality of the research on clusters. On the other side, a similar percentage (45%) of total articles is published in non classified journals, the lowest quality journals rank.

Our findings also allow us to conclude that types and themes of articles mainly related to formal and empirical methodologies tend to be published in higher-ranking journals, namely AA and A journals. Indeed, we observe that most of the 'formal related' themes, such as 'agglomeration economies' and 'methods and measures', are published in the highest ranked journals. This contrasts with more appreciative research, such as 'industrial policy' and 'institutional approaches to clusters', which appear to be over represented in the lowest journal ranking categories. This fact is further corroborated when analyzing authors. Those

more focused on 'formal' and 'formal-empirical' related research have a stronger presence in AA and A journals.

Although the analysis performed is useful to provide some quantitative evidence of the published research on clusters in the last fifty years, it would be interesting to complement it with a citation analysis. This would enable us to more rigorously trace the scientific roots of this literature and to map, in a more comprehensive and detailed way, the scientific community on clusters. This would for sure be an interesting and stimulating path for future research in the area.

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