Does the Environment Matter? Mapping Academic Knowledge on Entrepreneurial Ecosystems in GEM

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Abstract

Environmental factors determine several features of society, but are becoming increasingly relevant in the entrepreneurship process. In recent years, entrepreneurship has been expanding worldwide and implies an exponential role of the environment. Accordingly, research into this phenomenon has also increased: contributions have rocketed, including increasingly complex and sophisticated analytical frameworks and empirical studies.

This research aims to offer, through a bibliometric analysis, a comprehensive picture of research into entrepreneurial ecosystems using the GEM database published in Web of Science journals during the 2004-2016 period. A bibliometric analysis allows us to identify both the leading authors and journals that contribute to the progress made by the literature on entrepreneurial ecosystems. We expect our analysis to be useful to both junior and experienced scholars. The results show that the entrepreneurial ecosystems literature has a relatively high impact, as well as a high demand of related journals (an indicator about the quality of studies).

KEYWORDS: Entrepreneurial ecosystems; Global Entrepreneurship Monitor (GEM); bibliometric analysis

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1. INTRODUCTION

Entrepreneurial ecosystems are made up of a complexity and diversity of actors, roles and environmental features that interact to shape the entrepreneurial performance of a territory (Spilling, 1996). Along the same lines, and according to Isenberg (2010), entrepreneurial ecosystems involve a set of individual elements (e.g., leadership, culture, capital markets and open-minded customers) that combine in complex ways.

Recently, a holistic approach to entrepreneurship has become a new trend in the European policy (Stam and Nooteboom, 2011; Autio et al., 2014; between others), focusing on the role of the entrepreneurial ecosystem. In this sense, Audretsch and Belitski (2017) have defined entrepreneurial ecosystems as institutional and organisational as well as other systemic factors -geographically bounded- that interact and influence identification and commercialisation of entrepreneurial opportunities.

Thus talking about 'entrepreneurial ecosystems' implies the presence of a dynamic system, developed in a specific territory where its companies interact (they compete at the same time as they exchange knowledge and services), and where some territorial resources exist that support the creation of start-ups (Borissenko and Boschma, 2016). The different start-ups located in the ecosystem not only support their activity with their resources but, at the same time, also attract new companies and new resources that can benefit from their proximity (Brown and Mason, 2017). As a result, an ecosystem comprises a set of resources and actors that result from the interventions of both public and private entities (Van de Ven, 1993). According to Neck et al. (2004), this requires analysing the evolution of some resources and actors that interact in such a way that a dynamic system is generated that feeds the creation of start-ups.

Nowadays, entrepreneurial ecosystems are a growing innovative field of scientific research, as evidenced by the number of publications on the topic (Acs et al., 2017; Borissenko and Boschma, 2016; Brown and Mason, 2017; Kuratko et al., 2017; Stangler and Bell-Masterson, 2015). In 2011 Martínez et al. (2011) noticed this growing interest. Also in 2011, Alvarez and Urbano (2011) noticed a worldwide unprecedented surge of interest in the topic. According to Web of Science database, the topic 'entrepreneurial ecosystems' has rocketed in 2017 (WoS, 2017). Economic development is the result of complex entrepreneurial processes (Spilling, 1996) and, consequently, the latest political, economic and environmental changes have encouraged this interest.

Several authors define research into entrepreneurship as non-unified, divided and still being developed (Gartner, 2007; Shane and Venkataraman, 2000). Therefore, it is difficult to categorise the different existing streams in the research field. Considerable diversity in the field has also been noted across countries, but there is very little precise knowledge on entrepreneurship research (Aldrich, 2000).

According to Acs and Szerb (2010), entrepreneurial activity is the start-up activity in the medium- or high-technology sector, initiated by educated entrepreneurs and launched thanks to opportunity motivations in a not too highly competitive environment, measured by the following variables: (a) opportunity-based motivation to create venture; (b) belonging to a technology intensive sector; (c) level of education and (d) uniqueness of the product or service (p 364).

Entrepreneurship research has been situated according to three main approaches: (1) the economic view, where scholars highlight economic rationality aspects and argue that new

venture creation is due to economic issues (Audretsch and Keilbach, 2004; Audretsch and Thurik, 2001; Parker, 2004; Thurik and Wennekers, 2004; Thompson et al., 2012)); (2) the psychological view, where scholars discuss that individual factors or psychological traits determine entrepreneurial activity (Carsrud and Johnson, 1989; Collins and Low, 2010; Davis and McClelland, 1962); (3) the sociological and institutional view, where scholars affirm that the socio-cultural environment determines the decision about new venture creation (Berger, 1991; Busenitz et al., 2000; Manolova and Eunni, 2008; Shapero and Sokol, 1982; Steyaert and Katz, 2004; Zimmer, 1986).

Entrepreneurship behaviour in a country is affected by the environment (Anderson and Dodd, 2012; Audretsch, 2012; Lee et al., 2011; Mueller and Thomas, 2001; Nielsen and Lassen, 2012; Renko et al., 2012; Shane and Kolvereid, 1995). The link between economic development and institutions affects the environment but may, at the same time, influence governance quality, access to finance and entrepreneurs' perceptions (Acs et al., 2008).

As a result, several authors connect entrepreneurship with the environment. Levie and Autio (2008) discuss cross-country patterns of high growth aspiration for entrepreneurial activity, its associations with the national entrepreneurial environment, and entrepreneurs' individual characteristics. Bowen and Clercq (2008) study the impact of institutions on entrepreneurs' intentions to create larger firms, but do not consider microlevel factors. Autio and Acs, (2010) analyse entrepreneurs' individual and country level expected employment.

So when talking about entrepreneurship and environmental factors, Gnyawali and Fogel (1994) highlight five dimensions that influence entrepreneurial activity: a) government policies and procedures; b) a social and economic environment; c) knowledge and entrepreneurial skills; d) financial assistance for new ventures; e) non-financial assistance.

So, one of the factors of the environment are the entrepreneurial competences or skills.

Recently, for example, Turró et al. (2016) have examined the influence of internal and external (environmental) factors on entrepreneurship in the Spanish context by considering differences among regions. Terjesen and Szerb (2008) have studied the individual (entrepreneur) firm and national environment factors associated with the growth expectations of nascent, baby and established firms. Levie and Autio (2008) have tested the relationship between entrepreneurial education and training and GEM's measures of national entrepreneurial activity.

In this study, we adopt the definition of Moss (2007): The environment includes both 'rules of the game', believed by social scientists to generate incentives for entrepreneurial activity, and the socio-economic or political setting that determines legitimate or acceptable behaviour. Put simply, the environment refers to a broad range of conditions that affect entrepreneurs (p 205).

The Global Entrepreneurship Monitor (GEM) is a trusted entrepreneurship resource, and there is a large literature based on its information. GEM measures entrepreneurship and identifies the factors that determine the level of entrepreneurial activity at the institutional, cultural, normative and public policy levels (Global Entrepreneurship Monitor, 2017). It allows a deep understanding of the environment for entrepreneurship and provides valuable insights, which is why we wished to use it as a key word in our work. There are only three articles in Web of Science about entrepreneurial ecosystems and GEM. Note that we conducted the search in the Web of Science Core Collection and used all the indices. This obtained works are about innovation and the entrepreneurial ecosystem established at the University of Technology (Free State – South Africa) (De Jager et al., 2017), and about the effects of Schumpeterian and Kirznerian entrepreneurship on economic growth and the

specific case of Turkey (Ferreira et al., 2017; Öner and Kunday, 2016). As they all are recent studies, the topic appears to be getting more popular.

Study aim

To the best of our knowledge, very few works have focused on the scientific production of entrepreneurial ecosystems in the GEM literature. Therefore, this paper aims to bridge this gap by applying bibliometric and social network techniques to a representative collection of research articles in this knowledge field to complement and enhance the findings reported in the above studies.

In order to achieve this, our work analyses the research on entrepreneurial ecosystems published in a wide range of journals over a 13-year period (2004-2016) and attempts to use cited references to analyse/identify:

1) The distribution patterns of papers.
2) The leading authors, institutions and journals that directly (by publication) and indirectly (by citation) contribute to the entrepreneurial ecosystems literature.
3) The core articles that influence the international literature.
4) The main topics and themes used in the scientific literature (and its relations).
5) The existing social networks by means of co-occurrence authorship, keywords and citations among entrepreneurial ecosystems articles.
6) The differences among contributions' approaches and findings through a content analysis.
7) These research questions will provide the researchers who are interested in entrepreneurial ecosystems with several benefits, such as gaining a better understanding of the relevance of the topic, and identifying the current research lines and gaps to conduct future works.
8) This paper is structured in four sections. The first offers a brief introduction to entrepreneurial ecosystems and the aim of this paper. The second section introduces the bibliometric techniques used in this study. This article explains the analysis results. Finally, the study concludes by discussing the results, limitations and implications for future research.

2. METHODOLOGY

2.1. Bibliometrics, Social Network Analysis (SNA) and Content Analysis.

A bibliometric analysis is a research technique that uses quantitative and statistical analyses to describe the distribution patterns of research articles with a given topic and a given time period (Diodato and Gellatly, 2013).

There are two common methodological approaches to quantify information flows. The first approach uses a publication as a whole or its attributes, such as the author's name, keywords, citations, etc. The second approach consists in identifying the links among objects, their co-occurrences and networks (Gupta and Bhattacharya, 2004).

In the first approach, scalar techniques are generally used. Such techniques are based on direct counts (occurrences) of specific bibliographic elements, such as articles (Gupta and Bhattacharya, 2004), and provide the major characteristics of various actors' (individual

researchers, countries, fields, etc.) research performance (Verbeek et al., 2002), as well as its evolution and trends over time (Gupta and Bhattacharya, 2004). This approach is considered a satisfactory measure of scientific production, but can be regarded as only a partial indicator of contributions to knowledge (Martin, 1996).

In the second approach, a Social Network Analysis (SNA) is used. This technique identifies and clusters related nodes of researchers and institutions to evaluate relationships and collaborations (Benckendorf and Zehrer, 2013). Specifically, these procedures identify the relations (co-occurrences) of particular items, such as the number of times that keywords (co-words), citations (co-citations) and authors (co-authorships) are mentioned together in publications in a particular research field This approach is concerned mainly about understanding the underlying structure of the similarities and interrelationships between items (Gupta and Bhattacharya, 2004).

A co-word analysis is based on the assumption that a paper's keywords offer an adequate description of its content and of the links between topics. Two keywords co-occurring within the same document denote a link between them (Cambrosio et al., 1993).

A co-citation analysis counts the frequency with which any paper of a given author is co-cited with another in the references of cited documents (Bayer and Smart, 1990). It assumes that the more frequently two authors are cited together, and the more similar their patterns of co-citations are with others, the closer the relationship between them (White and Griffith, 1981).

Co-authorship is the most recognised expression of intellectual collaboration in scientific research. It implicates the participation of two authors or more in conducting research, which leads to scientific output of a higher quality or a larger quantity than that achieved by an individual (Hudson, 1996).

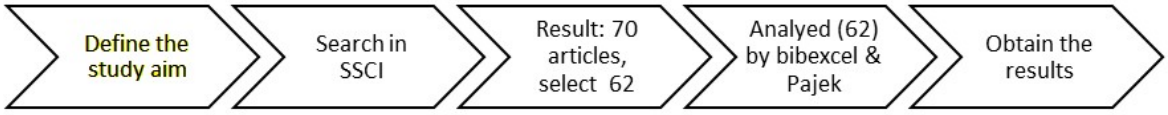
Finally, a Content Analysis is a research methodology used to make valid inferences from data to their context in order to provide knowledge, new insights, the representation of facts and a practical guide to action (Krippendorff, 1980). A Content Analysis can be quantitative or qualitative, and is a systematic and rule-guided method used to study the contents of textual data in order to make sense of it (Mayring, 2000).

In order to obtain an overview of the entrepreneurial ecosystems literature, we used herein a combination of all these techniques (scalar and analytical). The use of a bibliometric analysis to evaluate and monitor research performance has become widespread (Tijssen, 1992).

2.2. Data Collection

We conducted a search in the Web of Science (WoS) database. This database is composed of several Citation Indices in its Core Collection: The Science Citation Index Expanded (SCI-EXPANDED), the Social Sciences Citation Index (SSCI), the Arts and Humanities Citation Index (A&HCI), etc. In this study, we used SSCI from 2004 to 2016. The search started in 2004 because it was the first publication where the term entrepreneurial ecosystems appears in WoS. Figure 1 shows the complete methodological process.

Figure 1 Methodological process



The source of scientific documents is composed only of the research articles published in a journal because they have been submitted to critical review, and also to the approval of fellow researches and have, therefore, passed a certification process (Callon et al., 1993).

The ISI Web of Science (WoS) is probably the most important database for bibliometric analyses, which is the reason for choosing it. WoS covers all the publications and corresponding citations from more than 12,000 professional journals, which constitute the core of the international scientific serial literature for many fields (Garfield, 1979; Moed et al., 1985; Tijssen, 1992; Wos, 2017).

The search criteria include the joint appearance of one of these terms, entrepreneurship, Global Entrepreneurship Monitor or GEM, context, ecosystem or environment, in the categories title, abstract and keywords.

Seventy preliminary articles were retrieved from WoS for the study period. The second constraint was to limit the search for it to be in accordance with the economy businesses research area. The last step was an in-depth study of the titles and abstracts of the 70 articles to detect possible articles which, despite complying with search requirements, did not relate to our study aim. Eight items were removed, which were based on corporate entrepreneurship, or focused on a very specific field, or entrepreneurial ecosystems was not the core aim of the article.

After this procedure, a data set of 62 articles was obtained for the period covering 2004-2016. To analyse this data set, this study used bibliometrics techniques with the Bibexcel software. In addition to displaying the network, the Pajek software was used as the data analysis and the visualisation tool for our research.

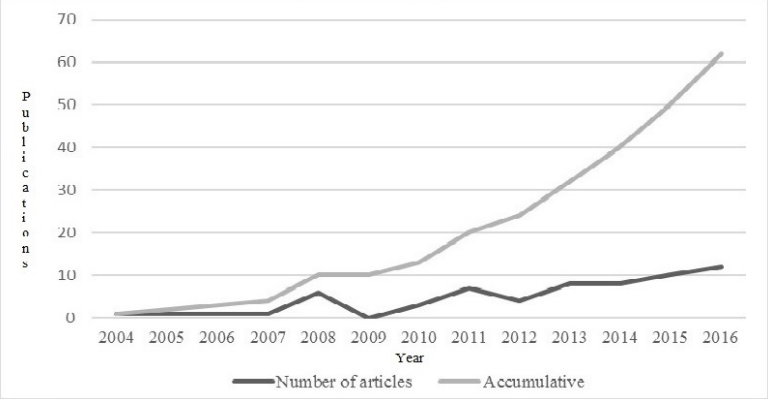
3. RESULTS

This section contains the results of the citation and co-citation analyses of the bibliometric references made by the 129 authors in the 62 articles published in the data set covering the 2004-2016 study period.

3.1. Distribution pattern of the literature

We firstly analysed the evolution of the publications in the years from 2004 to the present-day. The results are shown in Figure 2:

Figure 2 Evolution of publications



Despite the 13-year time span, the majority of articles have been published recently according to Figure 2. There are several reasons for the increasing volume of studies on this subject (Ratin et al., 2015): (1) Governments and private corporations have developed programmes to support the creation of new ventures that provide a wide range of services to cater for all kinds of new ventures. (2) Public and private education institutions have started to include entrepreneurship courses in all programmes, and now some universities even host schools of entrepreneurship.

Regarding the languages the articles come in, these were published only in two, mostly in English, 55 (89%), versus seven (11%) published in Spanish.

3.2. Most productive authors, institutions and journals

One hundred and thirty different authors participated in 62 articles, of which 106 (82%) published a single article. Table 1 presents the eight researchers with three published works or more. The most productive authors were Sternberg (n=7), Urbano (n=6) and Alvarez (n=6). Table 4 shows the number of authors per article.

Table 1 Most productive authors, country and institution that they belong to

Rank	No.	Author	Institution	Country
1	7	Sternberg R	Leibniz Universität Hannover	Germany
2	6	Urbano D	Autonomous University of Barcelona	Spain
3	6	Alvarez C	Universidad EAFIT · School of Management	Colombia
4	6	Acs ZJ	The London School of Economics and Political Science	England
5	4	Amoros JE	University of Desarrollo	Chile
6	3	Bosma N	Utrecht University	Netherlands
7	3	Estrin S	The London School of Economics and Political Science	England
8	3	Mickiewicz T	Aston University	England

Eighty-nine different institutions signed the 62 retrieved documents. The most productive institutions were the Autonomous University of Barcelona (n=7) and the London School of Economics (n=5). Some of the most productive authors in the entrepreneurial ecosystems field belong to these top institutions.

Analysing where the authors work (based on the authors' institutional addresses) by geolocation means is another way to analyse the core literature structure. The geographic situation of authors' works was identified to investigate whether the degree of impact of this field was European or global.

Figure 3 Geolocation of where the authors work (reload)

By GPS viewing, Figure 3 shows that the authors who investigated entrepreneurial ecosystems in the GEM literature were located mainly in developed economies: Europe and North America. When analysing European authors, we found that the largest group of researchers was located in Spain (35). In second place came Germany (23) and in third place England (22). When analysed by continent, North-America (20) came in second place. The large number of countries that researched in this field reflects the high prestige and impact of this research topic. These results relate directly to the most productive authors since the countries of the lead authors were also the main producers of the articles that analysed this issue.

Most productive journals

The 62 works appeared in 36 different journals. The journals with three, or more than three, papers are presented in Table 2, of which the most productive are Small Business Economics (The Netherlands, n=12), Journal of Business Venturing (United States, n=4) and Revista de Economía Mundial (Spain, n=4). Of all the published articles, 58% (36 of 62) were featured in the top ten.

Table 2 Journal citation frequency (more than five publications per journal)

Journals	Record Count	% of 62	IF 2016	Quartile	Scope
Small Business Economics	12	19%	2.421	Q1	Entrepreneurship, self-employment, family firms, small- and medium-sized firms, and new venture creation
Journal of Business Venturing	4	6%	5.774	Q1	Entrepreneurship, Entrepreneurial Finance, Innovation and Regional Development
Revista de Economía Mundial	4	6%	0.281	Q4	All facets of world economy
International Entrepreneurship and Management Journal	3	5%	1.312	Q4	Entrepreneurship and its relation to management and strategy; interfaces between entrepreneurship and technological innovation; and the impact of public policy on entrepreneurial ventures
Regional Studies	3	5%	2.780	Q1	Economic, environmental, political and social change aspects of regional development and policy-making

Except for *Revista de Economía Mundial* and the International Entrepreneurship and Management Journal, all the others were in Quartile 1. As noted, the journals in the list with the source articles are quite broad in scope, but most reflect entrepreneurship.

3.3. The most frequently cited articles in the international literature

Table 3 provides a ranking of the most cited articles. The most cited article is "Global Entrepreneurship Monitor: Data collection design and implementation 1998-2003" by Reynolds et al., published in 2005 in Small Business Economics, which obtained 316 cites. This is clearly the most remarkable work in the field, so it is the most cited one and –in addition- it has the strongest normalised impact with 24.31 cites per year (the following one had 12 cites on average).

Forty-three (69%) of the 62 articles received at least one citation, and 17 (27%) were cited more than 10 times.

Table 3 Ranking of the most cited articles

Rank	Title	Authors	Year	Citations	A
1	Global Entrepreneurship Monitor: Data collection design and implementation 1998-2003	Reynolds, Bosma, Autio, Hunt, De Bono, Servais, Lopez-Garcia and Chin	2005	316	
2	Institutions and entrepreneurship development in Russia: A comparative perspective	Aidis, Estrin and Mickiewicz	2008	120	
3	Entrepreneurship, economic development and institutions	Acs, Desai and Hessels	2008	94	
4	Why are some entrepreneurs more innovative than others?	Koellinger	2008	63	
5	The Normative Context for Women's Participation in Entrepreneurship: A Multicountry Study	Baughn, Chua, Neupert and Kent	2006	62	
6	Regional clusters in Germany - their geography and their relevance for entrepreneurial activities	Sternberg and Litzenberger	2004	60	

3.4. The main topics and themes used in the literature

A keyword analysis can be used in various fields. This method examines the content of scientific works or works of other types (Berelson, 1952; Kassarjian, 1977). It is used not only to identify topics and preferred statistical approaches (Helgeson et al., 1984), but also identifies trends (Roznowski, 2003; Yale and Gilly, 1988). In this study, we analysed co-keywords to describe and discover the interactions between different keywords in the core entrepreneurial ecosystems literature. This analysis reduces the keywords space to a set of network graphs that explain the strongest associations among keywords (Coulter et al., 1998). The Co-Keyword analysis used Bibexcel and analysed the co-occurrence of the keywords in the descriptors or the keywords in each article. Figure 6 is represented by Pajek, along with the Fruchterman-Reingold 2D algorithm. The co-occurrence matrix is formed by the co-occurrence frequency of two keywords in which these two keywords appear together in the descriptors or keyword field of each article. Several keywords are interconnected in this figure, where the volume of spheres is a vector, which represents the frequency of keyword occurrence in the core literature (the volume of spheres is proportional to frequency). To obtain this result, we utilised the process described by Persson et. al (2009).

Figure 4 illustrates the analysis of the keywords and their interconnections, and depicts a network graph that represents the subjects included in the core entrepreneurial ecosystems

literature. Given the objective to ensure the reliability of keyword counts, the database was refined to avoid spelling errors or the inclusion, or not, of the plural of words to not distort the results; e.g., the word "Global Entrepreneurship Monitor" or "GEM" appeared in different forms: Global Entrepreneurship Monitor, Global Entrepreneurship Monitor (GEM), GEM data or GEM; for "entrepreneurship", the solution was to homogenise entrepreneurship and new venture or new firm. The best studied keywords, in relative weights in the number of works, were institutions (28). entrepreneurial activity (6) and female entrepreneurship, economic development and economic growth with five articles. They all appear in the centre of the cluster and connect most clusters, and thus represent the importance of these words in studying the entrepreneurship environment.

Table 4 Keyword Frequency

No.	Keyword
28	Institutions
6	Entrepreneurial Activity
5	Female Entrepreneurship
5	Economic Development
5	Economic Growth

The result of the algorithm produced two different clusters, which were related. Both were quite big, and the included words indicate a strong co-occurrence and had a high centrality index, which meant that they were core words in the GEM entrepreneurial ecosystems literature. The 'entrepreneurship cluster' included institutions, entrepreneurial activity, economic development and public policy, among others. The 'cluster about GEM' included institutions, multilevel analysis, female entrepreneurship and international entrepreneurship, among others. Tables 4 and 5 show the keyword frequency and the keyword co-occurrence, respectively.

Table 5 Keyword Co-occurrence

No.	Keyword	Keyword
2	Cognition	Female entrepreneurship
2	multilevel analysis	Regional entrepreneurship
2	Female entrepreneurship	Venture creation decision
2	Female entrepreneurship	International entrepreneurship
2	Female entrepreneurship	Information processing
2	Entrepreneurship policy	Regional development
2	Information processing	Venture creation decision
2	Information processing	International entrepreneurship
2	Emerging economies	Institutions
2	economic development	public policy
2	economic development	institutions
2	Institutions	Public policy
2	Cognition	Venture creation decision
2	Cognition	Information processing
2	Cognition	International entrepreneurship
2	International entrepreneurship	Venture creation decision
2	Institutions	Social networks

---------- Insert Table 5 here ----------

3.5. The Social Network Analysis

Co-authorship analysis

In scientific research, co-authorship is the most formal demonstration of intellectual collaboration (Acedo et al., 2006). Co-authorship is when two authors or more collaborate to produce a work. Such collaborations produce higher quality or a larger quantity of works than if they were conducted by only one author (Hudson, 1996). Traditionally, research articles have been signed by a single author, but this situation has changed significantly in the last few decades (Acedo et al., 2006). The study of Acedo et al. (2006) describes how multi-authored works seem to have a stronger impact because they are more likely to be cited and attract more citations than those articles written by one author. This conclusion coincides with the study of Glänzel and Moed (2002).

Table 6 Number of authors per article

	Articles	%
One author	6	10%
Two authors	19	31%
Three authors or more	37	60%
	62	

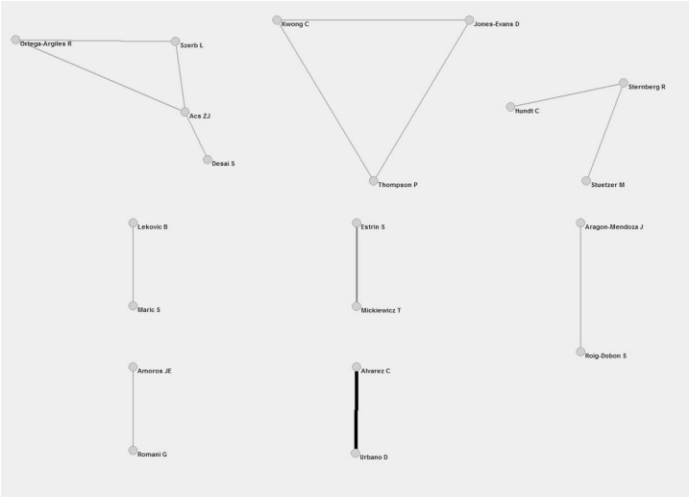
In the present study, as we can see in Table 6 that six articles (10%) were written by one author, 19 articles by two authors (31%), but most were written by three authors or more with (37) articles (60%). This situation suggests that the articles in this field are often written by more than one author, which indicates collaboration between researchers.

This result encouraged us to not only seek which groups of researchers collaborated in publishing these works, but to also check whether the network collaboration was connected or not.

The first step was to purge the entire database by hand to ensure the reliability of the results. Errors were detected mainly in names and surnames from including one surname or two, or special characters for different languages, which meant that Bibexcel did not correctly interpret the database. The results are provided in Figure 5 using the Kamada-Kawai algorithm (2D) by separated components. Besides improving visualisation, we proceeded to eliminate low frequencies and we established at least two co-authorings. In this figure, we observe eight research groups with different numbers of co-authorships. Urbano and Alvarez obtained six collaborations, while Estrin and Mickievicz obtained three. Finally with two collaborations, we find Acs sans Szerb, Acs and Ortega-Argiles, Acs and Desai, Amoros and Romani, Aragon-Mendoza and Roig-Dobon, Hundt and Sternberg, Jones-Evans and Thompson, Jones-Evans and Kwong, Kwong and Thompson, Lekovic and Maric, Ortega-Argiles and Szerb, and Sternberg and Stuetzer.

If these results involved an institution that researchers worked in, a relationship was observed between the number of collaborations among authors and those belonging to the same institution. For example, Roig-Dobon and Aragon-Mendoza belonged to the same university. Despite there being a large number of authors seen in Table 6, Figure 5 shows that a few relationships are held, which confirms the poor degree of collaboration among the authors of the study population.

Figure 5 Co-authorship



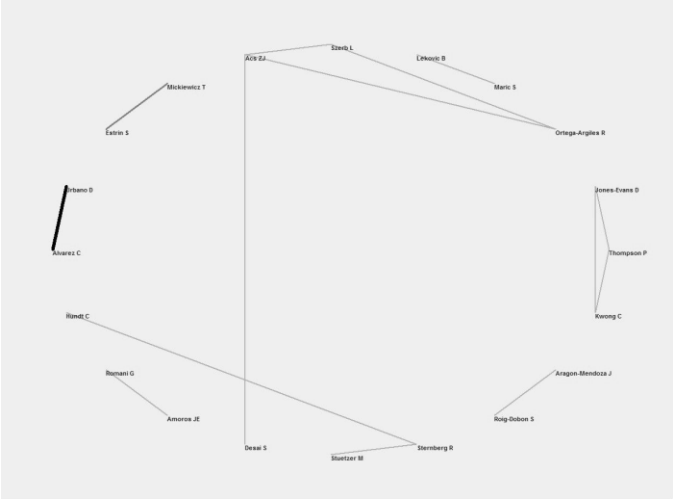
Source: Edited by the author

Centrality

In the centrality analysis, we observe authors' relevance for the collaboration network structure, and if a network of the scientific community of its discipline was isolated or not (Ronda-Pupo and Guerras-Martín, 2013). There are several ways to calculate centrality algorithms; we used degree, betweenness and closeness.

When analysing degree, which indicates the number of different authors with which an author connects directly, varying degrees of collaboration are represented among them (Freeman, 1978; Valderrama-Zurián and González-Alcaide, 2007). To improve visualisation in this study (Figure 6), we eliminated low frequencies (minimum of 2), and the degree of centrality in the network was 0.093, which is very low.

Figure 6 Centrality measure Degree (Frequency 2)



Intermediation is based on the closest distance among authors in the network structure (Freeman, 1978; Ronda-Pupo and Guerras-Martín, 2013); e.g., it evaluates to what extent an author is located between the –or among the other- authors of the network, and thus allows interconnection, which denotes the ability to access and control information flows and authors' prestige (Valderrama-Zurián and González-Alcaide, 2007). Once again, the low centrality pattern of the network (0,011) was repeated, where Sternberg, Alvarez, Urbano and Acs were the most prestigious authors, and indicated the best ability to access and control information flows is indicated.

Finally, the closeness index describes an author's speed of interaction with the other authors of the network, and allows us to observe the "closeness" of each author with other authors (Valderrama-Zurián and González-Alcaide, 2007). The Pajek network analysis did not yield the proximity index for poor network connectivity.

Co-citation

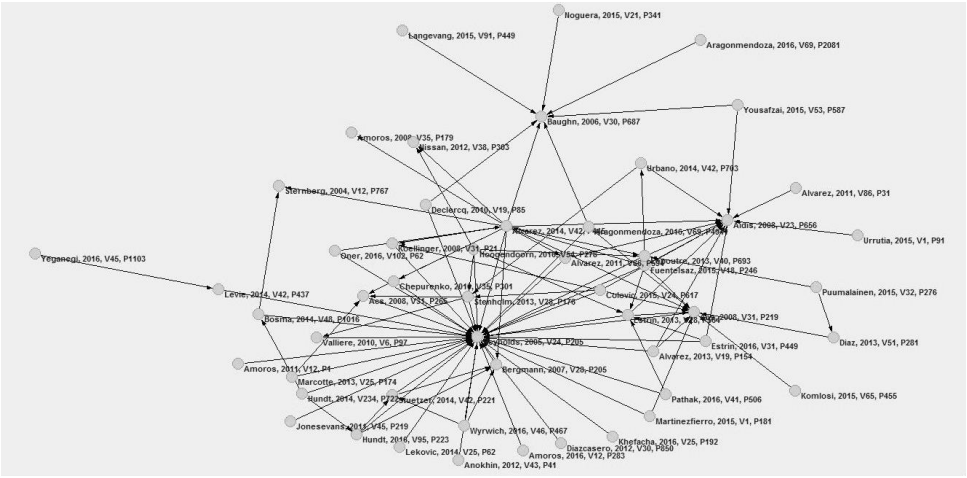
The co-citation map provides insight into the breadth and importance of the most cited literature in the core entrepreneurial ecosystems literature. The map displayed in Figure 7 was created by the Pajek and Bibexcel software. To obtain these results, we utilised the process described by Persson et al. (2009), and the figure was obtained through the Kamada-Kawai algorithm (2D) (Figure 7). It shows the pattern that emerged for the 62 articles considered in this analysis. The co-citation map indicates the core entrepreneurial ecosystems literature used. Documents are represented by authors and year of publication. It is noteworthy that most of the core literature cites lots of works, and the most cited are Reynolds (2005), and North (1990). These two works were the most repeated references of the core items, which can be considered the main reference source for the core literature.

The first step was to purge the entire database by hand to ensure the reliability of the results, and to also avoid possible misinterpretations. Errors were detected mainly in names or titles, caused by including one surname or two surnames, or special characters; so Bibexcel did not correctly interpret the database.

The cluster algorithm produced four clusters. There was a dense cluster formed by a large number of works, which used the GEM database, and three other small clusters about entrepreneurship, institutions and economic development.

The most cited of these was Reynolds (2005). This work analysed how entrepreneurship affects national economic growth and adaptation. Secondly, the book written by North (1990) analysed how institutions affected the performance of economies.

Figure 7 Co-citation (Minimum of 10)



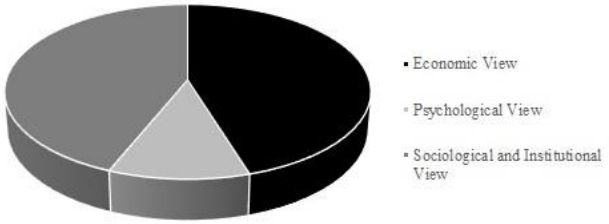
3.6. Content analysis

Views and dimensions

Entrepreneurship research has been situated according to three main approaches: (1) the economic view, where scholars highlight aspects of economic rationality and argue that new venture creation is due to economic issues (Audretsch and Keilbach, 2004; Audretsch and Thurik, 2001; Parker, 2004; Thurik and Wennekers, 2004); (2) the psychological view, where scholars discuss that individual factors or psychological traits determine entrepreneurial activity (Carsrud and Johnson, 1989; Collins and Low, 2010; Davis and McClelland, 1962); (3) the sociological and institutional view, where scholars affirm that the socio-cultural environment determines the decision about new venture creation (Berger, 1991; Busenitz et al., 2000; Manolova and Eunni, 2008; Shapero and Sokol, 1982; Steyaert and Katz, 2004; Zimmer, 1986).

According to this classification, we can state that 45% (33 articles) of the articles can be included in the economic view; 11% (8) of the articles can be included in the psychological view; 44% (32 articles) of the articles can be included in the sociological and institutional view. Note that the total amount is larger than the number of selected articles as we considered that an article could be considered in one view or more.

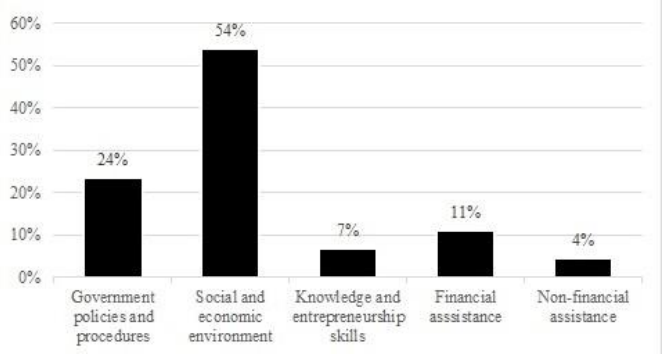
Figure 8 Views



When talking about entrepreneurship and environmental factors, Gnyawali and Fogel (1994) highlight five dimensions that influence entrepreneurial activity: a) government policies and procedures; b) social and economic environment; c) knowledge and entrepreneurial skills; d) financial assistance for new ventures; e) non-financial assistance.

According to this classification, we can state that 24% (21 articles) of the articles can be included in government policies and procedures dimension; 54% (48) of the articles can be included in the social and economic environment dimension; 7% (6 articles) of the articles can be included in the knowledge and entrepreneurial skills; 11% (10 articles) of them can be included in the financial assistance dimension and 4% (4 articles) of them can be included in non-financial assistance. Note that the total amount is larger than the number of selected articles as we considered that an article could be considered in one view or more.

Figure 9 Dimensions



Theories involved

When writing a paper, referring to the different theories that march our field of work is usual. In this case, there were several articles which do not highlight a theory, but some others mention one theory or more as part of the core literature review. The table below shows the most cited theories, with a frequency higher than two.

Table 7 Theories involved

10	Institutional Theory
6	Entrepreneurship Theory
3	Prospect Theory
3	Schumpeter Theory
2	Human Capital Theory
2	Network Theory
2	Agglomeration Theory
2	Economic Theory
2	Sarasvathy's Effectuation Theory
2	Ethnic Enclave Theory
2	Welfare State Theory
2	Interdependence Theory
2	Middleman Theory
2	Supply-side Theory
2	Schwartz Theory

As we can see from the above table, Institutional Theory is the most popular theory among the articles, and its frequency equals 10. Entrepreneurship appears in six articles and is the second most popular theory. These results are consistent with the initial search as institutions are strongly linked with ecosystems, which was one of the key words, and evidently with entrepreneurship. Prospect Theory and Schumpeter Theory have a frequency that equals 3. With a frequency that equals two, we find Human Capital Theory, Network Theory, Agglomeration Theory, Economic Theory, Sarasvathy's Effectuation Theory, Ethnic Enclave Theory, Welfare State Theory, Interdependence Theory, Middleman Theory, Supply-side Theory and Schwartz Theory.

Information Sources

In order to analyse data about entrepreneurial ecosystems, an information source is needed. According to the table below, in our case the GEM project was used in 42 articles; World Bank in eight articles, Index of Economic Freedom in five articles, World Values Survey in three articles and Chamber of Commerce in two articles.

Table 8 Information sources

42	GEM
8	World Bank
5	Index of Economic Freedom
3	World Values Survey
2	Chamber of Commerce

The GEM project is considered the most popular source of information as it has wide-ranging information about entrepreneurship in both the Adult Population Survey and the National Expert Survey.

Methodology

After collecting data, it is important to choose a proper methodology to analyse it.

Table 9 Methodology

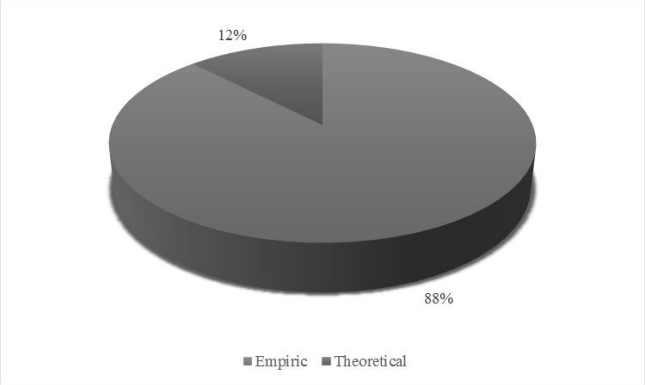
28	Regression Model
13	Descriptive statistics
7	Literature Review
6	Structural Equation Models

About half the articles use a Regression Model; 13 articles use descriptive statistics; seven are a literature review and six use Structural Equation Models.

Study type

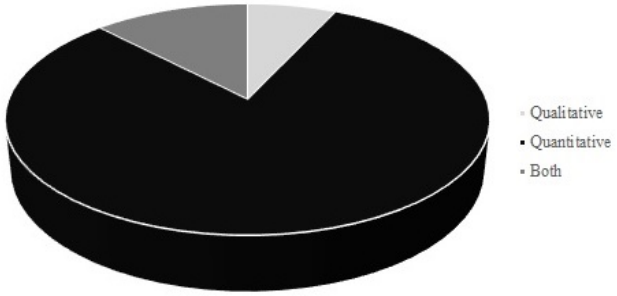
When analysing study type, we identified that most of the literature is empirical (88%). Only 12% of the articles can be considered theoretical.

Figure 10 Empiric or theoretical study



In the same way, 81% of the articles are quantitative, only 7% of the articles are qualitative, and 12% can be considered both.

Figure 11 Study type



It is important to state that despite entrepreneurial ecosystems literature undergoing development, the articles found in it are manly empirical and quantitative.

Dependent variables

We can find a wide range of dependent variables. After analyzsng them, we obtained found the following classification:

Table 10 Dependent variable

Freq.	Variable
36%	Entrepreneurial Activity
17%	TEA
8%	Technological entrepreneurship
6%	Aspirations of employment growth of entrepreneurs
3%	Real Savings
3%	Conditions of the entrepreneurial environment
3%	Input Density, Aspirations
3%	Social enterprise
3%	Probability of the employer being international
3%	Log of the percentage of the active population that owns and manages a consolidated activity
3%	Fear of failure in the enterprise
3%	GDP per capita
3%	Cognitive Scripts
3%	Country Patent Applications, Total Factor Productivity of the Country
3%	Spinouts
3%	Vision for Women Entrepreneurship, Women's Business Leadership

Main findings

The conclusions are quite diverse and can be grouped on three axes: on the one hand, we emphasise the articles that talk about the factors that influence entrepreneurial activity; On the other hand, there is also a large number of articles which talk about factors that facilitate or impede entrepreneurial activity.

Among the factors that influence entrepreneurship, it is important to highlight technological progress. Several articles affirm that technological progress can facilitate entrepreneurship. However, when technological progress is high, this trend can be reversed. There are also factors that influence entrepreneurship, such as the geographic area and human capital.

Among the factors that facilitate entrepreneurship development, we find the economic crisis, the development of formal institutions, associative activity, GDP per capita and economic development.

Lastly, the rigidity of the financial, product and labour markets hampers entrepreneurship from developing.

4. CONCLUSIONS

Worldwide the environment matters in terms of building an effective entrepreneurial ecosystem. That is why increasing interest in entrepreneurial ecosystems is being shown in the academic literature. Indeed we found a significant amount of GEM literature on entrepreneurial ecosystems.

These facts are closely linked to the first objective of our work, that of identifying the distribution patterns of the papers on this topic. The reasons that explain the increasing number of works about entrepreneurship environments perhaps lie in the plans that governments and private corporations have developed to support the creation of new ventures, and to include entrepreneurship programmes in higher education (Ratinho et al.,

2015). These programmes have provided a wide range of services to cater for all kinds of new ventures.

However, despite the large number of countries that have researched in this field, academic debate on entrepreneurial ecosystems is located mainly in Eastern-Europe (Sternberg, Urbano, Acs, Bosma, Estrin, Mickiewicz) and North America (Alvarez and Amoros). As a result, the most relevant authors belong to this area. This is exactly what Objective 2 is about; i.e., leading authors, institutions and journals.

In general, the entrepreneurial ecosystems literature has a strong and increasing impact. Thus 69% of the articles receive at least one citation, and 27% of them have more than 10 citations.

The large number of journals that have published articles denotes the vitality of the subject matter, and also if the journals' fields of study have analysed the broad heterogeneity observed among them. In addition, most of the most active journals in the field are also the most prestigious journals in business and management categories. Thus, journals like Small Business Economics, Journal of Business Venturing or Regional Studies have a high impact factor and a strong scientific influence for the international community (they are all located in Quartile 1 among all the sources of their categories). The keen interest that these journals show in entrepreneurial ecosystems indicates the high quality of the published studies.

Objective 3 is about the core articles that influence the international literature. Here we find Reynolds et al. (2005) with 'Global Entrepreneurship Monitor: Data collection design and implementation 1998-2003' and Aidis et al. (2008) with 'Institutions and entrepreneurship development in Russia: A comparative perspective'.

In the entrepreneurial ecosystems context, there are several common topics in the literature. By achieving Objective 4, which is related to the most popular topics and themes, the main topics related to the entrepreneurship environment are institutions, economic development and economic growth. There is also a large number of articles about entrepreneurial activity and female entrepreneurship.

Our research Objective 5 is about existing Social Networks by means of the co-occurrence authorship, key words and citations among entrepreneurial ecosystems articles. The co-authorship analysis confirms that besides research groups not collaborating in a number of articles, they are sometimes from the same institution, but some other articles include co-authors from different countries or institutions. The subsequent centrality of authorship analysis support and reinforce these conclusions. Centralisation confirms these results because the three algorithms of centrality show poor connectivity among the authors in the collaboration network.

The co-occurrence map provides insight into the breadth and importance of key words, Global Institutions and entrepreneurial activity are found in the core entrepreneurial ecosystems literature, and are an essential nexus in the entrepreneurial ecosystems literature.

The co-citation analysis indicates that researchers use literature on recourses and differences in universities when they wish to explain entrepreneurial ecosystems. Two of the most important works that the literature cites are Reynolds (2005), and North (1990), which can be considered the main reference source for the core literature.

Lastly, the content analysis shows that most of the works have a social and economic environment dimension. Therefore, the most popular theory is the institutional theory. Regarding type of study, we find that they use mainly a regression model or descriptive statistics, and they are empiric and quantitative works.

Finally, this study is not without its limitations in the search, selection and data analysis. One clear limitation is the possible non-inclusion of one of the considered key articles, or more, in the considered database, which was not due to lack of methodology. This work is focused on GEM-related articles, because GEM database offers the biggest cross-country dataset available on entrepreneurial activity. However, most of the research on entrepreneurial ecosystems is not based on GEM data. So, there could be a 'missing literature' on entrepreneurial ecosystems because of the GEM approach adopted as a purpose of the study. On the other hand, the number of countries is restricted in GEM (especially developing countries). Consequently, could exist a geographical bias in the field of studies based on GEM.

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