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Innovation and entrepreneurship: an approach based on bibliometric analysis

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Abstract

The purpose of this article is to investigate the literature that relates innovation and entrepreneurship for its recognized contribution to the economy. In this article a bibliometric analysis of the research on this topic extracted from the main collection of the Web of Science (WoS) database from 2000 to 2020 is carried out, obtaining 1785 documents. The main of the bibliometric method is to perform, through BibExcel and VOSviewer software, a trend analysis, a study of the general and annual structure of citations, to present the advances associated with the main authors, journals and most relevant countries and to analyze their evolution over time and identify key research topics to contribute to the development of this field. In addition, this study will analyze co-citations, bibliographic couplings, co-occurrences and co-authorships, among others. The results show that the publication trend increases considerably from 2010 especially in the last two years. In relation to the most publishing countries, the United States, China, England and Spain are among the most representative. It is also found that the most influential journals in this field are Small Business Economics and Journal of Business Research. This systematic mapping of the field helps to illustrate the evolution of research over time, identify areas of current interest for use in theoretical and empirical frameworks, and provide, thanks to its findings, a solid roadmap for future research by detecting potential directions.

Keywords: *Bibliometric Analysis, Entrepreneurship, Innovation, Creativity, Co-citation, Bibliographic Coupling.*

Introduction

The contribution of technological innovation to national economic growth is well established in the economic literature, both theoretically (Solow, 1956; Romer, 1986) and empirically (Mansfield, 1972; Nadiri, 1993). Entrepreneurship is also a factor undoubtedly recognized as a driver of economic activity and a catalyst for economic growth and development (Robbins

et al., 2000; Harrison,C., Burnard, K.,& Paul,S., 2016). According to Schumpeter (1934), entrepreneurship is a developer of local, regional and national economies and an engine for overcoming economic crises. Organizations should be more entrepreneurial to improve their performance, adaptability and long-term survival (Gupta et al., 2004; Kuratko, 2007). In addition, entrepreneurship promots innovation in organizations (Bremer, 2011).

The purpose of this research is to conduct and present a bibliometric analysis of the literature on entrepreneurship and innovation to provide an updated and plural knowledge to this fields by identifying both the main authors and the countries, journals or categories that investigate it. Similarly, by means of graphic maps of bibliometric networks, visualize elements such as co-citation, bibliographic coupling and co-occurrences of keywords. By exploring these issues, it is hoped to provide a bibliographic framework to delineate appropriate actions to encourage the implementation of new and more pluralistic endeavors.

The structure of the remainder of this article is as follows. First, the bibliometric methods used in this paper are discussed as their purpose, and the search methodology used to obtain the database. The following section presents the results: a study of publications, authors, countries, journals, research areas and keywords, structured by number of elements and their citation structure and a graphical analysis of networks of bibliographic data. Finally, the conclusions are addressed and the identification of potential future research.

Bibliometric Method

The methodology employed in this research is bibliometric analysis. Bibliometric performance indicators are used to measure academic production using a quantitative approach (Cancino, Merigó, Coronado, Dessouky & Dessouky, 2017) through data extraction and manipulation, based on content or citation analysis (Martínez, Herrera, Contreras, Ruíz, & Herrera-Viedma, 2014), which gives an idea of a given field of research (Merigó, Gil-Lafuente, & Yager, 2015). The results could are about the total number of papers published in a period of time, the impact of these publications, the average number of citations per article, the most relevant authors, the most representative journals and the impact factor (Thongpapanl, 2012), the h-index of an author (Hirsch, 2005; Alonso, Cabrerizo, Herrera-Viedma, & Herrera, 2009), and data on the geographical distribution of the publications as country of origin (Bonilla, Merigó, & Torres-Abad, 2015).

In addition, a network analysis with graphical maps based on the bibliographic datawas performed using the free software VOSviewer (version 1.6.15 (0)) (Van Eck & Waltman, 2010) to graphically represent and analyze information such as the co-citations of journals, bibliographic coupling by authors and countries and co-occurrence of authors' keywords (Merigó, Pedrycz, Weber, & de la Sotta, 2018) and to visualize the connections between these variables (Merigó, Cancino, Coronado, & Urbano, 2016).

To obtain the bibliographic base, the first step was consulted the main collection of the Web of Science (WoS) database. The indices used were: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC. In a 2nd step, appropriate search terms were defined using search equations Title: ("entrepre*") and combined: AND Title: ("innovat*" or "creativ*"). The 3th step was to define the time frame from 2000 to 2020[1] to analyze a long enough period to understand the evolution of the literature in this field. The results were then refined by choosing only articles and reviews and, in order not to exclude countries of authorship, articles published in all languages were included, resulting in 1785 documents distributed in 1748 articles and 37 reviews. Thirty-one papers had no publication date and 28 had a publication date in 2021, so a decision was made to always include the early access date as a preference in counts reaching 59 publications[2].

Results

3.1 Publications: distribution by year and citation structure.

The number of publications per year has been increasing over the last sixt years, see Table 1. From 2007 to 2014, the object of this research was hardly of interest but it is in the period 2015-2020, when it begins to have a more sustained publication coming to produce almost 213 articles on average per year, with almost 71% of the articles published. The general citation structure allows analyzing the amount of documents in relation to a citation threshold (Cancino et al., 2017), in this sense, 71,5% of the documents indexed have received less than 10 citations, about 20,5% have received between 10 and 50 citations, almost 4% have received at least 200 citations as can be seen in Table 1. The year with the most citations is 2015 with a total of 2500, followed by 2011 with 2179. This base reveals that the most cited papers are located in the most recent years, since the period 2011 and 2020, 85% of the papers are generated concentrating more than 60% of the total citations. This clearly indicates the increased interest of the scientific community in recent years.

Table 1. Annual citation structure on entrepreneurial and innovation research

Year	TP	TC	≥1	≥10	≥20	≥50	≥ 100	≥200	≥300
2000	7	331	7	6	4	2	1	0	0
2001	7	1405	6	5	4	3	3	2	2
2002	6	657	5	4	4	3	2	1	1
2003	6	53	6	1	1	0	0	0	0
2004	13	975	9	8	4	3	3	2	2
2005	12	1086	11	7	5	4	3	2	1
2006	10	524	10	5	5	4	2	1	0
2007	24	1714	22	16	14	12	7	3	0
2008	35	1426	31	22	17	8	5	0	0
2009	33	1861	27	18	17	12	7	2	1

[1] The WoS database extraction date was June 5, 2021.

[2] Early access articles are fully peer-reviewed, citable and published, but have not yet been assigned any volume/number/page number (source: WoS).

2010	52	1443	47	22	17	9	4	1	0
2011	81	2179	54	22	18	12	7	2	1
2012	77	1612	58	31	24	10	3	0	0
2013	63	1860	46	30	27	15	5	0	0
2014	80	2238	62	39	28	13	7	1	1
2015	154	2500	122	64	40	14	4	0	0
2016	171	2097	143	65	32	6	2	0	0
2017	184	1557	128	43	21	7	1	0	0
2018	223	1835	176	51	27	5	1	0	0
2019	231	1165	169	37	13	1	0	0	0
2020	316	731	171	13	5	1	0	0	0
Total	**1785**	**29249**	**801**	**182**	**183**	**77**	**50**	**8**	**9**
%	**100%**		**44,9%**	**10,2%**	**10,3%**	**4,3%**	**2,8%**	**0,4%**	**0,5%**

Abbreviations: TP: Total Papers; TC: Total number of citations; ≥ 300, ≥ 200, ≥ 100, ≥ 50; ≥ 20, ≥ 10, ≥ 1: Number of Papers with equal or more than 300, 200, 100, 50, 20 and 1 citation

3.2 Bibliographic coupling of authors

Next, this research analyzes the bibliographic coupling that occurs when the authors of two papers, B and C, cite the same third paper A. In Figure 1, 38 authors with a minimum threshold of four papers showing the 100 most representative connections. This graphical mapping of authors connects or clusters those with similar research profiles and who cite similar bibliographic material. The red colour cluster shows the highest concentration of connections but it is the green cluster formed by Guerrero, Urbano and Peris-Ortiz that has the highest intensity marked by the thick lines connecting them showing that these authors may have similar or even joint lines of research with joint articles.

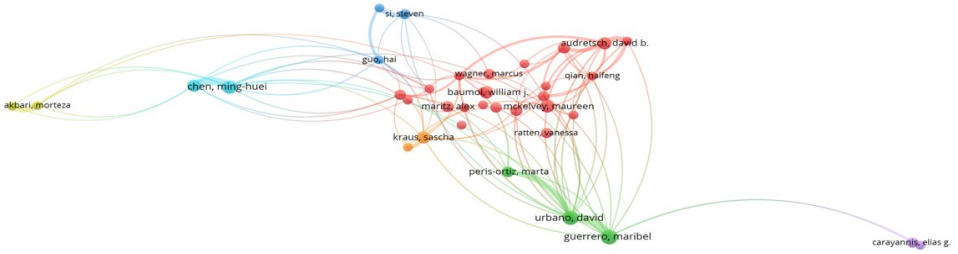

Fig. 1. Bibliographic Coupling of Authors (source: VOSviewer)

3.3 Geographical distribution of countries, bibliographic coupling by countries

Analyzing the geographical distribution of the documents, table 2 shows the 5th main countries of origin of the publishers from the highest to the lowest number of articles and the citations received. The USA is the country with the most papers published on the topic with 334 publications, followed by China with 163 and England with 160 articles followed by Spain. The structure of citations is different from the production of papers since, although the China is the second country with the most papers, England and Spain have more citations than China. USA, England and Germany have publications with 300 or more citations.

Table 2. Countries that publish the most on the topic (source: BibExcel and Own elaboration)

Nº	Country	TP	TC	H	TC/TP	≥ 300	≥ 200	≥ 100	≥ 50	≥ 10	≥ 1
1	USA	334	6552	77	19,6	1	3	17	38	124	201
2	PEOPLES R CHINA	163	1255	28	7,7	0	0	2	3	34	77
3	ENGLAND	160	2808	38	17,6	1	1	4	14	55	94
4	SPAIN	145	2295	36	15,8	0	0	6	14	50	73
5	GERMANY	81	1765	29	21,8	1	1	3	7	31	45
Abbreviations in table 1. H: h-index investigation database.											

Figure 2 presents the graphical map of bibliographic coupling between the main 47 countries with a threshold of at least 8 documents per country and 100 connections. Clearly, USA is bibliographically coupled with China and Australia and to a lesser extent England with France and Italy and another cluster Spain with Netherland among others.

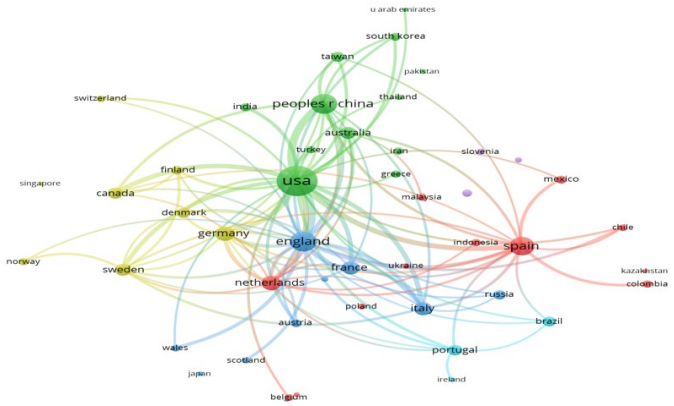

Fig. 2. Bibliographic Coupling by Countries (source: VOSviewer)

3.4. Most productive and cited publications sources and co-citation of journals

The journals more productive are: Small Business Economics, with 49 papers, and Journal of Business Research with 38. However, the most cited journal is Journal of Business Venturing (JVB) with 2959 citations and 17 articles. Regarding the citation structure, JBV have published 2 articles each with at least 300 citations, see table 3.

Table 3. Citation structure of the most published journals (source: BibExcel and Own elaboration)

Journal	TP	TC	H	TC/ TP	IF 2019	IF 5 years	% s/ TP	≥300	≥10	≥1
Small Business Economics	49	249	23	51	4.803	5.377	2,7%	1	1	46
Journal of Business Research	38	128	16	34	4.874	5.484	2,1%	0	0	35
Sustainability	33	198	7	6	2.576	2.798	1,8%	0	0	27
Technological Forecasting and Social Change	28	726	16	26	5.846	5.179	1,6%	0	0	27
International Entrepreneur and Manag. Journal	26	525	12	20	3.472	3.815	1,5%	0	0	24
Frontiers in Psychology	18	54	3	3	2.067	2.722	1%	0	0	12
Journal of Business Venturing	17	2959	16	174	7.59	10.873	1%	2	2	17
Abbreviations are shown in Table1; IF: Index Factor										

In Figure 3, the co-citation of the journals is analysed this is when two papers are cited in a third paper, they are co-cited (Merigó et al., 2018). The more citations the two papers have in the same paper, the greater their relationship and thus the larger the node size, and the greater the distance between nodes, the lower the citation frequency, and vice versa (Liao et

al., 2018). Figure 3 presents the overall visualization with a minimum threshold of 200 citations from 54 sources and 100 connections. The red cluster has the strongest co-citations and connections and it means that the journals, as Entrepreneurship theory and practice as Journal of business venturing are part of the same thematic. The other journals (green cluster) that stand out are the Research Policy and Small Business Economics.

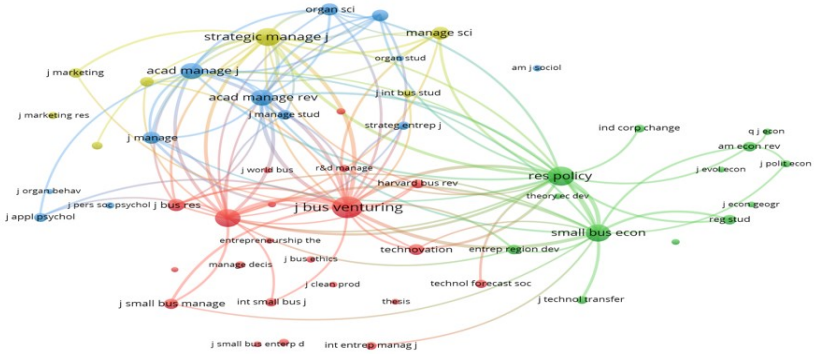

Fig. 3. Co-citation of Journals (source: VOSviewer)

3.5. WoS category research

With regard to the WoS categories, table 4 shows that almost 40% of the articles in our research are in the Business category and almost 38% are in the Management category.

Table 4. Main Categories in WoS and Citation Structure (source: BibExcel and Own elaboration)

WOS category	TP	%	TC	H	TC/ TP	≥ 300	≥ 200	≥ 100	≥ 50	≥ 20	≥ 10	≥ 1
Business	702	39,3%	15973	63	23	5	12	40	86	162	247	541
Management	667	37,4%	15691	64	24	6	9	39	85	176	257	532
Economics	314	17,6%	5156	35	16	2	3	11	23	57	98	225
Education & Research	124	6,9%	731	14	6	0	0	0	3	10	20	81

3.6 Keyword Research: Co-occurrences

Content analysis has potential when it comes to discovering emerging fields (Ellegaard & Wallin, 2015). Therefore, the main keywords in the document base are analyzed through the co-occurrence of all keywords, provided by the authors themselves.

Table 5 shows the main author keywords that appear most frequently in the same documents (Merigó et al., 2018). Ten most common author keywords are reflected with their respective co-occurrences and total link strength. Apart from the logical main words such as innovation, entrepreneurship and creativity other words such as entrepreneurial orientation and social entrepreneurship stand out.

Table 5. Most common co-occurrences of author keywords (source: VOSviewer)

N	keyword	occurrences	Tota Link Strength
1	innovation	398	303.00
2	entrepreneurship	384	291.00
3	creativity	80	68.00
4	entrepreneurial orientation	70	44.00
5	social entrepreneurship	53	34.00

Nº	keyword	occurren	TLS
6	social innovation	35	25
7	entrepreneur	33	23
8	corporate entrepreneurship	31	22
9	entrepreneurs	31	22
10	smes	28	19

Discussion

The bibliometric study has shown that the amount of research related to entrepreneurship and innovation has been gaining interest from 2015 to 2020 since they represent 71% of the published articles. But it is still low, as confirmed by the fact that 71,5% have less than 10 citations. However, a progress is perceived, the most cited papers are found in the most recent years, since in the period 2011 and 2020, 85% of the papers are generated concentrating more than 60% of the total citations.

The bibliographic coupling by authors reveals strong connections between authors who point to similar or even joint lines of research, as is the case of co-authorships between Guerrero, Urbano and Peris-Ortiz, among others.

The most active countries on the subject are the USA and China in terms of number of publications. The USA has more than 18% of the documents. In the bibliographic coupling by country, it can be seen how clearly the USA is bibliographically coupled with China and in different clusters Spain with Netherland and Colombia among others.

On the other hand, the top two journals are: Small Business Economics, with 49 papers, and Journal of Business Research with 38. However, the most cited journal is Journal of Business Venturing. The co-citation of the journals makes clear three clear areas of specialties, business, management and economics. The cluster with the most co-citations and connections are part of the same thematic. Within the categories section, 40% of the research articles are in the Business category and almost 38% are in the Management category.

The trends of entrepreneurship and innovation, obtained by the authors' keywords, have focused on examining the relationship between the two fields, but reveal some areas to explore such as social topic or corporate, among others.

Conclusion

The objective of this study was to contribute to the field of research on entrepreneurship and innovation to provide greater clarity to the panorama by identifying and mapping variables such as main researchers, publishing countries, scientific journals, research areas and keywords and the interrelationships between them. Future research directions include to analyze how entrepreneurial innovation are being addressed among different countries. This type of analysis could be done using other databases such as Scopus or Google Scholar, in order to have more information, because some countries have very few publications on the subject, but it does not mean that they are not writing or publishing.

Finally, another line of research is to analyze how the different areas of knowledge are interwoven. In this sense, it would be of great value for researchers to understand what is being researched and where research is heading in each field of knowledge, bearing in mind

that areas associated with business and economics, management, and organizational behavior, among others, are presented in this analysis.

By exploring all these issues, the objective is to improve the available knowledge and outline appropriate recommendations to encourage the implementation of more ventures.

As a limitation, it should be noted that these results come from the Web of Science Core Collection database which is considered one of the most influential for classifying research but has some limitations such as using the full count of all participating units of an article and, therefore, articles with several co-authors obtain better results than single-authored articles. Finally, the results represent the overall picture until 2020, which may change in the future these results as dynamic bibliometric data evolve differently than expected.

References

Alonso, S., Cabrerizo, F. J., Herrera-Viedma, E., & Herrera, F. (2009). h-Index: A review focused in its variants, computation and standardization for different scientific fields. *Journal of Informetrics*, *3*(4), 273–289. https://doi.org/10.1016/j.joi.2009.04.001

Bonilla, C. A., Merigó, J. M., & Torres-Abad, C. (2015). Economics in Latin America: a bibliometric analysis. *Scientometrics*, *105*(2), 1239–1252. https://doi.org/10.1007/s11192-015-1747-7

Bremer, I. (2011). Common factors between swedish and chinese entrepreneurial leadership styles. Human Resource Management: Issues, Challenges and Opportunities, 2(1), 1–311.

Cancino, C., Merigó, J. M., Coronado, F., Dessouky, Y., & Dessouky, M. (2017). Forty years of Computers & Industrial Engineering: A bibliometric analysis. *Computers and Industrial Engineering*, *113*, 614–629. https://doi.org/10.1016/j.cie.2017.08.033

Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, *105*(3), 1809–1831. https://doi.org/10.1007/s11192-015-1645-z

Garfield, E. (1972). Citation Analysis as a Tool in Journal Evaluation. *Science 178*, 417–479.

Gupta, V., MacMillan, I. C., & Surie, G. (2004). Entrepreneurial leadership: Developing and measuring a cross-cultural construct. *Journal of Business Venturing*, *19*(2), 241–260.

Harrison, C., Burnard, K., & Paul, S. (2016). Entrepreneurial leadership in a developing economy: a skill-based analysis. *Journal of Small Business and Enterprise Development*, *25*(3), 521–548.

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(46), 16569–16572.

Kuratko, D. F. (2007). Entrepreneurial Leadership in the 21st Century. *Journal of Leadership & Organizational Studies*, *13*(4), 1–11. https://doi.org/10.1177/10717919070130040201

Liao, H., Tang, M., Luo, L., Li, C., Chiclana, F., & Zeng, X. J. (2018). A bibliometric analysis and visualization of medical big data research. *Sustainability (Switzerland)*, *10*(1), 1–18.

Martínez, M. A., Herrera, M., Contreras, E., Ruíz, A., & Herrera-Viedma, E. (2014). Characterizing highly cited papers in Social Work through H-Classics. *Scientometrics*, *102*(2), 1713–1729.

Mansfield, E., 1972, 'Contribution of Research and Devel- opment to Economic Growth of the United States', Papers and Proceedings of a Colloquim on Research and Development and Economic Growth Productivity, National Science Foundation, Washington, DC.

Merigó, J. M., Gil-Lafuente, A. M., & Yager, R. R. (2015). An overview of fuzzy research with bibliometric indicators. *Applied Soft Computing Journal*, *27*, 420–433.

Merigó, J. M., Cancino, C. A., Coronado, F., & Urbano, D. (2016). Academic research in innovation: a country analysis. *Scientometrics*, *108*(2), 559–593. https://doi.org/10.1007/s11192-016-1984-4

Merigó, J. M., Pedrycz, W., Weber, R., & de la Sotta, C. (2018). Fifty years of Information Sciences: A bibliometric overview. *Information Sciences*, *432*, 245–268.

Nadiri, I., 1993, 'Innovations and Technological Spill- overs', Working Paper 423, National Bureau of Economic Research, Cambridge, MA.

Robbins, D. Keith, Pantuosco, Louis J., Parker, Darrell F., Fuller, Barbara K., 2000. An Ampirical assessment of the contribution of small business employment to US state economic performance. Small Bus. Econ. 15 (4), 293e302.

Romer, P. M., 1986, 'Increasing Returns and Long Run Growth', Journal of Political Economy 94.

Schumpeter, J. (1934). The theory of economic development: an inquiry into profits, capital, interest, and the business cycle. Cambridge: Harvard University Press.

Solow, R. M., 1956, 'A Contribution to the Theory of Economic Growth', Quarterly Journal of Economics 70, 65–94.

Thongpapanl, N. (2012). The changing landscape of technology and innovation management: An updated ranking of journals in the field. *Technovation*, *32*(5), 257–271.

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538.