RedFame

International Journal of Social Science Studies
Vol. 10, No. 5; September 2022
ISSN 2324-8033 E-ISSN 2324-8041
Published by Redfame Publishing
URL: http://ijsss.redfame.com

Systematic Literature Review on Academic Entrepreneurship by Bibliometric Metadata Analysis

Marco Antonio Domingues[1,2], Hortência E. P. Santana[3], Denise Santos Ruzene[3,4] & Daniel Pereira Silva[1,3,4]

[1]Graduate Program in Intellectual Property Science, Federal University of Sergipe, São Cristóvão, Sergipe, Brazil;

[2] Federal Institute of Education, Science and Technology of Sergipe, Itabaiana, Sergipe, Brazil

[3]Graduate Program in Biotechnology, Federal University of Sergipe, São Cristóvão, Sergipe, Brazil

[4] Northeastern Biotechnology Network, Federal University of Sergipe, São Cristóvão, Sergipe, Brazil

Correspondence: Daniel Pereira Silva**,** Federal University of Sergipe, Center for Exact Sciences and Technology, Av. Marechal Rondon, s/n, Jardim Rosa Elze, São Cristóvão, Sergipe 49100-000, Brazil.

Received: July 19, 2022 Accepted: August 31, 2022 Available online: September 9, 2022

doi:10.11114/ijsss.v10i5.5647 URL: https://doi.org/10.11114/ijsss.v10i5.5647

Abstract

The purpose of this article is to map the field of Academic Entrepreneurship focusing on the search for models that evaluate the viability of intellectual property as a product. The study was based on articles retrieved from the Web of Science database covering the period from 1988 to 2020, where the metadata data analysis was carried out using the RStudio software, bibliometrix package, and the web interface Biblioshiny, and a systematic review was conducted following the PRISMA protocol, Extension for Scoping Reviews. The findings revealed that the main objectives of studies on academic entrepreneurship are related to the analysis of human (training, leadership, and motivation), physical and management resources, as they are pointed out as the most necessary incentives to improve universities AE. Therefore, it was concluded that most models on AE are for the evaluation of the development of entrepreneurship in the academic environment and there is a research gap to develop models aiming at the commercialization of intellectual property.

Keywords: academic entrepreneurship, technology transfer, systematic review, metadata, bibliometrics

1. Introduction

Given the efforts of universities to improve their productivity and stimulate the capitalization of scientific knowledge, the issues of academic entrepreneurship have been the center of several theoretical and empirical research. Such importance of this subject can be perceived by the number of documents indexed in scholarly databases, only in the Web of Science database the search for “academic entrepreneurship", in all fields, results in 9526 documents. In that regard, due to the extensive literature, when it is necessary to identify, evaluate, and interpret the available papers to address a determined question on the subject, the manipulation of efficient tools to guide the systematic literature review is extremely useful. Without setting a reproducible method, with a clear protocol, the credibility of the findings can be compromised, which leads to biased and inefficient outcomes.

In recent years, health-related areas have sought to improve their review processes to become more systematic, transparent, and replicable, developing systematic review procedures that are being adopted by other areas, e.g., engineering. Those methods first include the formulation of a clear research question, the development of search strategies, description of inclusion and exclusion criteria, and a quality assessment of selected documents. Guides and protocols to conduct a systematic literature review are presented by Brereton et al (2007) e Kitchenham et al (2007; 2002) on the engineering field and by Tranfield, Denye and Smart (2003), Sampaio e Mancini (2007), Moher et al. (2009), and Page et al. (2021) on health fields.

To study the forms of measuring information and scientific knowledge, Vanti (2002) proposed to analyze the quantitative metric methods of bibliometrics, scientometrics, informatics, and webometrics under a theoretical conceptual discussion to explore and extend these concepts, while revising and discussing their main applications. The study stated some of the similarities and differences linking those subfields, showing that each one can be more adequate to obtain a reliable base

for the different types of literature review, and reviewed their theoretical history, revealing that the term bibliometrics was first introduced in literature by Paul Otlet (1934) and popularized by Alan Pritchard (1969).

Within the application of quantitative methods, the bibliometric analysis presented by multiple authors has as objects of study: books, documents, journals, papers, authors, or users; as variables: number of circulations and citations or sentence length frequency; as methods: ranking or distribution frequency; as others (Munim et al., 2020; Roldan-Valadez et al., 2019; Teles et al., 2020; Zhang et al., 2016). In addition, can be reported Lotka's Law of author productivity (Lotka, 1926), Zipf's Law of Word Occurrence (Zipf, 1949), and Bradford's law of Scattering of Scientific papers (Brandford, 1948) and citation analyses, that comprises: Most Cited Authors, Most Productive Authors, Author Impact, Corresponding Author's Country, Author Institutional Affiliation, Most Influential Authors on the specific research field, Most Common Document Type, Mean Age of References, Obsolescence of the literature, Geographic origin of the bibliography, Institutional Affiliations of the Bibliography, Most Cited Journals, and set of journals in a specific area of knowledge.

In that context, the indicators measured by bibliometrics are best suitable for covering the purpose of the present work, which is to develop a systematic literature review searching for evidence of models that evaluate the viability of products generated from academic intellectual property. The paper proposes to use the metadata analysis to clarify or answer the question of what documents should compose the theoretical framework in a literature review on EA, besides suggesting secondary questions on AE related to main research information and its evolution over time, who is leading the research, most relevant authors and current limitations on the topic.

2. Methods

The study was carried out using the PRISMA protocol recommendation, Extension for Scoping Reviews (PRISMA-ScR), an extension of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009; Page et al., 2021; A. C. Tricco et al., 2018) and bibliometric analysis followed as suggested by (Aria & Cuccurullo, 2019, p. 38) (Table 1).

Table 1. Bibliometric Analysis for Systematic Literature Reviews focused on the domain

Main data results	*Level of analysis*	*Metrics*
Time span ***Sources Types***	***Sources***	***Bradford's law*** ***H index*** ***Source dynamics*** ***Most relevant sources***
Author Appearances ***Authors of single-authored documents*** ***Authors of multi-authored documents*** ***Authors per Document*** ***Co-Authors per Documents*** ***Collaboration Index***	***Authors***	***Most relevant authors*** ***Annual production per author*** ***Loka's Law*** ***h index*** ***Most relevant affiliations*** ***Countries***
Document Types ***Document Contents*** ***References*** ***Documents per Author*** ***Single-authored documents***	***Documents***	***Most cited documents*** ***Cited references*** ***Words: Keywords Plus®,*** ***Author Keywords,*** ***Document Title, Abstract***

Source: Adapted from (Aria & Cuccurullo, 2019).

The data used for this work was retrieved from the Core Collection of the database Web of Science (WoS), which among the databases supported in Bibliometrix provides better data quality to export to package biblioshiny in "plain text" format (Aria & Cuccurullo, 2017, p. 17). The WoS database was accessed from CAPES/MEC Journal Portal via Federal University of Sergipe, then the search was performed by employing the term "academic entrepreneurship" and selecting the field "TOPIC", which includes title, authors keywords, and Keywords Plus.

Based on the eligibility criteria defined by Tricco, Lillie, Zarin, O'Brien, Colquhoun, Levac, et al., 2018, p. 22), this study searched for documents in all sources of the database WoS, covering the whole period up to 2020 and selecting only articles published in English from scientific peer-reviewed journals in the areas of "*Business economics"* and *"Operations research management science*".

The workflow to export the data from WoS to Biblioshiny can be described in four stages: (1) refining the results by applying the search strategy to export them in the form of Plain text file; (2) completing the record of cited references with the variables necessary for analysis; (3) exportation of txt files; and (4) uploading metadata from files to biblioshiny interface.

3. Results and Discussion

As initial results, from the conducted search on academic entrepreneurship in the database Web of Science, by using the

predefined keywords and filters, it was found 882 records. For extracting the files with consolidated data, without duplicates (certified by the individual analysis of each document), the data were exported to biblioshiny for bibliometricx and filtered from 1988 to 2020, which results in 848 as bases documents. Then, the main results were synthesized into three groups: (1) Main data information; (2) Document information; (3) Author information (Table 2).

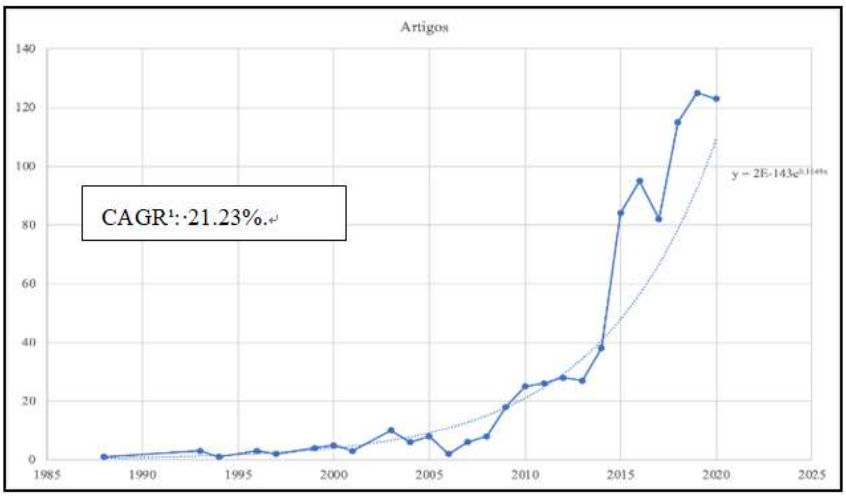
For the period covered in the research, it was observed that from 1988, the year of the first publication with the keyword AE, to the next 21 years (2008), the annual scientific production was not superior to ten per year, having had only 13 productive years and a total of 62 publications over that time. On the other hand, the following period of 9 years, from 2009 to 2017, and the last 3 consolidated years (2018-2020) ended up, respectively, with 423 and 363 published articles. For the selected period, a constant growth rate of 21.23% per year was measured by the Compound Annual Growth Rate (CAGR), while the exponential growth, which better represents the trend of the curve, is described by the expression $y = 2E\text{-}143e^{0,1649}$ (Figure 1 and Table 3).

Table 2. Main collection information from searching the keyword "academic entrepreneurship", WoS database

Information		Results
(1) Main data information	Period	1988:2020
	Sources (journals)	228
	Articles	848
	Average Years since Published	5.49
	Average Citations per Paper	31.03
	Average Citations per Year per Paper	3.079
	References	37.614
(2) Document information	Articles	848
	Keywords Plus	1371
	Author's keywords	2186
(3) Author's information	Authors	1.911
	Authorship Appearances	2.231
	Authors of single-authored papers	149
	Authors of multiple-authored papers	1.762
	Single-authored paper	162
	Multi-authored paper	0.444
	Authors per documents	2.25
	Co-authors per paper	2.63
	Collaborative Index	2.57

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix, ***Dataset/Main Information about the collection.***

Figure 1. Profile and trend of annual scientific production on AE, WoS database



Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. Dataset/Annual Scientific Production ¹Compound Annual Growth Rate.

Table 3. Annual scientific production on AE, WoS database

	Year	Articles	Year	Articles	Year	Articles	Year	Articles
1	1988	1	1999	4	2009	18	2018	115
2	1989		2000	5	2010	25	2019	125
3	1990		2001	3	2011	26	2020	123
4	1991		2002		2012	28		
5	1992		2003	10	2013	27		
6	1993	3	2004	6	2014	38		
7	1994	1	2005	8	2015	84		
8	1995		2006	2	2016	95		
9	1996	3	2007	6	2017	82		
10	1997	2	2008	8				
11	1998							
			Total 1	62	Total 2	423	Total	363
							Total	848

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix, Dataset/Annual Scientific Production.

Analyzing the Average Citations Per Year present in Table 4, it is possible to observe that, together, the five articles published in 2000 have recorded the highest average of 28.72 citations per year since their publication, a clear indication that those articles should compose the theoretical framework on AE. Further, the papers from the following years were also heavily cited by other authors, for which was found an average of 13.86 in 2004, 12.75 in 2003, and 12.10 in 2005. Therefore, the outcomes revealed the beginning of the 00s as an important period for the solidification of AE knowledge. Another highlight is the only single publication of 1994 that has been cited 299 times.

Table 4. Average Citations per Year on AE, ***WoS database***

Year	***TC*** [1]	***Art*** [2]	[3]***TC /Art***	[4]***TC /Year***	[5]***CY***	***Year***	***TC***	***TC*** [1]	***Art*** [2]	[3]***TC /Art***	[4]***TC /Year***
1988	36	1	36.00	1.09	33	2005	1549	8	193.63	12.10	16
1989	0	0	0.00	0.00	32	2006	94	2	47.00	3.13	15
1990	0	0	0.00	0.00	31	2007	749	6	124.83	8.92	14
1991	0	0	0.00	0.00	30	2008	843	8	105.38	8.11	13
1992	0	0	0.00	0.00	29	2009	1743	18	96.83	8.07	12
1993	371	3	123.67	4.42	28	2010	928	25	37.12	3.37	11
1994	299	1	299.00	11.07	27	2011	2194	26	84.38	8.44	10
1995	0	0	0.00	0.00	26	2012	1122	28	40.07	4.45	9
1996	144	3	48.00	1.92	25	2013	1251	27	46.33	5.79	8
1997	268	2	134.00	5.58	24	2014	1629	38	42.87	6.12	7
1998	0	0	0.00	0.00	23	2015	1848	84	22.00	3.67	6
1999	264	4	66.00	3.00	22	2016	1574	95	16.57	3.31	5
2000	3016	5	603.20	28.72	21	2017	749	82	9.13	2.28	4
2001	458	3	152.67	7.63	20	2018	775	115	6.74	2.25	3
2002	0	0	0.00	0.00	19	2019	558	125	4.46	2.23	2
2003	2295	10	229.50	12.75	18	2020	144	123	1.17	1.17	1
2004	1414	6	235.67	13.86	17						

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix Dataset/Average Citations per Year.
[1]Total Citations; [2]Number of Articles; [3]Mean TC/Article; [4]Mean TC/year; [5]Citable years.

Academic entrepreneurship has been reported in documents from different sources, such as journals, books, proceedings papers, and others, however, for this work, all the 848 documents selected were articles published in peer-reviewed journals. The 248 document sources (journals) were evaluated in terms of relevance and impact, measured by the number of publications (NP), the h-index (Hirsch, 2005), the analysis of Bradford's Law (1948), and publication growth dynamics.

The descending order of sources by the number of citations in Table 5, showed that the top 20 journals, 8.77% of the total, account for 80% of total citations, wherein the Research Policy and Journal of Business Venturing, first and second respectively, stand out with the highest h-indices and 41.91% of cumulative citations. In addition, the highest numbers of publications were 61 from Research Policy and 45 from Small Business Economics.

The 848 retrieved articles were divided into 3 groups (analyzes zones), each one containing approximately 1/3 of the documents: Zone1, with 288 articles distributed in 12 journals; Zone 2 with 283 articles distributed in 44 journals; and Zone 3, with 277 articles distributed in 177 journals. The journals in Zone 1 (Table 6) represent only 5.26% of total journals but cumulate 33.96% of the whole cited articles, therefore, according to Bradford's Law (1948), when considering the analysis of main journals on AE, zone 1 contains the most significant group of sources available on WoS.

Regarding the authors' analysis, the metrics used were: Most Relevant Authors, Most Cited Authors in the field of AE,

Authors' Production Per Year, Lotka's law, Author Impact (h-index), Most Relevant Affiliations, and Corresponding Author's Country. In terms of productivity, the Most Relevant Authors were: Wright with 10 articles, Meoli and Vismara with 8 articles, and Braunerhjelm with 7 articles (Table 7); while the Most Cited Authors were: Wright with 244 citations, Siegel with 110 citations, and Grimaldi with 100 citations (Table 8).

Table 5. Classification of articles' sources on academic entrepreneurship, WoS database

	Source	*h_index*	*g_index*	*m_index*	*TC [1]*	*NP [2]*	*PY_start [3]*	*TC_c[4]*	*Par_c[5]*
1	***Research Policy***	***39***	***61***	***2.05263***	***5970***	***61***	***2003***	***5970***	***22.69%***
2	***Journal of Business Venturing***	***22***	***25***	***0.75862***	***5059***	***25***	***1993***	***11029***	***41.91%***
3	***Small Business Economics***	***22***	***43***	***0.84615***	***1886***	***45***	***1996***	***12915***	***49.08%***
4	***Entrepreneurship Theory and Practice***	***11***	***15***	***0.64706***	***1146***	***15***	***2005***	***14061***	***53.43%***
5	***Academy of Management Journal***	***5***	***5***	***0.22727***	***902***	***5***	***2000***	***14963***	***56.86%***
6	***R & D Management***	***10***	***11***	***0.29412***	***822***	***11***	***1988***	***15785***	***59.98%***
7	***International Entrepreneurship and Management Journal***	***11***	***25***	***0.91667***	***639***	***26***	***2010***	***16424***	***62.41%***
8	***Strategic Entrepreneurship Journal***	***5***	***8***	***0.38462***	***621***	***8***	***2009***	***17045***	***64.77%***
9	***Strategic Management Journal***	***2***	***2***	***0.11111***	***607***	***2***	***2004***	***17652***	***67.08%***
10	***Organization Science***	***5***	***6***	***0.35714***	***463***	***6***	***2008***	***18115***	***68.84%***
11	***International Small Business Journal-Researching Entrepreneurship***	***13***	***21***	***0.92857***	***453***	***21***	***2008***	***18568***	***70.56%***
12	***Journal of Business Research***	***8***	***16***	***0.47059***	***432***	***16***	***2005***	***19000***	***72.20%***
13	***Industrial and Corporate Change***	***8***	***11***	***0.61538***	***386***	***11***	***2009***	***19386***	***73.67%***
14	***Management Decision***	***6***	***19***	***0.50000***	***362***	***19***	***2010***	***19748***	***75.04%***
15	***Journal of Small Business Management***	***7***	***7***	***0.53846***	***308***	***7***	***2009***	***20056***	***76.22%***
16	***International Business Review***	***5***	***7***	***0.35714***	***289***	***7***	***2008***	***20345***	***77.31%***
17	***California Management Review***	***2***	***2***	***0.25000***	***266***	***2***	***2014***	***20611***	***78.32%***
18	***British Journal of Management***	***4***	***4***	***0.57143***	***243***	***4***	***2015***	***20854***	***79.25%***
19	***Family Business Review***	***2***	***2***	***0.15385***	***218***	***2***	***2009***	***21072***	***80.08%***
20	***European Management Journal***	***4***	***6***	***0.33333***	***214***	***6***	***2010***	***21286***	***80.89%***

Source: Elaborated by the authors. [1]Total Citations; [2]Number of publications; [3]Year of the first publication; [4] Cumulative Total Citations; [5] Cumulative participations

Table 6. Sources (peer-reviews journals) aggregated to Zone 1, according to Bradford's Law for AE articles, WoS database

Sources	*Classification*	*Freq*	*CFreq*
Research Policy	***1***	***61***	***61***
Small Business Economics	***2***	***45***	***106***
International Entrepreneurship and Management Journal	***3***	***26***	***132***
Journal of Business Venturing	***4***	***25***	***157***
International Small Business Journal-Researching Entrepreneurship	***5***	***21***	***178***
Management Decision	***6***	***19***	***197***
International Journal of Entrepreneurial Behavior & Research	***7***	***18***	***215***
Jour. of Enterprising Communities-People and Places in The Global Economy	***8***	***17***	***232***
Journal of Business Research	***9***	***16***	***248***
Entrepreneurship Theory and Practice	***10***	***15***	***263***
Journal of International Entrepreneurship	***11***	***13***	***276***
Entrepreneurship Research Journal	***12***	***12***	***288***

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix, Sources/Bradford's Law [1] Frequency; [2]Cumulative frequency.

Table 7. Authors with the highest production of articles on AE up to 2020, WoS database

	Authors	Art [1]	Art.F [2]		Authors	Art	Art.F
1	Wright M	10	3.50	10	Cunningham JA	5	1.83
2	Meoli M	8	2.75	11	Czarnitzki D	5	1.87
3	Vismara S	8	2.92	12	Grimaldi R	5	1.67
4	Braunerhjelm P	7	2.50	13	Guerrero M	5	1.70
5	Fini R	6	1.92	14	Klofsten M	5	1.78
6	Link An	6	2.50	15	Rasmussen E	5	2.33
7	Urbano D	6	2.03	16	Siegel DS	5	1.58
8	Buenstorf G	5	3.50	17	Toole Aa	5	1.87
9	Carlsson B	5	2.42				

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix, *Authors/Most Relevant Authors.*

¹Number of articles; ²Fractionated articles represent the average participation of other authors in articles authorship; for single author paper = 1.

Table 8. Most Local Cited Authors on AE up to 2020, WoS database

Position	Author	Citations	Position	Author	Citations
1	Wright M	244	11	Rasmussen E	58
2	Siegel DS	110	12	Fini R	58
3	Grimaldi R	100	13	Shane S	57
4	Kenney M	95	14	Guerrero M	57
5	Klofsten M	74	15	Etzkowitz H	56
6	Feldman M	72	16	Tartari V	52
7	Bercovitz J	72	17	Jones-Evans D	52
8	Mosey S	66	18	Carsrud AL	51
9	Mcdougall PP	66	19	Reilly MD	49
10	Urbano D	58	20	Krueger NF	49

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix,

Authors/Most Local Cited Authors.

When analyzing the authors' production over time, it was noticed that Wright besides being one of the first authors to address AE, has also been demonstrated as one of the most constant producers (Figure 2): Clarysse et al., 2007; Estrin & Wright, 1999; Fini et al., 2019; Fryges & Wright, 2014; Grimaldi et al., 2011; Huyghe et al., 2016; Knockaert et al., 2011; Lockett et al., 2003; Lockett & Wright, 2005; Markman et al., 2008; Mosey & Wright, 2007; Mustar & Wright, 2010; Rasmussen et al., 2014; Rasmussen & Wright, 2015; Siegel & Wright, 2015; Wennberg et al., 2011; Wright, 2017; Wright et al., 2007. Other consistent authors are Klofsten, that started his production in 1999, the same year as Wright, and is: de Cleyn et al., 2015; Etzkowitz & Klofsten, 2005; Guerrero et al., 2016; Jones-Evans et al., 1999; Klofsten & Jones-Evans, 2000), and Grimaldi, that started his production four years later, in 2003 (Fini et al., 2009, 2011, 2020; Greco et al., 2013; Grimaldi et al., 2011; Grimaldi & Grandi, 2001; Kochenkova et al., 2016; Nosella & Grimaldi, 2009; Perkmann et al., 2013; Villani et al., 2018).

To examine author productivity and publications, Lotka (1926) developed the mathematical relation $y=C/x^n$, named Lotka's law, where: x is the number of publications, y is the relative frequency of authors with x publications, and n and C are constants. From its generalized form, where n is approximately 2, the law is known as the 'inverse square law of scientific productivity' and means that nearly 60% of all contributors will make only a single publication.

In the 848 selected records, there was the occurrence of 1911 authors who appeared 2231 times in the collection. The empirical productivity patterns of authors predicted by Lotka's law obtained fitted values of C=1408.8 and n=3.334 and equation $y=1408{,}8x^{-3{,}334}$, with correlation coefficient R2 of 0.9738. Hence, the frequency distribution was ranked from 1708 authors (about 89.38%) making one contribution in the field to a single author credited in 10 articles. On the basis of Lotka's inverse square law with C=1708 and n=2, was found that 2647 authors appeared 5003 times, wherein the theoretical frequency distribution ranged from 1708 authors (64.53% of participation contraction) making one contribution to 1708 authors credited in 10 articles. Therefore, the difference between empirical and generated data indicates different values of n when applying Lotka's Law (Figure 3 and Table 9). The 15 authors who wrote 5 or more articles have cumulative participation of 0.89% in the collection, whereas when calculated by Lotka's law the most relevant authors represent 8.14%, being then considered as the most important authors for this study.

The author-level academic impact can be measured by the citations metric of published articles calculating the h-, g-, and m- indices, as they reflect the contribution and recognition of the author within the academic community. The h-index was proposed by Hisch (2005) to quantify the author's scientific production, an author has index h when h of the total number of papers published (Np) have at least h citations each and the others (Np -h) papers have a number of citations <= h each. The g-index was designed by Leo Egghe (2006) aiming to improve the h-index to measure the performance of a series of articles. Based on the number of citations ranked in descending order of numbers of citations that have been received, the g-index is the highest number such that the top of g articles received together at least g2 citations. Considering the citation scores of the main articles is possible to produce a better distinction within the order of the scientists from the point of view of visibility. The m-index, also proposed by Hirsch (2005), known as m-quotient, is defined by the linear correlation $h \approx mn$ or $m = h/n$, where h is the h-index and n is the number of years since the author's first publication, and its useful to compare the authors' production from different periods.

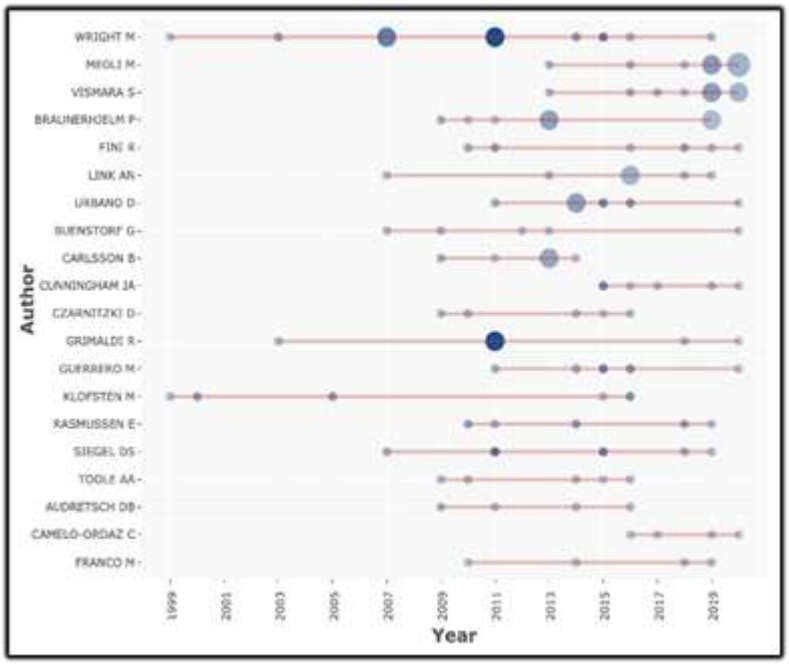


Figure 2. Top-Authors' Production on AE over Time, WoS database

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. Authors/Top- Authors' Production over Time.

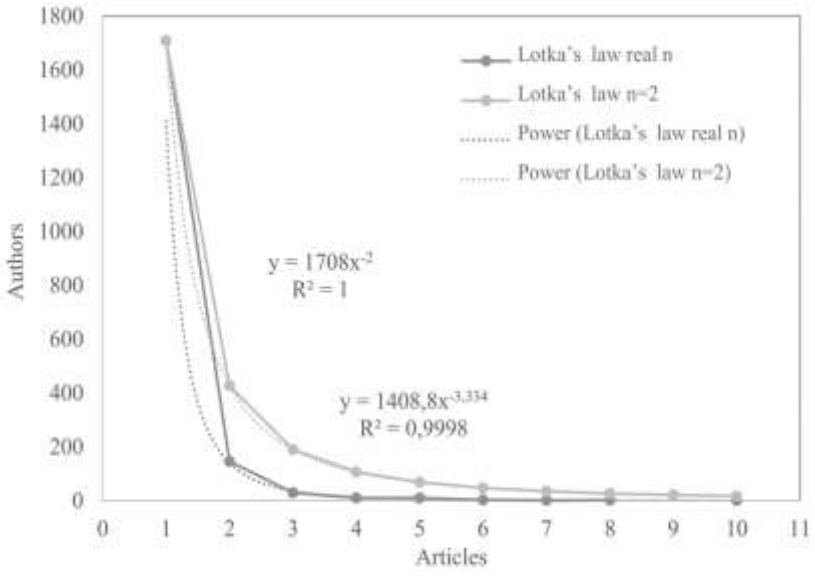


Figure 3. Frequency distribution of scientific productivity based on the AE collection from WoS (n real) and by Lotka's Law (theorical n=2)

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. Authors/Author Productivity through Lotka's Law.

Table 9. The frequency distribution of scientific productivity: comparison of values obtained from the collection and by Lotka's Law for articles on AE, WoS database

Values obtained for the collection					Values calculated by Lotka's Law			
No. of articles	No. of authors	Total No. of articles	Contr. [1]%	Cum. [2]%	No. of authors	Total No. of articles	Contr. %	Cum. %
1	1708	1708	89.38%	100.00%	1708.0	1708.0	64.53%	100.00%
2	146	292	7.64%	10.62%	427.0	854.0	16.13%	35.47%
3	30	90	1.57%	2.98%	189.8	569.3	7.17%	19.34%
4	10	40	0.52%	1.41%	106.8	427.0	4.03%	12.17%
5	10	50	0.52%	0.89%	68.3	341.6	2.58%	8.14%
6	3	18	0.16%	0.37%	47.4	284.7	1.79%	5.56%
7	1	7	0.05%	0.21%	34.9	244.0	1.32%	3.77%
8	2	16	0.10%	0.16%	26.7	213.5	1.01%	2.45%
9				0.05%	21.1	189.8	0.80%	1.44%
10	1	10	0.05%	0.05%	17.1	170.8	0.65%	0.65%
Total	1911	2231	100.00%		2647	5003	100.00%	

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. *Authors*/Author Productivity through Lotka's Law. [1]Contribution percentage; [2]Cumulative percentage.

In the studied collection, the authors were ranked first by h-index, then by g- and m- indices (Table 10). The highest h index of h =10 was found for the author Wright, whereas all your 10 articles had been cited more than 10 times each, followed by Vismara, Meoli e Link, h = 6, Urbano, Fini, Rasmussen, Siegel, e Klofsten, h=5. Given the most relevant authors, Wright, Vismara, Meoli, Link, Urbano, and Fini R, it was observed that, except for Wright, they do not belong to the oldest contributors.

Regarding the affiliation institutions, the most relevant were: Univ Beira Interior with 19 articles, Univ Bergamo with18 articles, Katholieke Univ Leuven with 15 articles, Indiana Univ with 14 articles, and Linkoping Univ with 14 articles (Figure 4). The country relevance was measured by the total of published articles by authors affiliated with that country, considering both Single Country Publication (SCP) when researchers' affiliations were from the same country, and Multiple Countries Publication (MCP) when researchers from multiple countries are collaborating. The top five countries ranked by the number of publications were: USA, 159 articles, United Kingdom, 88 articles, Italy, 70 articles, and Sapin, 55 articles.

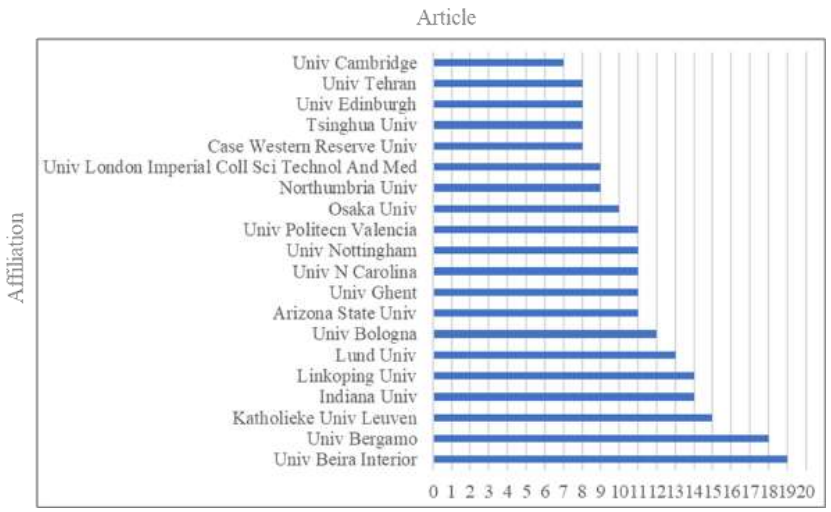


Figure 4. Most Relevant Affiliations of Authors on AE, WoS database

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. Authors/Most Relevant Affiliations.

Table 10. Authors on AE articles ranked based on Author Local Impact, WoS database

CL [1]	***Author***	***h_index***	***g_index***	***m_index***	***TC*** [2]	***NP*** [3]	***PY_start***[4]
1	Wright M	10	10	0.435	1545	10	1999
2	Vismara S	6	8	0.667	168	8	2013
3	Meoli M	6	8	0.667	145	8	2013
4	Link A N	6	6	0.400	145	6	2007
5	Urbano D	5	6	0.455	466	6	2011
6	Fini R	5	6	0.417	322	6	2010
7	Rasmussen E	5	5	0.417	370	5	2010
8	Siegel D S	5	5	0.333	702	5	2007
9	Klofsten M	5	5	0.217	740	5	1999
10	Braunerhjelm P	4	7	0.308	231	7	2009
11	Guerrero M	4	5	0.364	425	5	2011
12	Czarnitzki D	4	5	0.308	160	5	2009
13	Toole A A	4	5	0.308	160	5	2009
14	Buenstorf G	4	5	0.267	161	5	2007
15	Grimaldi R	4	5	0.211	624	5	2003
16	Ramadani V	4	4	0.571	41	4	2015
17	Tartari V	4	4	0.364	376	4	2011
18	Franco M	4	4	0.333	40	4	2010
19	Audretsch D B	4	4	0.308	188	4	2009
20	Cunningham J A	3	5	0.429	191	5	2015

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix.

Authors/Author Local Impact. [1]Classification; [2]Total Citations; [3]Number of publications; [4] Year of the first publication.

The MCP ratios, which means the MCP proportion of the total number of publications, were determined to evaluate the collaboration between countries. Among the top 20 productive countries, France, Netherlands, Denmark, Australia, and Canada, showed the highest degree of international collaboration, while Brazil, India, Iran, Spain e South Africa were identified with little inter-country collaboration (Table 11 and Figure 5). The country's scientific production, presented in Table 12, showed that the major numbers of authors with published articles on AE come from the ***USA, UK, Italy, Sweden, and Spain***, representing 70.9% of total citations (Table 13).

Table 11. Authors' collaboration in the publication of articles on AE, WoS database

	Country	Articles	Frequency	SCP [1]	MCP [2]	MCP_Ratio
1	USA	159	0.18817	121	38	0.2390
2	United Kingdom	88	0.10414	50	38	0.4318
3	Italy	70	0.08284	45	25	0.3571
4	Spain	55	0.06509	45	10	0.1818
5	Germany	41	0.04852	29	12	0.2927
6	Sweden	34	0.04024	23	11	0.3235
7	China	27	0.03195	18	9	0.3333
8	Canada	25	0.02959	13	12	0.4800
9	Australia	21	0.02485	9	12	0.5714
10	Poland	20	0.02367	15	5	0.2500
11	Brazil	19	0.02249	18	1	0.0526
12	France	18	0.02130	6	12	0.6667
13	Portugal	18	0.02130	14	4	0.2222
14	India	17	0.02012	16	1	0.0588
15	Netherlands	13	0.01538	5	8	0.6154
16	South Africa	11	0.01302	9	2	0.1818
17	Denmark	10	0.01183	4	6	0.6000
18	Finland	10	0.01183	6	4	0.4000
19	Iran	10	0.01183	9	1	0.1000
20	Ireland	10	0.01183	6	4	0.4000

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. *Authors/Corresponding Author's Country* [1]Single Country Publication; [2]Multiple Country Publication.

Table 12. Country Scientific production on AE, WoS database

	Region	Freq [1]		Region	Freq		Region	Freq		Region	Freq
1	USA	359	21	Denmark	17	41	Pakistan	7	61	Cambodia	2
2	UK	212	22	South Africa	17	42	Nigeria	6	62	Ecuador	2
3	Italy	160	23	Finland	16	43	Slovakia	6	63	Ethiopia	2
4	Spain	121	24	Austria	15	44	Vietnam	6	64	Ghana	2
5	Germany	100	25	Malaysia	15	45	Bangladesh	5	65	Yemen	2
6	Sweden	89	26	Romania	14	46	Macedonia	5	66	Argentina	1
7	Canada	65	27	Colombia	13	47	Singapore	5	67	Bulgaria	1
8	China	58	28	Switzerland	13	48	Slovenia	5	68	Costa rica	1
9	Portugal	57	29	Mexico	12	49	Croatia	4	69	Georgia	1
10	France	43	30	Russia	11	50	Hungary	4	70	Jordan	1
11	Belgium	41	31	Ukraine	11	51	Lithuania	4	71	Kazakhstan	1
12	Brazil	40	32	Greece	10	52	Saudi Arabia	4	72	Kosovo	1
13	Australia	37	33	Israel	10	53	Serbia	4	73	Kuwait	1
14	India	33	34	South Korea	10	54	Thailand	4	74	Latvia	1
15	Netherlands	32	35	Turkey	10	55	Belarus	3	75	Luxembourg	1
16	Ireland	28	36	New zealand	9	56	Cyprus	3	76	Malta	1
17	Poland	28	37	Indonesia	8	57	Estonia	3	77	Oman	1
18	Iran	24	38	Chile	7	58	Lebanon	3	78	Zambia	1
19	Japan	23	39	Czech republic	7	59	Liechtenstein	3	79	Não identificado	1
20	Norway	18	40	Egypt	7	60	Morocco	3			
										Total	1911

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix.

Authors/ Country Scientific Production. [1]Frequency.

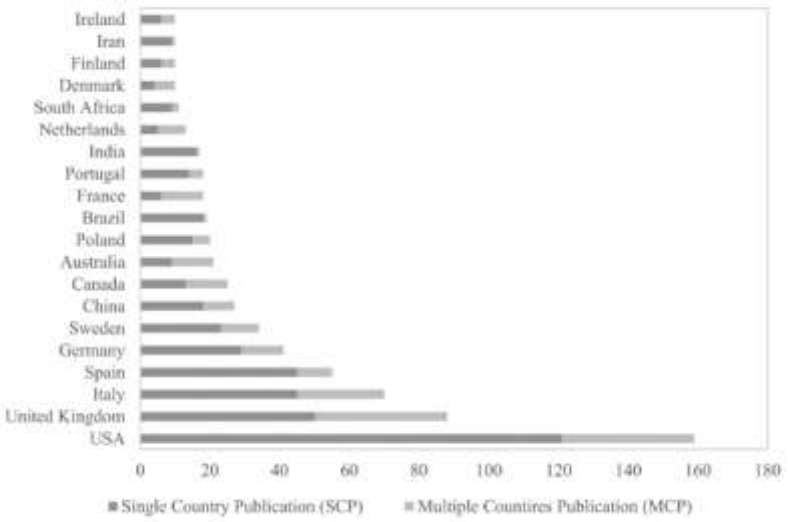


Figure 5. Number of articles on AE published as Single Country Publication and Multiple Countries Publication , WoS database

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. *Authors/Corresponding Author's Country.*

Mapping the top best-cited publications, in terms of global citations, 6 from the 848 articles selected had over 500 citations: *Competing models of entrepreneurial intentions* (Krueger et al., 2000), *International entrepreneurship: the intersection of two research paths* (McDougall & Oviatt, 2000), *Research groups as 'quasi-firms': The invention of the entrepreneurial university* (Etzkowitz, 2003), *Research in social entrepreneurship: past contributions and future opportunities , Science as a map in technological search* (Fleming & Sorenson, 2004) *The chronology and intellectual trajectory of American entrepreneurship education:* 1876–1999 (Katz, 2003) (Table 14).

Table 13. Most Cited Countries on AE, WoS database

	Country	TC [1]	AAC [2]	Part. [3]		Country	TC	AAC	Part.
1	U S A	11106	69.8	42.7%	21	Malaysia	93	9.3	0.4%
2	U K	3238	36.8	12.4%	22	Poland	82	4.1	0.3%
3	Italy	1634	23.3	6.3%	23	Liechtenstein	64	64.0	0.2%
4	Sweden	1268	37.3	4.9%	24	India	61	3.6	0.2%
5	Spain	1203	21.9	4.6%	25	Brazil	59	3.1	0.2%
6	Canada	1160	46.4	4.5%	26	Switzerland	56	9.3	0.2%
7	Germany	1000	24.4	3.8%	27	Romania	52	5.8	0.2%
8	Ireland	740	74.0	2.8%	28	Korea	42	8.4	0.2%
9	Norway	728	104.0	2.8%	29	Colombia	40	8.0	0.2%
10	Belgium	571	71.4	2.2%	30	South Africa	38	3.5	0.1%
11	Australia	533	25.4	2.0%	31	Georgia	33	16.5	0.1%
12	France	300	16.7	1.2%	32	Greece	32	8.0	0.1%
13	Finland	299	29.9	1.1%	33	Iran	30	3.0	0.1%
14	Portugal	274	15.2	1.1%	34	Pakistan	27	5.4	0.1%
15	Israel	201	33.5	0.8%	35	Malta	26	26.0	0.1%
16	Netherlands	196	15.1	0.8%	36	Belarus	25	25.0	0.1%
17	Denmark	155	15.5	0.6%	37	Egypt	25	5.0	0.1%
18	China	148	5.5	0.6%	38	Macedonia	25	8.3	0.1%
19	Chile	114	22.8	0.4%	39	Austria	23	3.3	0.1%
20	New Zealand	109	27.3	0.4%	40	Czech Republic	22	4.4	0.1%

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix.

Authors/Most Cited Countries. [1]Total citations; [2]***Average Article Citations;*** [3]% of participation.

Table 14. Most Global Cited Documents on AE, WoS database

	Paper	TC [1]	TC per Year	Normalized TC
1	Krueger N F., 2000. J Bus Venturing	1765	80.227	2.9261
2	Mcdougall P P., 2000. Acad Manage J	773	35.136	1.2815
3	Etzkowitz H., 2003. Res Policy	685	36.053	2.9847
4	Short J. C., 2009. Strateg Entrep J	542	41.692	5.5972
5	Fleming L., 2004. Strategic Manage J	533	29.611	2.2617
6	Katz J. A., 2003. J Bus Venturing	501	26.368	2.1830
7	Martin B. C., 2013 . J Bus Venturing	409	45.444	8.8273
8	Bercovitz J., 2008. Organ Sci	404	28.857	3.8339
9	Gulbrandsen M., 2005. Res Policy	381	22.412	1.9677
10	Grimaldi R., 2011. Res Policy	368	33.455	4.3610
11	Powers J B., 2005. J Bus Venturing	319	18.765	1.6475
12	Linan F., 2015. Int Entrep Manag J	310	44.286	14.0909
13	George G., 2011. Entrep Theory Pract	308	28.000	3.6500
14	Robinson P B., 1994. J Bus Venturing	299	10.679	1.0000
15	Klofsten M., 2000. Small Bus Econ	284	12.909	0.4708
16	Jain S., 2009. Res Policy	280	21.538	2.8916
17	Mosey S., 2007. Entrep Theory Pract	277	18.467	2.2190
18	Etzkowitz H., 2005. R&D Manage	259	15.235	1.3376
19	Goldfarb B., 2003. Res Policy	258	13.579	1.1242
20	Crane A., 2014. Calif Manage Rev	254	31.750	5.9251

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. *Documents/Most Global Cited Documents.* [1]Total Citations.

As in terms of local citations in the collection, the highest scores, with over 40 citations were from *Academic entrepreneurs: organizational change at the individual level* (Bercovitz & Feldman, 2008), *30 years after Bayh-Dole: reassessing academic entrepreneurship* (Grimaldi et al., 2011), *Competing models of entrepreneurial intentions* (Krueger et al., 2000), *Comparing Academic Entrepreneurship in Europe - The Case of Sweden and Ireland* (Klofsten & Jones-Evans, 2000) *Research groups as 'quasi-firms': the invention of the entrepreneurial university* (Etzkowitz, 2003), *University start-up formation and technology licensing with firms that go public: a resource-based view of academic entrepreneurship* (Powers & McDougall, 2005), *From human capital to social capital: a longitudinal study of technology-based academic entrepreneurs* (Mosey & Wright, 2007), *Academic entrepreneurship: time for a rethink?* (Siegel & Wright, 2015) (Table 15).

Table 15. Most Cited Articles on AE collection, WoS database

	Paper	Year	LC	GC	LC/GC (%)	NLC[1]	NGC[2]
1	Bercovitz J., 2008. Organ Sci	2008	72	404	17.82	6.19	3.83
2	Grimaldi R., 2011. Res Policy	2011	60	368	16.30	5.84	4.36
3	Krueger N F., 2000. J Bus Venturing	2000	49	1765	2.78	2.09	2.93
4	Klofsten M., 2000. Small Bus Econ	2000	49	284	17.25	2.09	0.47
5	Etzkowitz H., 2003. Res Policy	2003	48	685	7.01	2.61	2.98
6	Powers J B., 2005. J Bus Venturing	2005	47	319	14.73	4.18	1.65
7	Mosey S., 2007. Entrep Theory Pract	2007	44	277	15.88	3.07	2.22
8	Siegel D S., 2015. Brit J Manage	2015	44	184	23.91	31.06	8.36
9	Clarysse B., 2011. Res Policy	2011	39	179	21.79	3.80	2.12
10	Lockett A., 2003. Small Bus Econ	2003	37	240	15.42	2.01	1.05
11	Jain S., 2009. Res Policy	2009	37	280	13.21	4.90	2.89
12	Kenney M., 2004. Res Policy	2004	35	192	18.23	2.19	0.81
13	Haeussler C., 2011. Res Policy	2011	32	137	23.36	3.12	1.62
14	Murray F., 2004. Res Policy	2004	30	247	12.15	1.88	1.05
15	Abreu M., 2013. Res Policy	2013	30	169	17.75	9.53	3.65
16	Fini R., 2011. Res Policy	2011	29	149	19.46	2.82	1.77
17	Gulbrandsen M., 2005. Res Policy	2005	28	381	7.35	2.49	1.97
18	Wennberg K., 2011. Res Policy	2011	28	153	18.30	2.73	1.81
19	Krabel S., 2009. Res Policy	2009	25	125	20.00	3.31	1.29
20	Shane S., 2004. J Bus Venturing	2004	23	203	11.33	1.44	0.86

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix.

Documents/Most Local Cited Documents. [1]Local Citation; [2]Global Citation.

With 37588 references identified over the 848 records imported from WoS, 8 references stood out with 60 or more citations: *A general theory of entrepreneurship: the individual-opportunity nexus* (Shane, 2003), *University entrepreneurship: a taxonomy of the literature* (Rothaermel et al., 2007), *The promise of entrepreneurship as a field of research* (Shane & Venkataraman, 2000), *Why do some universities generate more start-ups than others?* (di Gregorio & Shane, 2003), *Academic entrepreneurs: organizational change at the individual level* (Bercovitz & Feldman, 2008), *Entrepreneurial orientation, technology transfer and spinoff performance of U. S. universities* (O'Shea et al., 2005), *Resources, capabilities, risk capital, and the creation of university spin-out companies* (Lockett & Wright, 2005), *30 years after Bayh-Dole: reassessing academic entrepreneurship* (Grimaldi et al., 2011) (Table 16).

Table 16. Most Local Cited References on AE collection, WoS database

	Cited References	Citations		Cited References	Citations
1	Shane, 2003	109	11	Stuart & Ding, 2006	56
2	Rothaermel et al., 2007	102	12	Vohora et al., 2004	54
3	Shane & Venkataraman, 2000	81	13	Etzkowitz et al., 2000	53
4	di Gregorio & Shane, 2003	79	14	Ajzen, 1991	51
5	Bercovitz & Feldman, 2008	72	15	Siegel et al., 2003	50
6	O'Shea et al., 2005	66	16	Klofsten & Jones-Evans, 2000	49
7	Lockett & Wright, 2005	63	17	Krueger et al., 2000	49
8	Grimaldi et al., 2011	60	18	Lumpkin & Dess, 1996	49
9	Perkmann et al., 2013	59	19	Etzkowitz, 2003	48
10	Eisenhardt, 1989	58	20	Jensen & Thursby, 2001	47

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. *Documents/Most Local Cited References.*

Concerning the Most Frequent Words, it was noted that using the keyword 'academic entrepreneurship' in the basic search on the field 'Title, Abstracts, Author's keywords and Keywords Plus®', there was a single occurrence in the abstract and no occurrence in titles. The 10 most frequent words in *Author's Keywords* were*: entrepreneurship, academic entrepreneurship, innovation, technology transfer, social entrepreneurship, entrepreneurship education, entrepreneurial university, university, higher education, entrepreneurial orientation, and entrepreneurship*, which the first and second ones appeared 176 and 135 times, respectively (Table 17). In the Keywords Plus® field, the 10 Most Frequent Words were *performance, entrepreneurship, innovation, knowledge, impact, firms, Science, technology-transfer, university, and academic entrepreneurship*, which AE appeared in the 10 ºposition with 58 times. Therefore, the analysis indicates that AE is part of a major subject, entrepreneurship, and is often associated with performance, innovation, technology transfer, knowledge, university, education, and others (Figure 6). In addition, it should be pointed the KeyWords Plus®: management (55), model (51) and commercialization (49), as words references used to analyze the results of this work.

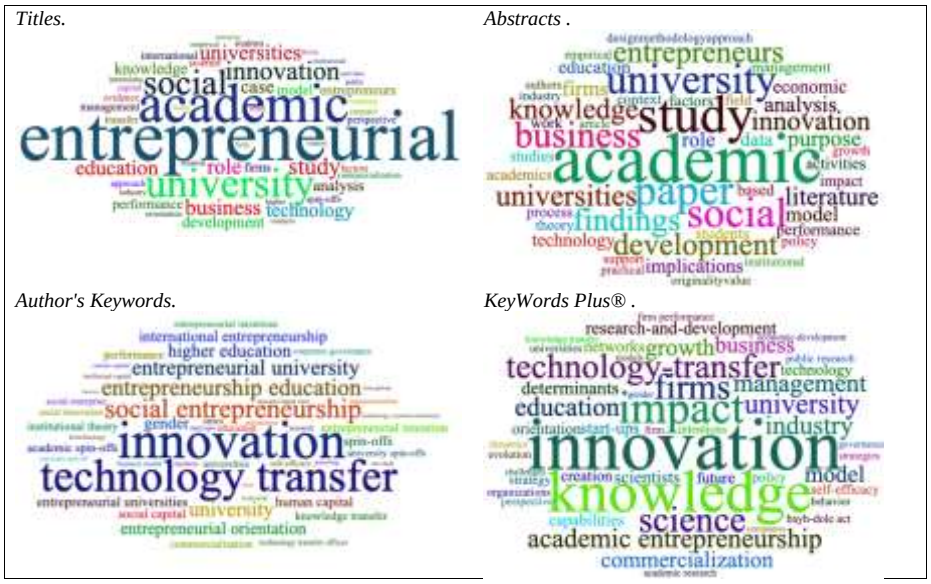


Figure 6. Top words in Titles, Abstracts, Author's Keywords, and KeyWords Plus®, represented by Word Cloud, WoS database

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. Documents/ ***Word Cloud.***

Table 17. Most Frequent Words in the AE literature over the years, WoS database

N	Author's keywords	Oc. [1]	N	KeyWords Plus®	Oc.
1	entrepreneurship	176	1	performance	195
2	academic entrepreneurship	135	2	entrepreneurship	166
3	innovation	58	3	innovation	156
4	technology transfer	50	4	knowledge	127
5	social entrepreneurship	30	5	impact	98
6	entrepreneurship education	26	6	firms	77
7	entrepreneurial university	24	7	science	77
8	university	23	8	technology-transfer	74
9	higher education	20	9	university	61
10	entrepreneurial orientation	19	10	academic entrepreneurship	58
11	gender	18	11	education	57
12	international entrepreneurship	17	12	industry	57
13	entrepreneurial universities	15	13	management	55
14	human capital	15	14	growth	52
15	spin-offs	15	15	model	51
16	entrepreneurial intention	14	16	business	50
17	social capital	14	17	commercialization	49
18	academic spin-offs	13	18	determinants	40
19	institutional theory	13	19	research-and-development	38
20	knowledge transfer	13	20	scientists	38

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix.

Documents/Most Frequent Words/Author's Keywords. [1]Occurrences.

The investigation of dynamics in the use of words related to AE, within the retrieved articles by using the keyword academic entrepreneurship, allowed us to link the frequency of words and the discussion development over time. The word *management* was first used in 2005 and has two peak moments, in articles produced in 2015 and 2019; the words model or models first appeared in 2004 and had a maximum peak in 2019, although they were still high in 2020 productions; the word *commercialization*, that was early used in 2010 and keep growing ever since, reaching 9 articles in 2020 (Figure 7). Therefore, could be identified the recent discussion on AE and issues related to management models and their commercialization.

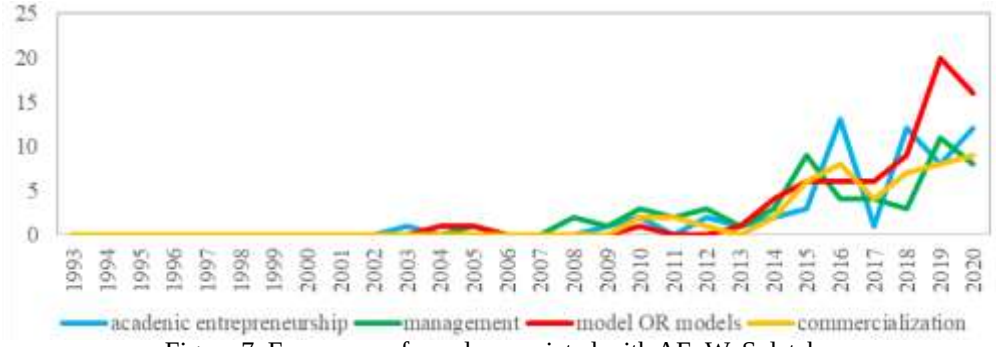


Figure 7. Frequency of words associated with AE, WoS database

Source: Elaborado pelo autor. dados gerados no biblioshiny for bibliometrix. Documents/Word Dynamics/Field – Keywords Plus

In the investigation of the tendency of the most discussed topics in the last 10 years (2011-2010), it was detected as the most used keywords by the authors, minimum frequency of 5 occurrences: start-up and academic spin-offs in 2020, academic spin-offs in 2017, academic entrepreneurship and spin-offs in 2016, commercialization in 2014 (Table 18).

Table 18. ***Trend Topics*** in the Academic entrepreneurship literature over the years, WoS database

Item	*Freq*	*Year*	*Item*	*Freq*	*Year*
patenting	***7***	***2011***	***spin-offs***	***15***	***2016***
entrepreneurialism	***7***	***2012***	***entrepreneurship***	***176***	***2017***
licensing	***6***	***2012***	***academic spin-offs***	***13***	***2017***
university-industry relations	***6***	***2012***	***education***	***11***	***2017***
biotechnology	***7***	***2013***	***smes***	***11***	***2017***
intellectual property rights	***5***	***2013***	***innovation***	***58***	***2018***
commercialization	***12***	***2014***	***social entrepreneurship***	***30***	***2018***
corporate governance	***10***	***2014***	***entrepreneurship education***	***26***	***2018***
born globals	***6***	***2014***	***entrepreneurial orientation***	***19***	***2019***
technology transfer	***50***	***2015***	***knowledge transfer***	***13***	***2019***
human capital	***15***	***2015***	***performance***	***13***	***2019***
r&d	***6***	***2015***	***start-ups***	***8***	***2020***
academic entrepreneurship	***135***	***2016***	***entrepreneurial education***	***6***	***2020***
international entrepreneurship	***17***	***2016***	***academic spinoffs***	***5***	***2020***
entrepreneurial universities	***15***	***2016***	***knowledge translation***	***5***	***2020***

Source: Elaborated by the authors from data generated by biblioshiny for bibliometrix. Documents/ ***Trend Topics*****/*****Field – Keywords Plus.***

A set of studies were selected according to the described by Tricco (2018, p. 2), evaluated for eligibility, and included in the review, which the reasons for exclusions at each stage are illustrated as a flowchart in Figure 8. The aim of the 112 articles was examined considering the data extracted from the fields: AU-Authors, TI-Document Title, DE-Author Keywords, ID-Keywords Plus®, AB-Abstract, PY-Year Published. Then, among them, it was identified models that deal with the development of entrepreneurship in the academic environment, whereas no models for evaluating intellectual property as products to be commercialized were found. Else, it was noted objectives related to the role of resources (physical, human and managerial) available at the university to collaborate with the development of entrepreneurship activities, the role of technology transfer offices, the training of professors, and the commercialization capacity necessary to generate economic resources for both university and professors. The results were aggregated by the contribution of each author in the comprehension of the themes: (1) model development, (2) management, and (3) commercialization of intellectual property (Table 19).

4. Conclusion

Through this literature review, within the documents available on *Web of Science* database and covering the whole period up to 2020, it was possible to verify that the main objectives of the selected studies on academic entrepreneurship are related to the analysis of resources, human (training, leadership, and motivation), physical and management.

The models found in the scientific articles were mainly related to the assessment of entrepreneurship development in the academic environment, then it was identified a gap for models that evaluate intellectual property as products to be commercialized, being, therefore, pointed as a research opportunity. Also, it was detected indication of research space to develop models to evaluate the intellectual property registered in technology transfer offices, as a basis for products to be commercialized.

Table 19. Analysis of articles' objectives on AE retrieved from the WoS base

Subject	Article	Objective
1. Models development	**Krueger et al., 2000**	Compares two intention-based models in terms of their ability to predict entrepreneurial intentions
	Etzkowitz & Klofsten, 2005	Sets forth a model of knowledge-based regional development conceived as a set of multi-linear dynamics, based on alternative technological paradigms
	O'Shea et al., 2007	Develop a systematic model of the entrepreneurial university
	Kirby et al., 2011	Development of a model to make universities more entrepreneurial
	George & Bock, 2011	Review prior research and reframe the business model with an entrepreneurial lens
2. Management	**Guerrero et al., 2016**	Improve the understanding of the theoretical, empirical, managerial and political implications of emerging models of entrepreneurial universities in the new social and economic landscape
	Heaton et al., 2019	Propose the dynamic capabilities framework to guide how universities might manage their innovation ecosystems
3. Intellectual property commercialization	**Klofsten & Jones-Evans, 2000**	Examine the activities of academics involved with industry and the influence of gender, age, previous entrepreneurial experience, work experience and university environment on the entrepreneurship activities; and discuss and contrast the extent to which academic entrepreneurship has developed.
	Goldfarb & Henrekson, 2003	Evaluate the efficiency of national policies in promoting the commercialization of university-generated knowledge
	Shane, 2004	Examine the effect of one U.S. public policy initiative (the Bayh-Dole Act in the U.S.) on one aspect of technology commercialization (university patenting)
	Powers & McDougall, 2005	Investigate the effects of particular internal and external resource factors on the performance of universities
	Toole & Czarnitzki, 2009	Analyze how the depth of the scientists' scientifically and commercially oriented academic human capital contributes to the firm performance when they start or join for-profit firms
	Grimaldi et al., 2011	Describe the evolving role of universities in the commercialization of research considering the rationale for academic entrepreneurship on the 30th anniversary of enactment of the Bayh–Dole Act in the U.S. and discuss and appraise the effects of legislative reform in several OECD countries relating to academic entrepreneurship
	Buenstorf & Geissler, 2012) -	Explore the way in which inventor, technology, and licensee characteristics affect the commercialization of academic inventions
	Buenstorf & Schacht, 2013	Analyze how the probability and magnitude of commercial success are affected by geographic distance between licensors and licensees
	O'Kane et al., 2017	Examine what factors publicly funded principal investigators perceive as inhibiting their involvement in commercialization activities
	Fini et al., 2018	Outlines a research agenda on the societal impacts of science commercialization by extending current theories, data, and methods and exploring the need to consider ethical concerns and who is benefiting from these impacts.
	Fini et al., 2019	Shows how research on science commercialization may yield conceptual contributions to the field of management

Source: Elaborated by the authors

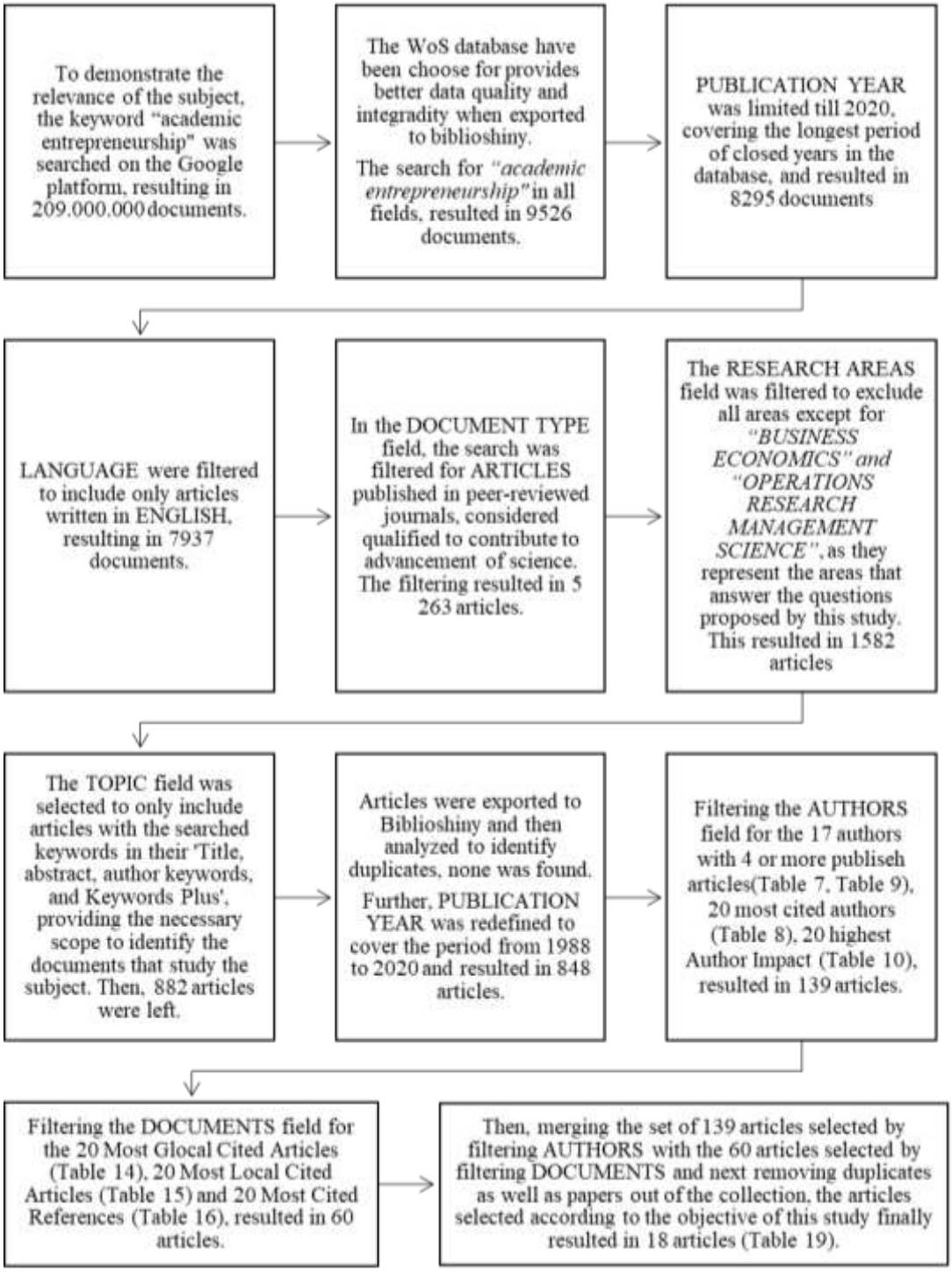


Figure 8. Flowchart of studies selected, evaluated for eligibility and included in the review [1]

Source: Elaborated by the authors. [1]Each flowchart step indicates the reasons for document exclusions considering the systematic literature review on academic entrepreneurship.

Acknowledgments

The authors acknowledge financial assistance from the Brazilian research funding agencies as CAPES (Coordination for the Improvement of Higher Education Personnel) under Finance Code 001, a Brazilian foundation within the Ministry of Education (MEC), CNPq (National Council for Scientific and Technological Development), a Brazilian foundation associated to the Ministry of Science, Technology and Innovations (MCTI), and FAPITEC/SE (the Foundation of Support to Research and Technological Innovation of the State of Sergipe).

References

Abreu, M., & Grinevich, V. (2013). The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities. *Research Policy*, *42*(2), 408-422. https://doi.org/10.1016/j.respol.2012.10.005

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211. https://doi.org/10.4135/9781446249215.n22

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Aria, M., & Cuccurullo, C. (2019). Biblioshiny: Bibliometrix for no coders. Em *Bibliometrix.org*. Retrieved from https://www.bibliometrix.org/biblioshiny/assets/player/KeynoteDHTMLPlayer.html#0

B.A Kitchenham & Charters. (2007). Guidelines for performing systematic literature reviews in software engineering. Em *Technical report, Ver. 2.3 EBSE Technical Report. EBSE* (Vol. 1).

Bercovitz, J., & Feldman, M. (2008). Academic entrepreneurs: Organizational change at the individual level. *Organization Science*, *19*(1), 69–89. https://doi.org/10.1287/orsc.1070.0295

Bradford, S. C. (1948). *Documentation*. Crosby Lockwood and Son. Retrieved from https://dspace.gipe.ac.in/xmlui/bitstream/handle/10973/28823/GIPE-026162.pdf?sequence=2

Brereton, P., Kitchenham, B. A., Budgen, D., Turner, M., & Khalil, M. (2007). Lessons from applying the systematic literature review process within the software engineering domain. *Journal of Systems and Software*, *80*(4), 571-583. https://doi.org/10.1016/j.jss.2006.07.009

Buenstorf, G., & Geissler, M. (2012). Not invented here: Technology licensing, knowledge transfer and innovation based on public research. *Journal of Evolutionary Economics*, *22*(3), 481-511. https://doi.org/10.1007/s00191-011-0261-1

Buenstorf, G., & Schacht, A. (2013). We need to talk-or do we? Geographic distance and the commercialization of technologies from public research. *Research Policy*, *42*(2), 465-480. https://doi.org/10.1016/j.respol.2012.06.010

Clarysse, B., Tartari, V., & Salter, A. (2011). The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship. *Research Policy*, *40*(8), 1084-1093. https://doi.org/10.1016/j.respol.2011.05.010

Clarysse, B., Wright, M., Lockett, A., Mustar, P., & Knockaert, M. (2007). Academic spin-offs, formal technology transfer and capital raising. *Industrial and Corporate Change*, *16*(4), 609-640. https://doi.org/10.1093/icc/dtm019

Crane, A., Palazzo, G., Spence, L. J., & Matten, D. (2014). Contesting the value of "creating shared value". *California Management Review*, *56*(2), 130-153. https://doi.org/10.1525/cmr.2014.56.2.130

de Cleyn, S. H., Braet, J., & Klofsten, M. (2015). How human capital interacts with the early development of academic spin-offs. *International Entrepreneurship and Management Journal*, *11*(3), 599-621. https://doi.org/10.1007/s11365-013-0294-z

di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others? *Research Policy*, *32*(2 SPEC.), 209-227. https://doi.org/10.1016/S0048-7333(02)00097-5

Egghe, L. (2006). Theory and practise of the g-index. *Scientometrics*, *69*(1), 131-152. https://doi.org/10.1007/s11192-006-0144-7

Eisenhardt, K. M. (1989). Building Theories from Case Study Research Published by : Academy of Management Stable. *The Academy of Management Review*, *14*(4), 532-550. https://doi.org/10.2307/258557

Estrin, S., & Wright, M. (1999). Corporate Governance in the Former Soviet Union: An Overview. *Journal of Comparative Economics*, *27*(3), 398-421. https://doi.org/10.1006/jcec.1999.1603

Etzkowitz, H. (2003). Research groups as "quasi-firms": The invention of the entrepreneurial university. *Research Policy*, *32*(1), 109-121. https://doi.org/10.1016/S0048-7333(02)00009-4

Etzkowitz, H., & Klofsten, M. (2005). The innovating region: Toward a theory of knowledge-based regional development. *R and D Management*, *35*(3), 243-255. https://doi.org/10.1111/j.1467-9310.2005.00387.x

Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. (2000). The future of the university and the university of the future: Evolution of ivory tower to entrepreneurial paradigm. *Research Policy*, *29*(2), 313-330. https://doi.org/10.1016/S0048-7333(99)00069-4

Fini, R., Grimaldi, R., & Meoli, A. (2020). The effectiveness of university regulations to foster science-based entrepreneurship. *Research Policy*, *49*(10), 104048. https://doi.org/10.1016/j.respol.2020.104048

Fini, R., Grimaldi, R., Santoni, S., & Sobrero, M. (2011). Complements or substitutes? the role of universities and local context in supporting the creation of academic spin-offs. *Research Policy*, *40*(8), 1113-1127. https://doi.org/10.1016/j.respol.2011.05.013

Fini, R., Grimaldi, R., & Sobrero, M. (2009). Factors fostering academics to start up new ventures: An assessment of Italian founders' incentives. *Journal of Technology Transfer*, *34*(4), 380-402. https://doi.org/10.1007/s10961-008-9093-z

Fini, R., Rasmussen, E., Siegel, D., & Wiklund, J. (2018). Rethinking the commercialization of public science: From entrepreneurial outcomes to societal impacts. *Academy of Management Perspectives*, *32*(1), 4-20. https://doi.org/10.5465/amp.2017.0206

Fini, R., Rasmussen, E., Wiklund, J., & Wright, M. (2019). Theories from the Lab: How Research on Science Commercialization can Contribute to Management Studies. *Journal of Management Studies*, *56*(5), 865-894. https://doi.org/10.1111/joms.12424

Fleming, L., & Sorenson, O. (2004). Science as a map in technological search. *Strategic Management Journal*, *25*(8–9), 909-928. https://doi.org/10.1002/smj.384

Fryges, H., & Wright, M. (2014). The origin of spin-offs: A typology of corporate and academic spin-offs. *Small Business Economics*, *43*(2), 245-259. https://doi.org/10.1007/s11187-013-9535-3

George, G., & Bock, A. J. (2011). The Business Model in Practice and its Implications for Entrepreneurship Research. *Entrepreneurship: Theory and Practice*, *35*(1), 83-111. https://doi.org/10.1111/j.1540-6520.2010.00424.x

Goldfarb, B., & Henrekson, M. (2003). Bottom-up versus top-down policies towards the commercialization of university intellectual property. *Research Policy*, *32*(4), 639-658. https://doi.org/10.1016/S0048-7333(02)00034-3

Greco, M., Grimaldi, M., Scarabotti, L., & Schiraldi, M. M. (2013). The sources of competitive advantage in university spin-offs: A case study. *Journal of Technology Management and Innovation*, *8*(3), 139-151. https://doi.org/10.4067/s0718-27242013000400013

Grimaldi, R., & Grandi, A. (2001). The Contribution of University Business Incubators to New Knowledge-Based Ventures: Evidence from Italy. *Industry and Higher Education*, *15*(4), 239-250. https://doi.org/10.5367/000000001101295731

Grimaldi, R., Kenney, M., Siegel, D. S., & Wright, M. (2011). 30 years after Bayh-Dole: Reassessing academic entrepreneurship. *Research Policy*, *40*(8), 1045-1057. https://doi.org/10.1016/j.respol.2011.04.005

Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M., & Mian, S. (2016). Entrepreneurial universities: emerging models in the new social and economic landscape. *Small Business Economics*, *47*(3), 551-563. https://doi.org/10.1007/s11187-016-9755-4

Gulbrandsen, M., & Smeby, J. C. (2005). Industry funding and university professors' research performance. *Research Policy*, *34*(6), 932-950. https://doi.org/10.1016/j.respol.2005.05.004

Haeussler, C., & Colyvas, J. A. (2011). Breaking the Ivory Tower: Academic entrepreneurship in the life sciences in UK and Germany. *Research Policy*, *40*(1), 41-54. https://doi.org/10.1016/j.respol.2010.09.012

Heaton, S., Siegel, D. S., & Teece, D. J. (2019). Universities and innovation ecosystems: A dynamic capabilities perspective. *Industrial and Corporate Change*, *28*(4), 921-939. https://doi.org/10.1093/icc/dtz038

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. https://doi.org/10.1073/pnas.0507655102

Huyghe, A., Knockaert, M., Piva, E., & Wright, M. (2016). Are researchers deliberately bypassing the technology transfer office? An analysis of TTO awareness. *Small Business Economics*, *47*(3), 589-607. https://doi.org/10.1007/s11187-016-9757-2

Jain, S., George, G., & Maltarich, M. (2009). Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity. *Research Policy*, *38*(6), 922-935. https://doi.org/10.1016/j.respol.2009.02.007

Jensen, R., & Thursby, M. (2001). Proofs and prototypes for sale: The licensing of University inventions. *American Economic Review*, *91*(1), 240-259. https://doi.org/10.1257/AER.91.1.240

Jones-Evans, D., Klofsten, M., Andersson, E., & Pandya, D. (1999). Creating a bridge between university and industry in small European countries: The role of the Industrial Liaison Office. *R and D Management*, *29*(1), 47-56. https://doi.org/10.1111/1467-9310.00116

Katz, J. A. (2003). The chronology and intellectual trajectory of American entrepreneurship education 1876-1999. *Journal of Business Venturing*, *18*(2), 283-300. https://doi.org/10.1016/S0883-9026(02)00098-8

Kenney, M., & Goe, W. R. (2004). The role of social embeddedness in professorial entrepreneurship: A comparison of electrical engineering and computer science at UC Berkeley and Stanford. *Research Policy*, *33*(5), 691-707. https://doi.org/10.1016/j.respol.2003.11.001

Kirby, D. A., Guerrero, M., & Urbano, D. (2011). Making universities more entrepreneurial: Development of a model. *Canadian Journal of Administrative Sciences*, *28*(3), 302-316. https://doi.org/10.1002/CJAS.220

Kitchenham, B. A., Pfleeger, S. L., Pickard, L. M., Jones, P. W., Hoaglin, D. C., Emam, K. el, & Rosenberg, J. (2002). Preliminary guidelines for empirical research in software engineering. *IEEE Transactions on Software Engineering*, *28*(8), 721-734. https://doi.org/10.1109/TSE.2002.1027796

Klofsten, M., & Jones-Evans, D. (2000). Comparing Academic Entrepreneurship in Europe -The Case of Sweden and Ireland. *Small Business Economics*, *14*(4), 299-309. https://doi.org/10.1023/A:1008184601282

Knockaert, M., Ucbasaran, D., Wright, M., & Clarysse, B. (2011). The relationship between knowledge transfer, top management team composition, and performance: The case of science-based entrepreneurial firms. *Entrepreneurship: Theory and Practice*, *35*(4), 777-803. https://doi.org/10.1111/j.1540-6520.2010.00405.x

Kochenkova, A., Grimaldi, R., & Munari, F. (2016). Public policy measures in support of knowledge transfer activities: a review of academic literature. *Journal of Technology Transfer*, *41*(3), 407-429. https://doi.org/10.1007/s10961-015-9416-9

Krabel, S., & Mueller, P. (2009). What drives scientists to start their own company?. An empirical investigation of Max Planck Society scientists. *Research Policy*, *38*(6), 947-956. https://doi.org/10.1016/j.respol.2009.02.005

Krueger, N. F., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial intentions. *Journal of Business Venturing*, *15*(5), 411-432. https://doi.org/10.1016/S0883-9026(98)00033-0

Liñán, F., & Fayolle, A. (2015). A systematic literature review on entrepreneurial intentions: citation, thematic analyses, and research agenda. *International Entrepreneurship and Management Journal*, *11*(4), 907-933. https://doi.org/10.1007/s11365-015-0356-5

Lockett, A., & Wright, M. (2005). Resources, capabilities, risk capital and the creation of university spin-out companies. *Research Policy*, *34*(7), 1043-1057. https://doi.org/10.1016/j.respol.2005.05.006

Lockett, A., Wright, M., & Franklin, S. (2003). Technology Transfer and Universities' Spin-Out Strategies. *Small Business Economics*, *20*(2), 185-200. https://doi.org/10.1023/A:1022220216972

Lotka, A. J. (1926). The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences*, *16*(12), 317-323. https://doi.org/10.1016/s0016-0032(26)91166-6

Lumpkin, G. T., & Dess, G. G. (1996). Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance. *The Academy of Management Review*, *21*(1), 135. https://doi.org/10.2307/258632

Markman, G. D., Siegel, D. S., & Wright, M. (2008). Research and technology commercialization. *Journal of Management Studies*, *45*(8), 1401-1423. https://doi.org/10.1111/j.1467-6486.2008.00803.x

Martin, B. C., McNally, J. J., & Kay, M. J. (2013). Examining the formation of human capital in entrepreneurship: A meta-analysis of entrepreneurship education outcomes. *Journal of Business Venturing*, *28*(2), 211-224. https://doi.org/10.1016/j.jbusvent.2012.03.002

McDougall, P. P., & Oviatt, B. M. (2000). International entrepreneurship: The intersection of two research paths. *Academy of Management Journal*, *43*(5), 902-906. https://doi.org/10.2307/1556418

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., … Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7). https://doi.org/10.1371/journal.pmed.1000097

Mosey, S., & Wright, M. (2007). From human capital to social capital: A longitudinal study of technology-based academic entrepreneurs. *Entrepreneurship: Theory and Practice*, *31*(6), 909-935. https://doi.org/10.1111/j.1540-6520.2007.00203.x

Munim, Z. H., Dushenko, M., Jimenez, V. J., Shakil, M. H., & Imset, M. (2020). Big data and artificial intelligence in the maritime industry: a bibliometric review and future research directions. *Maritime Policy and Management*, *00*(00), 577-597. https://doi.org/10.1080/03088839.2020.1788731

Murray, F. (2004). The role of academic inventors in entrepreneurial firms: Sharing the laboratory life. *Research Policy*,

33(4), 643-659. https://doi.org/10.1016/j.respol.2004.01.013

Mustar, P., & Wright, M. (2010). Convergence or path dependency in policies to foster the creation of university spin-off firms? a comparison of France and the United Kingdom. *Journal of Technology Transfer*, *35*(1), 42-65. https://doi.org/10.1007/s10961-009-9113-7

Nosella, A., & Grimaldi, R. (2009). University-level mechanisms supporting the creation of new companies: An analysis of italian academic spin-offs. *Technology Analysis and Strategic Management*, *21*(6), 679-698. https://doi.org/10.1080/09537320903052657

O'Kane, C., Zhang, J. A., Cunningham, J. A., & O'Reilly, P. (2017). What factors inhibit publicly funded principal investigators' commercialization activities? *Small Enterprise Research*, *24*(3), 215-232. https://doi.org/10.1080/13215906.2017.1396558

O'Shea, R. P., Allen, T. J., Chevalier, A., & Roche, F. (2005). Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities. *Research Policy*, *34*(7), 994-1009. https://doi.org/10.1016/j.respol.2005.05.011

O'Shea, R. P., Allen, T. J., Morse, K. P., O'Gorman, C., & Roche, F. (2007). Delineating the anatomy of an entrepreneurial university: The Massachusetts Institute of Technology experience. *R and D Management*, *37*(1), 1-16. https://doi.org/10.1111/j.1467-9310.2007.00454.x

Otlet, P. (1934). *Traité de documentation. Le livre sur le livre*. Editiones Mundaneum; Palais Mondial; Imp. Van Keerberghen & fils. Retrieved from https://archive.org/details/OtletTraitDocumentationUgent/page/n1

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. Em *PLoS Medicine* (Vol. 18, Issue 3, p. e1003583). Public Library of Science. https://doi.org/10.1371/JOURNAL.PMED.1003583

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., … Sobrero, M. (2013). Academic engagement and commercialisation: A review of the literature on university-industry relations. *Research Policy*, *42*(2), 423-442. https://doi.org/10.1016/j.respol.2012.09.007

Powers, J. B., & McDougall, P. P. (2005). University start-up formation and technology licensing with firms that go public: A resource-based view of academic entrepreneurship. *Journal of Business Venturing*, *20*(3), 291-311. https://doi.org/10.1016/j.jbusvent.2003.12.008

Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of Documentation*, *25*(4), 348. https://doi.org/10.1108/eb026482

Rasmussen, E., Mosey, S., & Wright, M. (2014). The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures. *Research Policy*, *43*(1), 92-106. https://doi.org/10.1016/j.respol.2013.06.007

Rasmussen, E., & Wright, M. (2015). How can universities facilitate academic spin-offs? An entrepreneurial competency perspective. *Journal of Technology Transfer*, *40*(5), 782-799. https://doi.org/10.1007/s10961-014-9386-3

Robinson, P. B., & Sexton, E. A. (1994). The effect of education and experience on self-employment success. *Journal of Business Venturing*, *9*(2), 141-156. https://doi.org/10.1016/0883-9026(94)90006-X

Roldan-Valadez, E., Salazar-Ruiz, S. Y., Ibarra-Contreras, R., & Rios, C. (2019). Current concepts on bibliometrics: a brief review about impact factor, Eigenfactor score, CiteScore, SCImago Journal Rank, Source-Normalised Impact per Paper, H-index, and alternative metrics. *Irish Journal of Medical Science*, *188*(3), 939-951. https://doi.org/10.1007/s11845-018-1936-5

Rothaermel, F. T., Agung, S. D., & Jiang, L. (2007). University entrepreneurship: A taxonomy of the literature. *Industrial and Corporate Change*, *16*(4), 691-791. https://doi.org/10.1093/icc/dtm023

Sampaio, R., & Mancini, M. (2007). Estudos de revisão sistemática: um guia para síntese criteriosa da evidência científica. *Revista Brasileira de Fisioterapia*, *11*(1), 83-89. https://doi.org/10.1590/s1413-35552007000100013

Shane, S. (2003). A general theory of entrepreneurship: The individual-opportunity nexus. Em *A General Theory Of Entrepreneurship: The Individual-Opportunity Nexus*. Edward Elgar Publishing. https://doi.org/10.4337/9781781007990

Shane, S. (2004). Encouraging university entrepreneurship? The effect of the Bayh-Dole Act on university patenting in the United States. *Journal of Business Venturing*, *19*(1), 127-151. https://doi.org/10.1016/S0883-9026(02)00114-3

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, *25*(1), 217-226. https://doi.org/10.5465/AMR.2000.2791611

Short, J. C., Moss, T. W., & Lumpkin, G. T. (2009). Research in social entrepreneurship: past contributions and future opportunities. *Strategic Entrepreneurship Journal*, *3*(2), 161-194. https://doi.org/10.1002/sej.69

Siegel, D. S., Waldman, D., & Link, A. (2003). Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: An exploratory study. *Research Policy*, *32*(1), 27-48. https://doi.org/10.1016/S0048-7333(01)00196-2

Siegel, D. S., & Wright, M. (2015). Academic Entrepreneurship: Time for a Rethink? *British Journal of Management*, *26*(4), 582-595. https://doi.org/10.1111/1467-8551.12116

Stuart, T. E., & Ding, W. W. (2006). When do scientists become entrepreneurs? The social structural antecedents of commercial activity in the academic life sciences. *American Journal of Sociology*, *112*(1), 97-144. https://doi.org/10.1086/502691

Teles, M. N. O., Santos, B. L. P., Silva, D. P., Teixeira, J. A., & Ruzene, D. S. (2020). A Bibliometric Description of Lignin Applicability for the Removal of Chemical Pollutants in Effluents. *Water, Air, and Soil Pollution*, *231*(7). https://doi.org/10.1007/s11270-020-04702-y

Toole, A. A., & Czarnitzki, D. (2009). Exploring the relationship between scientist human capital and firm performance: The case of biomedical academic entrepreneurs in the sbir program. *Management Science*, *55*(1), 101-114. https://doi.org/10.1287/mnsc.1080.0913

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, *14*(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467-473. https://doi.org/10.7326/M18-0850

Tricco, A., Zarin, L. E., O'Brien, K., Colquhoun, H., & Levac, D. (2018). *Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist SECTION*. Ann Intern Med. https://doi.org/10.7326/M18-0850

Vanti, N. A. P. (2002). Da bibliometria à webometria: uma exploração conceitual dos mecanismos utilizados para medir o registro da informação e a difusão do conhecimento. *Ciência Da Informação*, *31*(2), 369-379. https://doi.org/10.1590/s0100-19652002000200016

Villani, E., Linder, C., & Grimaldi, R. (2018). Effectuation and causation in science-based new venture creation: A configurational approach. *Journal of Business Research*, *83*, 173-185. https://doi.org/10.1016/j.jbusres.2017.10.041

Vohora, A., Wright, M., & Lockett, A. (2004). Critical junctures in the development of university high-tech spinout companies. *Research Policy*, *33*(1), 147-175. https://doi.org/10.1016/S0048-7333(03)00107-0

Wennberg, K., Wiklund, J., & Wright, M. (2011). The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs. *Research Policy*, *40*(8), 1128-1143. https://doi.org/10.1016/j.respol.2011.05.014

Wright, M. (2017). Innovation and ownership variety. *Innovation: Management, Policy and Practice*, *19*(1), 74-79. https://doi.org/10.1080/14479338.2016.1233827

Wright, M., Hmieleski, K. M., Siegel, D. S., & Ensley, M. D. (2007). The role of human capital in technological entrepreneurship. *Entrepreneurship: Theory and Practice*, *31*(6), 791-806. https://doi.org/10.1111/j.1540-6520.2007.00202.x

Zhang, K., Wang, Q., Liang, Q. M., & Chen, H. (2016). A bibliometric analysis of research on carbon tax from 1989 to 2014. *Renewable and Sustainable Energy Reviews*, *58*, 297-310. https://doi.org/10.1016/j.rser.2015.12.089

Zipf, G. K. (1949). Human Behavior and the Principle of Least Effort: An Introduction to Human Ecology. Em *Language* (Vol. 26, Issue 3). Addison-Wesley Press, Inc.,. https://doi.org/10.2307/409735