



Academic Entrepreneurship: A Bibliometric Overview Between 1972 and 2023



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ABSTRACT

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This study aims to provide an overview of the main contributions to academic entrepreneurship. To do so, a bibliometric analysis was carried out that developed various indicators, such as productivity, citations, and the h-index. The Scopus database was used to identify the area's most relevant journals, articles, and affiliations. In addition, the VOSviewer software was used to create a graphic map of references in this field, analyzing aspects such as co-citation, bibliographic coupling, and co-occurrence of keywords. The findings reveal that research on academic entrepreneurship has experienced growth in the last decade, with most publications occurring in this period. The United Kingdom is the leading country in this field, with the most influential authors and institutions.

1. INTRODUCTION

Academic entrepreneurship (AE) has been identified as an innovation driver that boosts competitive advantage and economic development in the region [1-4]. Consequently, in recent decades, universities have expanded their entrepreneurial activities, focusing on technology transfer and supporting the commercialization of research results through patents, licensing, and the creation of spin-off companies [5-8].

AE is creating new companies based on knowledge generated in universities [9-11]. Furthermore, Hayter et al. [12] argue that AE encompasses the activities of professors, postdocs, students, or affiliated staff seeking to establish new companies derived from university technology.

The relevance of AE has been widely recognized in the literature, reflected in the remarkable increase in publications on the topic in recent years; this field has attracted numerous researchers from various disciplines, leading to a growing literature base [13-15]. Therefore, to mitigate the risk of fragmentation in this field and encourage the systematic generation of relevant knowledge on AE, it is essential to understand the structure of the existing literature and the importance of classifying it according to the main trends in the discipline [16-18].

One of the most common techniques to address these challenges is bibliometrics, which deals with the quantitative study of bibliographic material and provides an overview of a research field [19]. This methodological technique analyses scientific production from two perspectives: the first focuses on quantitative analysis, which uses various indicators to assess the impact of citations of scientific articles (e.g., authors, affiliations, and countries) in each study area. The

second perspective includes the graphic mapping of science, which complements bibliometric indicators and allows for visualizing structural aspects [20].

Bibliometric studies are expected in different areas of research, including management. Podsakoff et al. [21] applied bibliometric techniques to analyze journals publishing articles related to the management field, using the number of citations to assess the impact of each research paper in each period. In innovation, Cancino et al. [22] examined research published between 1989 and 2013, filtering by keywords and areas related to management, and thus identified the most productive universities and the most influential journals containing the most significant number of cited publications and a high H index.

However, bibliometric studies specific to AE research are limited. Skute [23] conducted a quantitative literature review using bibliographic coupling on 615 articles to interpret the bibliometric findings comprehensively. They identified hierarchical clusters of frequent terms and conducted a content analysis of the publications. Mathisen and Rasmussen [16] systematically reviewed recent research on university spin-offs' development, growth, and performance, highlighting the top journals, authors, and universities. However, most publications overlook techniques and indicators typically used in bibliometric analysis, such as influence indicators (H-index) and citation analysis.

This paper aims to provide an overview of the main contributions of academic entrepreneurship (AE). To achieve this, a comprehensive bibliometric analysis was carried out based on data from the Scopus database, including various indicators, such as the H-index, productivity, and citations. The study examines the evolution of this research topic, covering journals, articles, authors, affiliations, and countries.

The article is structured as follows: Section 2 delves into a review of relevant literature. Section 3 details the methodology used. Section 4 analyses the evolution of academic entrepreneurship and the 30 most prominent journals, articles, authors, institutions, countries and presents graphical visualizations of the results, using the VOS Viewer software to analyze cocitation, bibliographic coupling, and keyword frequency. Finally, Section 5 presents the main conclusions of the study.

2. LITERATURE REVIEW

According to Hayter et al. [12] Academic Entrepreneurship (AE) refers to activities related to the creation of new spin-off companies by professors, postdocs, students, or affiliated staff, based on university technology and is a fundamental vehicle for economic and social development. Augier and Teece [11] define AE as the process that arises from collaborations between university researchers and companies, contract research, the commercialization of intellectual property and when academic researchers create new businesses.

Wang et al. [4] and Wang et al. [24] argue that in recent decades universities have expanded their entrepreneurial activities, especially due to collaboration with the productive sector through technological innovations that impact regional economic growth. At the same time, Guerrero and Siegel [25] point out the importance of the university's entrepreneurial culture that values technology transfer and supports the commercialization of research through patents, licensing, and the creation of spin-offs.

The present literature review allows us to visualize that on AE lines of research have been developed in different types of documents (book chapters, reviews, bibliometrics, case studies, among others) and in various areas/levels: macro, meso, and micro [26, 27]. Under the macro approach, there are studies related to the incidence of the legal, economic, and social framework on academic entrepreneurship and the impact of this phenomenon in the region [6, 28]. Regarding studies with a meso approach, the literature presents studies related to procedures and practices of organizational management for strengthening the academic entrepreneurship ecosystem that allows commercializing research results [29-31]. Finally, the lines of research with a micro perspective study the individual characteristics of the entrepreneur or by research groups, the entrepreneurial orientation of the faculties, how academic entrepreneurs identify business opportunities, and what the attitude towards entrepreneurship and the intention to undertake the university community: academics, students and administrative staff [32-34].

Thus, Audretsch et al. [28] have shown that in entrepreneurial activities of universities (mainly the creation of academic spin-offs), access to financing and profits of such companies depends largely on the adoption of digital technologies and the stage of growth. In their research they contribute to the ongoing debate on the factors affecting access to such variables, their findings allow us to distinguish the development of digital technology by the entrepreneur himself, the stage of growth, and the field of science in which the spin-off is developed represent three boundary conditions for access to external financing and obtaining profitability.

Gaspar Pacheco et al. [29] consider that the commercialization of research produced by universities constitutes a central facet of AE, thus supporting the

importance of consolidating an entrepreneurial ecosystem. Their study evaluates the mechanisms facilitating AE and the variables (incubation programs, support initiatives and proof-of-concept programs) that can moderate the relationship between these mechanisms and AE in 125 Portuguese universities through a structural equation model.

In addition, the literature supports that to strengthen AE activities it is important not only to consolidate an environment of entrepreneurial universities, but that the regions as a whole must generate contextual characteristics, both socioeconomic and institutional and informational, that benefit business ecosystems in general and, consequently, reinforce and strengthen regional innovation systems and entrepreneurship. Audretsch and Belitski [1] study the domains of entrepreneurial ecosystems (culture, infrastructure, services, formal institutions, entrepreneurs), through a complex model of start-ups. Their results support policymakers and academics in developing new policies that lead to improving systems with a more multifunctional and multidisciplinary approach.

In particular, to better define AE support and policies, literature increasingly recognizes the vital role of academia, as several studies have shown that knowledge transfer occurs bottom-up, from the student or scientist to the university. Individual characteristics and motives have been highlighted as the best predictors of AE; thus, attention is being paid to understanding the factors that encourage academic entrepreneurial intention. Luo et al. [32] argue that AE is influenced by a combination of individual, organizational, and institutional factors, and the relationships behind the factors are hierarchy-dependent, interdependent, and resilient to each other, but the purpose of AE is mainly focused on knowledge transfer, which links the university's governance structure with the ability to create academic by-products.

Finally, it should be noted that there is little and fragmented literature regarding EA from a gender perspective, for example, Di Paola's study [33] argues that female entrepreneurship is uncommon in the academic field, and female scientists tend to create spin-off companies less frequently than their male colleagues. Her research has a sample of 52 academic researchers affiliated with 13 different university departments. The results obtained highlight different scenarios and implications related to female academic entrepreneurship.

3. METHODOLOGY

Scopus is a primary collection database used as the main source in various academic research [35, 36]. The research methodology begins with selecting keywords essential to define the literature search equation and obtain the study sample in the AE thematic line: "academic entrepr*" OR "academic spin*" OR "universit* spin*" OR "academic start-up" OR "universit* start-up ". Quotation marks and the logical operator OR were used to ensure results and match publication titles, abstracts, and keywords.

The search was conducted in August 2023 and covers all documents published on Academic Entrepreneurship from 1972 to 2023. During this period, the Scopus database recorded 2,107 documents. The search was refined by document type, including articles, reviews, notes, and letters.

As of that date, Academic Entrepreneurship has received 51,931 citations from other documents in Scopus, which

results in an average of 33.23 citations per document. In addition, the H index is 115, which means that out of the 1,563 papers, they receive 115 citations or more, in addition to citations in other articles.

Based on the data obtained, an analysis of the information provided by Scopus was performed, considering various bibliometric indicators, such as productivity (total number of publications in the field of AE, TP AE), influence (number of citations, TCAE), citations per year (C/Y), citations per publication (C/P), and citation thresholds (≥ 100 , ≥ 50 , ≥ 20). The H index, which connects the number of documents with the number of citations, and the temporal evolution (grouping the articles published in different periods) were also examined. The analysis includes the number of articles and citations per million inhabitants in each country.

The study was complemented by classifying universities according to the Academic Ranking of World Universities (ARWU) and the Quacquarelli Symonds University Ranking (QS). In addition, the VOS visualization software was used to graphically map the bibliographic material, allowing co-citation, bibliographic coupling, and author keyword analysis from data collection and the construction of graphic maps [37-40].

4. RESULTS

4.1 Production and trend of publications

Below are the results of the bibliometric analysis applied to documents related to research in Academic Entrepreneurship (AE) published between 1972 and 2023. The search, carried out in August 2023, yielded 1,563 publications. Of these, 1,459 articles, 85 reviews, 15 notes, and four letters in various thematic areas were selected.

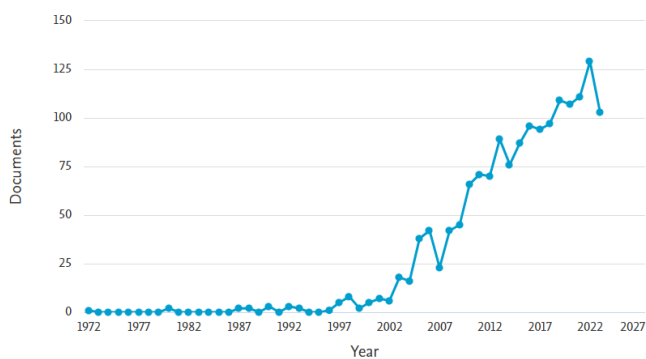


Figure 1. Number of AE publications per year

The number of peer-reviewed publications is a crucial indicator for assessing the development of a discipline or research topic [41]. According to Figure 1, research in AE has shown a significant increase in recent years. Most articles have been published in the last decade, with 1,092 articles dated between 2013 and 2023, representing 69.87% of the total. The first publication dates to 1972, and until 1990, publications were scarce, with less than ten publications per year. From 2002 onwards, a steady increase in annual publications began to be noticed, reaching a peak in 2013 with 89 publications. Although there was a slight decrease in 2014 (76 publications), the overall trend has remained upward, with 109 articles

published in 2019. This growth reflects a growing interest of the scientific community in the subject, as no significant reduction in the number of publications has been observed.

Several factors may explain this increase in publications. Firstly, there is a tendency towards an increase in the number of international researchers interested in this field. Secondly, journals have shown a greater willingness to accept studies related to Academic Entrepreneurship [42].

The influence of a document in a research field is measured through citations. Regarding AE, related articles present a remarkably low citation rate compared to management, innovation, and technology transfer. To assess the citation rate in the field of EA, Table 1 provides an overview of the most cited research in Scopus, ranked by number of citations and showing the percentage of articles in each category. Only nine articles have received more than 500 citations, and barely 13.37% have reached at least 25 citations. Furthermore, the H-index for the set of articles in the field of EA is 115, indicating that at least 115 articles have received at least 115 citations each.

Table 1. General citation structure in AE research in Scopus

Number of Citations	Number Articles	% Articles
≥ 500	9	0.58%
≥ 250	22	1.41%
≥ 100	94	6.01%
≥ 50	130	8.32%
≥ 25	209	13.37%
≤ 25	1099	70.31%
Total articles	1563	

4.2 The most productive and influential journal in AE research

Table 2 shows that the journal with the highest number of publications in the field of Academic Entrepreneurship is the Journal of Technology Transfer (JTT), with 120, representing 17.9% of all articles the journals have published. However, Research Policy (RP) is the most influential journal because it has 64 articles, with the highest TCAE and H-index. Some journals stand out not only for their scientific productivity but are influential because their articles published in EA are above 100 citations. These include Journal of Business Venturing (JBV), Technovation (T), Small Business Economics (SBE), Technological Forecasting and Social Change (TFSC), R and D Management (RDM), Science and Public Policy (SPP), Entrepreneurship and Regional Development (ERD), European Planning Studies (EPS), Archives of Physical Medicine and Rehabilitation (APMR) and Entrepreneurship Theory and Practice (ETP).

Another aspect to consider in Table 2 is the total number of citations for Academic Entrepreneurship (TCAE). The journal RP stands out again, accumulating 13,423 citations, followed by JTT and JBV, which have 7,340 and 2,652 citations, respectively. A third group of journals, such as T and SBE, have more than 1,000 citations. In a fourth group, journals such as RDM, ERD, EPS, TFSC, SPP, and APMR have between 300 and 750 citations, while the rest have a TCAE of less than 300 citations. The differences in the number of citations between the groups of journals can be explained by factors such as their quality, impact factor, and recognition in their respective fields.

Table 2. Most influential journal in AE research

R	Journal	TPAE	TCAE	H-AE	C/P	T30	≥100	≥50	≥25	Q1	Q2	Q3	Q4	H	IF
1	JTT	120	7340	52	61.2	2	23	30	30	-	2	28	90	95	5.3
2	RP	64	13423	48	209.7	17	39	8	17	-	1	35	28	271	7.2
3	IHE	47	518	11	11.0	-	-	2	3	-	8	20	19	30	1.7
4	T	33	2528	27	76.6	-	11	8	8	-	-	13	20	150	12.5
5	TFSC	28	899	14	32.1	-	2	4	5	-	-	1	27	155	12
6	SBE	28	1741	18	62.2	2	5	7	4	-	1	4	23	157	7.4
7	IEMJ	28	730	17	26.1	-	1	2	8	-	-	6	22	71	6.1
8	SJ	24	440	13	18.3	-	-	1	8	-	-	7	17	126	4.5
9	SS	23	139	8	6.0	-	-	-	-	-	-	-	23	136	3.9
10	RDM	19	1074	15	56.5	-	3	3	7	-	1	9	9	112	4.37
11	JTMI	17	211	8	12.4	-	-	1	3	-	-	2	15	34	0.9
12	IJESB	17	102	5	6.0	-	-	-	1	-	-	10	7	44	1.1
13	TASM	16	449	11	28.1	-	-	3	6	-	1	8	7	78	3.5
14	SPP	16	408	8	25.5	-	2	-	1	-	-	6	10	75	2.8
15	SHE	15	54	4	3.6	-	-	-	1	-	-	-	15	120	4.5
16	IJEBR	15	328	11	21.9	-	1	-	3	-	-	2	13	83	6.4
17	JIE	14	285	11	20.4	-	-	-	4	-	-	-	14	53	4.1
18	JBV	14	2652	12	189.4	3	8	2	1	2	1	5	6	211	8.7
19	IJTM	13	220	7	16.9	-	-	1	2	-	-	3	10	64	2.8
20	IJEIM	13	87	6	6.7	-	-	-	-	-	-	6	7	30	0.8
21	IJITM	12	96	6	8.0	-	-	-	-	-	-	3	9	24	1.8
22	VC	11	124	7	11.3	-	-	-	-	-	-	6	5	59	4.0
23	JKE	11	148	6	13.5	-	-	1	1	-	-	-	11	38	3.0
24	JSBED	11	231	7	21.0	-	-	1	2	-	1	4	6	80	5.2
25	EJIM	11	135	6	12.3	-	-	1	1	-	-	2	9	74	5.5
26	EINT	11	182	6	16.5	-	-	1	1	-	-	9	2	62	3.3
27	EPS	10	498	9	49.8	-	1	3	2	-	2	4	4	95	3.5
28	ERD	10	604	6	60.4	-	2	3	-	-	2	1	7	106	6.9
29	ETP	9	968	7	107.6	1	3	1	2	-	-	6	3	185	14.4
30	APMR	9	403	8	44.8	-	1	2	4	-	2	6	1	206	4.3

Source: Our elaboration based on Scopus 2023. R, ranking; TPAE and TCAE, Total Papers and Citations only AE; H-AE, H-index only AE; C/P, Cites per paper; T30, number of papers in the Top 30 list shown in Table 3; ≥100, ≥50, ≥25, number of paper with more than 100, 50 and 25 citations; Q1: 1972-1990 period; Q2: 1991-2001 period; Q3: 2002-2012; Q4: 2013-2023; H, h-index of journal; IF, impact factor 2023; Journal Abbreviations are: JTT: Journal of Technology Transfer; RP: Research Policy, IHE: Industry and Higher Education; T: Technovation, TFSC: Technological Forecasting and Social Change; SBE: Small Business Economics; IEMJ: International Entrepreneurship and Management Journal; SJ: Spine Journal; SS: Sustainability Switzerland; RDM: R and D Management; JTMI: Journal of Technology Management and Innovation; IJESB: International Journal of Entrepreneurship and Small Business; TASM: Technology Analysis and Strategic Management; SPP: Science and Public Policy; SHE: Studies in Higher Education; IJEBR: International Journal of Entrepreneurial Behavior and Research; JIE: Journal of International Entrepreneurship; JBV: Journal of Business Venturing; IJTM: International Journal of Technology Management; IJEIM: International Journal of Entrepreneurship and Innovation Management; IJITM: International Journal of Innovation and Technology Management; VC: Venture Capital; JKE: Journal of the Knowledge Economy; JSBED: Journal of Small Business and Enterprise Development; EJIM: European Journal of Innovation Management; EINT: Economics of Innovation and New Technology; EPS: European Planning Studies; ERD: Entrepreneurship and Regional Development; ETP: Entrepreneurship Theory and Practice; APMR: Archives of Physical Medicine and Rehabilitation.

Table 3. The most cited papers in AE research

R	Article	Ref. No.	Y	J	TC	TC/Y
1	Academic engagement and commercialisation: A review of the literature on university-industry relations	[43]	2013	RP	1410	141
2	Research groups as 'quasi-firms': The invention of the entrepreneurial university	[44]	2003	RP	918	45.9
3	The impact of network capabilities and entrepreneurial orientation on university spin-off performance	[45]	2006	JBV	791	46.5
4	Critical junctures in the development of university high-tech spinout companies	[46]	2004	RP	725	38.2
5	Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities	[47]	2005	RP	675	37.5
6	Academic entrepreneurs: Organizational change at the individual level	[48]	2008	OS	562	37.5
7	Resources, capabilities, risk capital and the creation of university spin-out companies	[49]	2005	RP	538	29.9
8	30 years after Bayh-Dole: Reassessing academic entrepreneurship	[50]	2011	RP	530	44.2
9	Industry funding and university professors' research performance	[51]	2005	RP	509	28.3
10	Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems	[52]	2014	RP	472	52.4
11	University start-up formation and technology licensing with firms that go public: A resource-based view of academic entrepreneurship	[53]	2005	JBV	442	24.6
12	Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity	[54]	2009	RP	420	30
13	From human capital to social capital: A longitudinal study of technology-based academic entrepreneurs	[55]	2007	ETP	408	25.5
14	A process study of entrepreneurial team formation: The case of a research-based spin-off	[56]	2004	JBV	373	19.6
15	What Is the Source of Chronic Low Back Pain and Does Age Play a Role?	[57]	2011	PM	365	30.4

16	Research collaboration in universities and academic entrepreneurship: The-state-of-the-art	[58]	2013	JTT	358	35.8
17	University spin-out companies and venture capital	[59]	2006	RP	357	21
18	Comparing Academic Entrepreneurship in Europe -The Case of Sweden and Ireland	[60]	2000	SBE	355	15.4
19	The creation of spin-off firms at public research institutions: Managerial and policy implications	[61]	2005	RP	351	19.5
20	Academic Entrepreneurship: Time for a Rethink?	[62]	2015	BJM	345	43.1
21	Academic and surrogate entrepreneurs in university spin-out companies	[63]	2001	JTT	343	15.6
22	The Evolution of Entrepreneurial Competencies: A Longitudinal Study of University Spin-Off Venture Emergence	[64]	2011	JMS	343	28.6
23	Bottom-up versus top-down policies towards the commercialization of university intellectual property	[65]	2003	RP	331	16.6
24	Mid-range universities' linkages with industry: Knowledge types and the role of intermediaries	[66]	2008	RP	326	21.7
25	Technology Transfer and Universities' Spin-Out Strategies	[67]	2003	SBE	326	16.3
26	Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom	[68]	2015	RP	325	40.6
27	What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'?	[69]	2011	RP	315	26.3
28	The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship	[70]	2011	RP	294	24.5
29	The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities	[71]	2013	RP	288	28.8
30	Research and technology commercialization	[72]	2008	JMS	280	18.7

Source: Our elaboration based on Scopus 2023. R: Ranking; Y: Year; J: Journal Abbreviations are available in the previous table; TC: Total Citations; TC/Y: Total Citations per Year.

Furthermore, analyzing the temporal evolution of AE research in these journals is relevant, grouping the number of papers published in different periods. The results indicate that AE research has been published increasingly in several journals, with the last two decades being incredibly productive (Q3 and Q4). RP published 17 of the 30 most cited papers considered in Table 4, and 7 of these articles are in the top 10.

4.3 The 30 most cited papers in AE research

One way to get a complete overview of published papers in a field is to analyze the number of citations received [19]. The number of citations reflects the popularity and influence of each article in the scientific community.

Table 3 shows the 30 most cited articles in the field of Academic Entrepreneurship, including the year of publication, the journal in which they appeared, the total number of citations, and the number of citations per year. The article with the highest number of citations is that of Perkman et al. [43], published in 2013, entitled “Academic Engagement and Commercialization: A Review of the Literature on University-Industry Relations.” The article has 1,410 citations in Scopus and generates 141 citations per year. In this research, the authors present a systematic review of how academics engage in collaborative research, contract research, consultancy, and informal relationships for knowledge transfer between university and industry, which they call “academic engagement”. This concept is related to academic entrepreneurship, as both approaches seek to facilitate knowledge transfer and interaction between academia and the business sector. However, the focus of academic entrepreneurship may be more on creating new companies and the commercialization of research.

Another relevant study is “Research Groups as 'quasi-firms': The Invention of the Entrepreneurial University” by Etzkowitz [44], which examines the transition of research universities toward the entrepreneurial university model. This article has accumulated 918 citations, generating an average of 45.9 citations annually. The following article, by Walter et al. [45], studies a database of 149 university spin-offs to investigate the impact of network capability and entrepreneurial orientation on organizational performance. This study has 791 citations

and an average of 46.5 citations per year.

4.4 Most productive and influential author in AE research

Table 4 presents the most influential researchers in the field of Academic Entrepreneurship. Wright is the most productive and influential author, with 44 articles, 8,358 citations (TCAE), and an H-index of 36 (H-AE). Furthermore, Wright has 13 studies in the Top 30 of the most cited articles in EA. In second place is Rasmussen, with 22 articles but 50% less productivity than Wright. Interestingly, of the three most prominent authors, two are from different institutions in the United Kingdom, and one is from Spain [36]. Most of these authors come from universities; seven are from Spain, and four belong to the University of Santiago de Compostela, adding together 94 publications in total, according to Table 4.

As for influential authors in the TCAE and C/P, figures such as Lockett, Clarysse, and Grimaldi stand out, with 3900, 2884, and 2632 citations, respectively. Etzkowitz is also a relevant author, with 1382 citations, and occupies second place in the list of the 30 most cited works. A group of five authors, including Secundo, Pazos, Mosey, Lehoux, and Guerrero, tied in TPAE with nine publications; however, Mosey stands out in TCAE with 1475 citations, 163.9 C/P and is also in the Top 30 of most cited works.

4.5 Most productive and influential affiliations in AE research

Table 5 presents the most relevant institutions in the field of EA research. The Universiteit Gent tops this list in Belgium with 44 published articles and 32 H-AE. Other universities with more than 30 articles are Imperial College Business School in the UK, Alma Mater Studiorum in the UK, and the University of Ghent in the UK. Università di Bologna in Italy, the University of Nottingham in the United Kingdom, and the University of Santiago de Compostela in Spain. There are also institutions tied in productivity, such as Delft University of Technology, the University of Michigan, and the University of Cambridge, with 21 articles each. Next are the Università di Studi di Bergamo, the University of Toronto, and KU Leuven, with 19 articles.

Table 4. Most productive and influential authors in AE research in Scopus

R	Name	Affiliation	Country	TPAE	TCAE	H-AE	C/P	TOP30	≥100	≥50	≥20
1	Wright, M.	Imperial College London	United Kingdom	44	8358	36	189.9	13	27	6	6
2	Rasmussen, E.	Nord University Business School	United Kingdom	22	1636	15	74.4	1	7	4	2
3	Rodeiro-Pazos, D.	Universidad de Santiago de Compostela	Spain	20	262	10	13.1	-	-	-	1
4	Fernández-López, S.	Universidad de Santiago de Compostela	Spain	20	219	10	10.9	-	-	-	1
5	Rodríguez-Gulías, M.	Universidad de Santiago de Compostela	Spain	19	221	10	11.6	-	-	-	1
6	Clarysse, B.	ETH Zürich	Switzerland	18	2884	14	160.2	5	10	1	2
7	Lockett, A.	Warwick Business School	United Kingdom	18	3900	15	216.7	6	10	5	2
8	Fini, R.	Alma Mater Studiorum Università di Bologna	Italy	15	2396	13	159.7	1	6	1	3
9	Meoli, M.	Università degli Studi di Bergamo	Italy	14	497	11	35.5	-	-	3	6
10	Haig, A.J.	University of Michigan	USA	14	438	10	31.3	-	-	3	4
11	Knockaert, M.	Universiteit Gent	Belgium	13	1173	12	90.2	1	5	2	4
12	Grimaldi, R.	Alma Mater Studiorum Università di Bologna	Italy	12	2634	10	219.5	2	5	2	1
13	Etzkowitz, H.	International Triple Helix Institute	USA	12	1382	9	115.2	1	2	3	2
14	Vismara, S.	Università degli Studi di Bergamo	Italy	11	532	11	48.4	-	-	4	5
15	Prencipe, A.	Università degli Studi di Teramo	Italy	11	98	6	8.9	-	-	-	-
16	Hayter, C.	Arizona State University	USA	11	793	9	72.1	-	4	3	1
17	Camelo-Ordaz, C.	Universidad de Cádiz	Spain	11	170	8	15.5	-	-	1	-
18	Cunningham, J.	Newcastle University Business School	United Kingdom	10	617	8	61.7	1	1	3	1
19	Corsi, C.	Università degli Studi di Teramo	Italy	10	86	9	8.6	-	-	-	-
20	Secundo, G.	Università degli Studi di Teramo	Italy	9	390	8	43.3	-	1	1	4
21	Pazos, D.	Universidad de Santiago de Compostela	Spain	9	64	14	7.1	-	-	1	-
22	Mosey, S.	University of Nottingham	United Kingdom	9	1475	9	163.9	2	4	3	2
23	Lehoux, P.	University of Montreal	Canada	9	152	6	16.9	-	-	1	-
24	Guerrero, M.	Arizona State University	USA	9	913	7	101.4	1	5	-	1
25	van Geenhuizen, M.	Faculteit Techniek	Netherlands	8	322	7	40.2	-	1	1	2
26	Parmentola, A.	Parthenope University of Naples	Italy	8	120	6	15.0	-	-	-	1
27	Klofsten, M.	Linköpings Universitet	Sweden	8	643	7	80.4	1	3	3	2
28	Franco-Leal, N.	Universidad de Cádiz	Spain	8	104	6	13.0	-	-	1	-
29	Zou, B.	Sun Yat-sen Business School	China	7	113	4	16.14	-	-	1	-
30	Urbano, D.	Universitat Autònoma de Barcelona	Spain	7	910	7	130.0	1	5	-	1

R: rank; TPAE, TCAE, H-AE: Total Papers, Total Citations and H-index in AE; C/P: Cites per paper; TOP30: Articles in TOP 30; ≥100, ≥50, ≥20, number of paper with more than 100, 50 and 20 citations.

Table 5. The most productive and influential affiliation in AE research in Scopus

R	Affiliation	Country	TPAE	TCAE	H-AE	C/P	TOP30	≥100	≥50	≥20	ARWU	QS
1	Universiteit Gent	Belgium	44	5734	32	130.3	7	13	10	8	84	143
2	Imperial College Business School	United Kingdom	36	6029	28	167.5	6	11	9	6	23	6
3	Alma Mater Studiorum Università di Bologna	Italy	35	3392	21	96.9	2	7	4	10	201-300	167
4	University of Nottingham	United Kingdom	32	6707	29	209.6	10	20	4	4	101-150	114
5	Universidad de Santiago de Compostela	Spain	31	341	11	11.0	-	-	-	5	601-700	751 - 800
6	Nottingham University Business School	United Kingdom	29	5802	27	200.1	6	18	5	5	101-150	114
7	Nord Universitet	Norway	25	1128	14	45.1	-	6	6	6	-	-
8	Universidade da Coruña	Spain	23	257	10	11.2	-	-	-	5	-	1001 - 1200
9	Delft University of Technology	Netherlands	21	496	12	23.6	-	1	2	6	151-200	61
10	University of Michigan, Ann Arbor	USA	21	501	12	23.9	-	-	3	5	26	25
11	University Of Cambridge	United Kingdom	21	2556	14	121.7	2	3	5	4	4	2
12	Università degli Studi di Bergamo	Italy	19	786	14	41.4	-	1	4	7	-	-

13	University of Toronto	Canada	19	339	10	17.8	-	1	1	3	24	34
14	KU Leuven	Belgium	19	1287	15	67.7	-	3	7	3	86	76
15	Lunds Universitet	Sweden	18	428	10	23.8	-	1	2	5	151-200	95
16	Birkbeck University of London	United Kingdom	17	416	8	24.5	-	1	2	3	-	343
17	Universidad de Cádiz	Spain	17	201	9	11.8	-	-	1	1	901-1000	-
18	Chalmers University of Technology	Sweden	15	679	12	45.3	-	2	3	5	401-500	125
19	Stanford University	USA	15	563	10	37.5	-	2	1	5	2	3
20	Imperial College London	United Kingdom	15	2087	12	139.1	2	8	2	2	23	6
21	Universitat Autònoma de Barcelona	Spain	15	1278	13	85.2	1	6	2	3	301-400	178
22	Universidade da Beira Interior	Portugal	14	193	7	13.8	-	-	-	5	-	-
23	ETH Zurich	Switzerland	14	258	8	18.4	-	-	1	3	20	9
24	Norges Teknisk-Naturvitenskapelige Universitet	Norway	14	522	9	37.3	-	1	4	3	101-150	352
25	Universität Augsburg	Germany	13	521	10	40.1	-	1	2	3	-	-
26	Politecnico di Milano	Italy	13	1051	9	80.8	-	4	4	1	201-300	139
27	Parthenope University of Naples	Italy	13	260	9	20.0	-	-	1	4	-	-
28	University of Montreal	Canada	13	160	6	12.3	-	-	1	1	-	116
29	Friedrich-Schiller-Universität Jena	Germany	13	669	10	51.5	-	3	2	3	401-500	340
30	Universiti Teknologi Malaysia	Malaysia	12	29	3	2.4	-	-	-	-	701-800	203

R: rank; TPAE, TCAE, H-AE: Total Papers, Total Citations and H-index in AE; C/P: Cites per paper; TOP30: Articles in TOP 30; ≥ 100 , ≥ 50 , ≥ 20 , Number of Paper with more than 100, 50 and 20 Citations; ARWU and QS: Ranking in the General ARWU and QS University Rankings.

Table 6. The most productive and influential countries in AE research in Scopus

R	Country	H-AE	TPAE	TCAE	C/P	TOP30	≥ 100	≥ 50	≥ 20	P/Po	C/Po
1	United Kingdom	67	255	19634	77	18	50	34	61	3.7	288.0
2	USA	66	329	16756	50.93	12	41	43	67	1.0	49.3
3	Italy	48	204	8903	43.6	3	34	26	94	3.3	146.0
4	Spain	35	146	5498	37.7	1	12	9	30	3.0	113.0
5	Germany	35	118	5950	50.4	2	10	16	30	1.4	71.4
6	Sweden	33	78	5162	66.2	2	11	9	26	7.5	496.0
7	Belgium	41	75	7462	99.5	1	24	13	14	6.4	635.0
8	China	15	74	554	7.5	-	-	1	8	0.0	0.4
9	Netherlands	30	71	2723	38.4	-	7	11	15	4.1	156.0
10	Canada	23	63	1617	25.7	-	2	8	14	1.6	40.9
11	France	23	56	3397	60.7	1	7	5	13	0.8	49.6
12	Norway	29	55	3377	61.4	1	11	9	14	1.0	619.0
13	Brazil	15	43	974	22.7	-	3	2	7	0.2	4.5
14	Portugal	15	42	713	17.0	1	1	1	12	4.1	69.5
15	Switzerland	15	36	707	19.6	-	-	4	9	4.0	79.2
16	Malaysia	5	31	172	5.5	-	-	1	-	0.9	5.0
17	Japan	8	27	342	12.7	-	1	-	4	0.2	2.8
18	Finland	9	27	801	29.7	-	2	4	2	4.9	144.0
19	Denmark	20	27	3579	132.6	1	7	4	9	4.6	603.0
20	Australia	11	24	473	19.7	-	1	2	7	0.9	18.0
21	Ireland	12	22	2040	92.7	-	5	3	4	4.4	405.0
22	Poland	8	21	174	8.3	-	-	-	3	0.6	4.6
23	South Africa	6	19	125	6.6	-	-	-	1	0.3	2.1
24	Russian Federation	8	18	239	13.3	-	-	2	-	0.1	1.7
25	South Korea	7	16	188	11.8	-	-	-	4	0.3	3.7
26	Austria	11	16	473	29.6	-	1	2	7	1.8	52
27	India	4	14	50	3.6	-	-	-	1	0.0	0.0
28	Iran	5	13	81	6.2	-	-	-	1	0.2	0.9
29	Mexico	6	12	176	14.7	-	-	-	4	0.0	1.4
30	Hong Kong	5	12	102	8.5	-	-	-	1	1.6	13.3

R: rank; TPAE, TCAE, H-AE: Total Papers, Total Citations and H-index in AE; C/P: Cites per paper; TOP30: Articles in TOP 30; ≥ 100 , ≥ 50 , ≥ 20 , Number of Paper with more than 100, 50 and 20 Citations; P/Po and C/Po = Papers and Cites per million inhabitants.

In addition, some universities are considered influential because of the number of citations received for their work. The University of Nottingham leads with 6707 citations,

generating an average of 209.6 C/P, and 20 articles with at least 100 citations. Other relevant institutions in terms of citations are Imperial College Business School (6029

citations), Nottingham University Business School (5802 citations), and Universiteit Gent (5734 citations).

Surprisingly, only four American universities (two from the US and two from Canada) appear on this list, unlike in other disciplines where the US occupies most of the top spots. European universities are very well represented, with 25 institutions in the ranking (83.3%), with the UK being the European country with the most universities on the list.

Finally, regarding quality indicators, 10 universities are in the ARWU top 100, and 10 more are in the QS Top 100. Of these, only seven are in both indicators within the top 50: Stanford University, University of Cambridge, Imperial College Business School, University of Michigan, University of Toronto, Imperial College London, and ETH Zurich.

4.6 Most productive and influential countries in AE research

This section aims to examine EA research according to its geographical distribution. Table 6 shows an analysis by country, indicating where the authors worked at the time of publication. The results are organized according to the EA-H, considering the indicators in the previous tables. In addition, the analysis includes the total population of the countries to assess productivity per million inhabitants.

According to Table 6, the United Kingdom is ranked as the most influential country, with 67 H-AEs and 19,634 TCAEs; it has published more than half of the 30 most cited articles. In second place is the United States, which presents significantly higher indicators than other countries. It is the most productive country in the ranking, with 329 TPAEs, 66 H-AEs, and 16,756 TCAEs.

In terms of H-AE, European countries dominate the top fifteen positions. Only two Latin American countries, Brazil and Mexico, are ranked 15th and 6th, respectively. On the other hand, five Asian countries, led by China, are also represented.

4.7 Graphical analysis of AE research with VOS viewer

The bibliographic connections between the main sources are visualized to carry out a more detailed analysis of the data obtained in the search. This work uses the VOS visualization software [37]. It is also essential to examine citations and co-citations, co-authorship, and the co-occurrence of author keywords [19, 73].

Figure 2 illustrates the overall visualization between 1972 and 2023, setting a minimum threshold of twenty citations and showing the 272 most significant connections. The circles' colors represent the clusters of the journals.

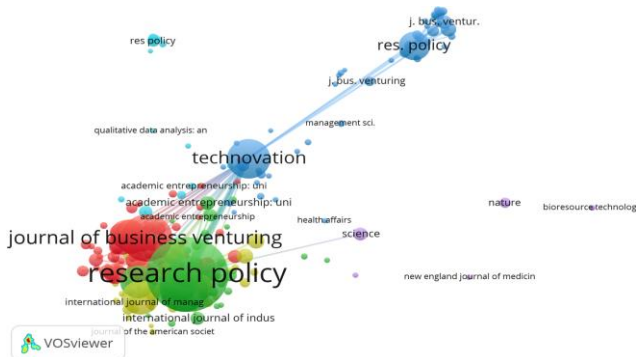


Figure 2. Co-citation of Journal cited in AE research

Next, the bibliographic coupling of authors publishing on AE is analyzed. Figure 3 presents the most productive authors, with a minimum threshold of three published documents and the fifty most robust coupling links between them.

This figure allows us to map the authors graphically, grouping those with similar research profiles, i.e., those who cite related bibliographic sources. The results of this figure are shown in Table 4.

Next, the bibliographic coupling of the affiliations publishing in the journal is investigated. Figure 4 visualizes the data with a minimum threshold of two documents and fifty connections. The primary affiliations are consistent with those presented in Table 5. The bibliographic data of these institutions depend on the authors working in them, highlighting that Ghent University maintains strong links with several of these affiliations.

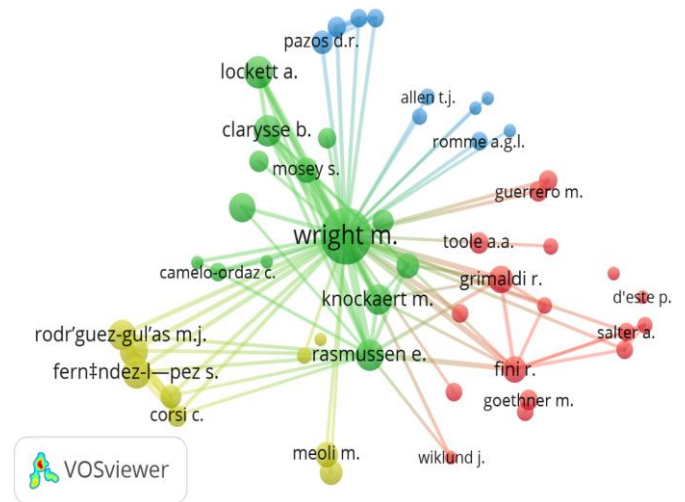


Figure 3. Bibliographic coupling of Authors in AE research

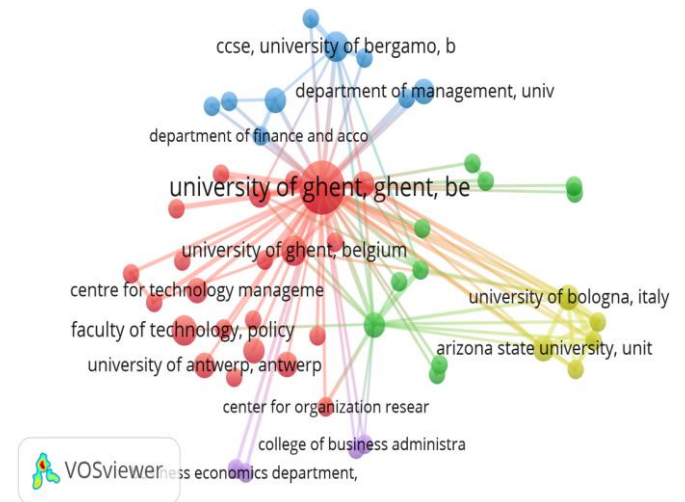


Figure 4. Bibliographic coupling of Affiliations in AE research

To summarize the results at the national level, Figure 5 presents the bibliographic coupling of countries with a threshold of one document and ninety connections. The results in Table 5 indicate that the USA is the most productive country, followed by the UK, which is the most influential. It can be observed that the countries in the highest positions are interconnected, with a notable presence and connection between European nations.

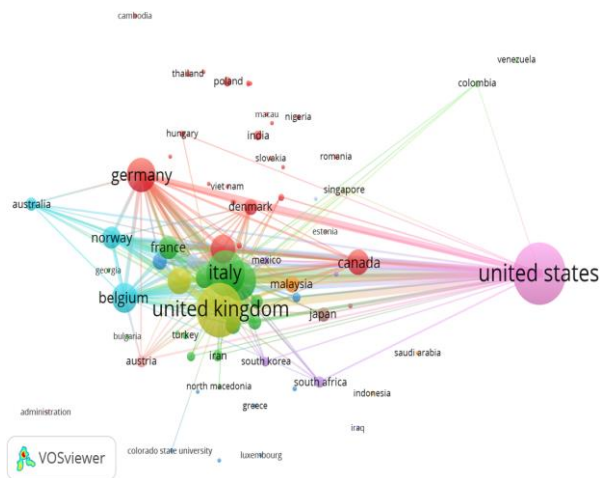


Figure 5. Bibliographic coupling of countries in AE research

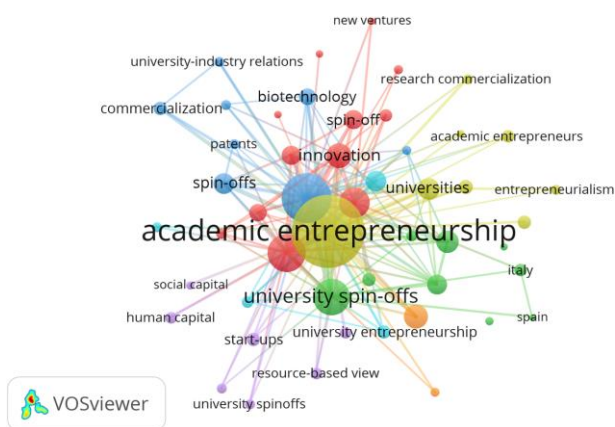


Figure 6. Co-occurrence of author keywords of documents in AE research

Table 7. Author keyword occurrences in AE research

R	Keyword	Oc	Co
1	Academic entrepreneurship	298	344
2	Technology transfer	154	288
3	Entrepreneurship	101	162
4	University spin-offs	91	129
5	Academic spin-offs	70	86
6	Innovation	49	84
7	Universities	38	77
8	Spin-offs	36	72
9	Knowledge transfer	36	71
10	Entrepreneurial university	45	59

Abbreviations. Oc: Author keyword occurrences. Co: Author keyword co-occurrences links.

Figure 6 shows the coincidence of the authors' keywords. This map considers a threshold of five occurrences and the fifty most representative connections. The largest node refers to the keyword "Academic Entrepreneurship", which is the central theme in the development of this field of research.

Furthermore, nodes related to "technology transfer," "entrepreneurship," and "university spin-off" are the most common keywords. Table 7 presents the 10 most frequent author keywords in AE research.

5. CONCLUSIONS

Scopus database, where the sample analyzed was 1563

documents. One of the main conclusions is that there is limited production in the number of publications on AE, but with an upward trend, which indicates the scientific community's interest in the subject; most of the articles were written between 2010 and 2019. The analysis of the journals demonstrates that the most important of the total publications is the Journal of Technology Transfer, and the most influential journal is Research Policy, with the most significant citations and the highest H index.

Among the articles on AE, the most cited is "Academic Engagement and Commercialization: A Review of the Literature on university-industry Relations", published by Perkmann et al. [43], in 2013, with 1410 citations. When analyzing the most influential researchers in the field, Wright, Rasmussen, Lockett, and Clarysse have the highest H-index in the ranking. The authors are European, and three come from the UK. The results show that the main affiliations are Universiteit Gent and Imperial College Business School, both from European countries.

This paper explores and describes how the literature on academic entrepreneurship is organized. The keywords analysis showed that studies on entrepreneurship and spin-offs in the university context are considered the means to transfer technology from the scientific to the business field. As future lines of research, literature reviews with a systematic approach are suggested that allow an exhaustive summary of the relevant literature to understand the theoretical approaches and methodologies used. In addition, the content of the articles will allow an understanding of the phenomena, contexts, and concepts usually addressed in the topic of academic entrepreneurship.

The Scopus database used to extract the literature is complete and prestigious. The documents reviewed only respond to the search criteria applied, so it is possible that when modified, the results may differ from the information presented here.

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